

MATERIAL

FALL 2018 ALUMNI NEWSLETTER

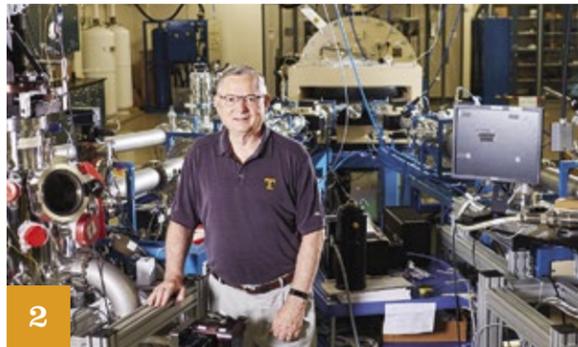
Harnessing the Power of Ions

Page 2

T MATERIALS SCIENCE & ENGINEERING

Inside: Senior design projects | Undergrad research | Family bonds

CONTENTS



- 1 | From the Department Head
- 2 | Ions: The Good and the Bad
Studying material interactions
- 4 | Senior Design
Students solve problems for companies
- 6 | Undergrad Research Highlights
UT students span the country
- 8 | Printers for Patients
Bringing 3D printed fun to the ward
- 10 | Million Dollar Idea Helps Fulfill Tennessee Promise
New program supports transfer students
- 18 | Family Bonds
The MSE family sticks together

DEPARTMENTS

- 9 | MSE Department Awards
- 12 | Faculty News
- 13 | An Interview with Roberto Benson
- 14 | New Faces in MSE
- 15 | Student News
- 16 | MSE Hall of Fame
- 17 | Alumni Spotlight: John G. Banker

A Message from the Department Head

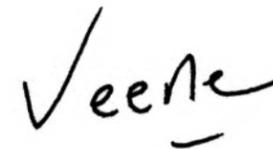
Just a few weeks ago, I overheard one of our staff members talk about our MSE department as “his work family,” looking out for one another, supporting one another, and while leafing through the draft of our magazine, his words really ring true. Our department is a family of students, staff, and faculty, and we all share in each other’s successes and breakthroughs—whether they are a promotion, a new research grant, or an A on the final exam. I am delighted to share our family news with you!

Along with new staff members Adam (IT specialist) and Hannah (undergraduate advisor), we proudly welcome a new faculty member to our family, Assistant Professor Dustin Gilbert, who joins us from the National Institute of Standards and Technology. Dustin brings a lot of expertise in film growth and neutron scattering and strengthens our efforts in functional materials. After 33 years of service, one family member is taking a step back: Roberto Benson decided to enjoy a well-deserved retirement. However, the family bond will remain strong: we’re happy to see Benson stay in the family as emeritus professor.

Talking about family bonds, this can be taken quite literally by Ian, Vincenzo, and Jacob, three of our department’s undergraduates. They are following in the steps of their older siblings Duncan, Brianna, and Madeline, who all graduated from our department in recent years. Their passion and enthusiasm for the materials field has become a true “family affair”!

I hope this edition helps you get to know our family better, and—as always—I wholeheartedly invite you to stop by when you are in our neck of the woods.

With best wishes from our family to yours!



Veerle Keppens
Department Head, Materials Science and Engineering
Director, Joint Institute for Advanced Materials



Department Head
Veerle Keppens

Editor, TCE Director of Communications
Christie Kennedy

Writers
Randall Brown
David Goddard
Whitney Heins

Designer
Mitchell Williamson

Project Manager
Melissa Callahan

Editorial Assistance
Chris Wetteland

Printer
University Printing and Mail

Material is published annually by the Department of Materials Science and Engineering at the University of Tennessee. mse.utk.edu

On the Cover: Inside William Weber’s Ion Beams Material Lab. Page 2.

IONS: the Good & the Bad

By Whitney Heins. Photography by Shawn Poynter.



When UT-ORNL Governor's Chair William Weber began his career studying the effects of radiation materials, his work was constricted, somewhat dangerous, and time-intensive.

"We always had to put on protective clothing and handle the materials in glove boxes," he remembered. "The materials were remotely handled using tweezers or tongs, and there was always a background level of radiation."

But now, what took years of study can be done in just a day without the risk of radiation and the confines of glove boxes.

How? UT's Ion Beam Materials Laboratory (IBML), which is home to an ion beam accelerator.

The accelerator has the ability to speed up the effects of radiation without actually exposing people to them. It does this by energizing ions, then shooting them at materials mounted in one of four target chambers. The lab, housed in UT's Senter Hall, is the brainchild of Weber who directs it.

In general, IBML harnesses the power of ions to study their good, bad, and not-so-ugly abilities as it relates to materials interactions.

So, what's the good? Weber uses the ion beams to improve existing materials by modifying their magnetic, electrical, or optical properties, thus changing their functions and abilities.

"We can add ions of different elements to materials and force them into a material even if they don't want to be there," Weber explained. "We have the power to induce transformation to phases that wouldn't exist naturally or in normal manufacturing processes."

The possibilities of this fundamental work, funded by the US Department of Energy's (DOE) Office of Science, are seemingly endless—from improving semiconductors and information transfer between devices to developing mini-labs on a chip.

Weber also studies the so-called bad side of ions created in nuclear environments—their damaging effects on materials, but without the radioactivity.

"These ions act as billiard balls on a pool table," Weber explained. "They knock the atoms inside materials around but they also excite the electrons. So, it is very challenging to understand and model their behavior."

By using the IBML to shoot heavy ions at materials, Weber and other researchers simulate the radiation effects of what sixty years inside a reactor, or hundreds of thousands of years sitting in nuclear waste would

look like in order to predict their performance in a nuclear environment. The work is especially relevant to making nuclear power safer.

"A lot of our research is aimed at improving the accident tolerance of fuel in our reactors," said Weber. "Specifically, we are trying to improve the fuel cladding so it doesn't rapidly oxidize."

Oxidization can occur on the zirconium-based metal cladding when exposed to high temperature steam during an accident. When rapid oxidation occurs, it exposes the fuel to the air creating the danger for release of radioactive materials.

With funding from the DOE Office of Nuclear Energy, Weber also researches the performance of new materials that could be used in the next generation of reactors and how their radiation tolerance could be improved. His research is also useful for nuclear waste disposal plans.



Members of the UT-ORNL IBML team (from left to right): Gihan Velisa, Zhe Fan, Miguel Crespillo, William Weber, Yanwen Zhang, Chen Xu, Lauren Nuckols, and Christopher Ostrouchov.

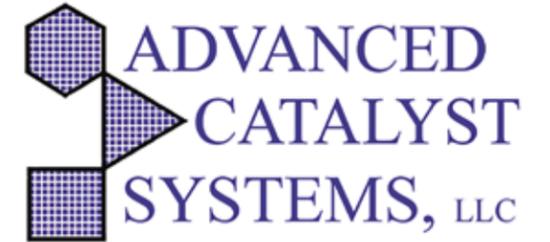
Finally, Weber's work peers into the not-so-ugly side of ions by harnessing their ability to reveal the chemistry of materials.

Weber has been surprised and fascinated by the way ions behave for more than forty years. Ironically (or ionically), Weber began his work with radioactive materials as an undergraduate student during a summer internship at Oak Ridge National Laboratory. The career of this joint UT-ORNL Governor's Chair has come full circle as he is now the one training the next generation of scientists.

Weber has accomplished a lot—with or without the power of an ion beam accelerator—and he can only imagine what his students will accomplish with the power of ions at their fingertips.

SENIOR DESIGN

All MSE students complete a design project in the spring semester of their senior year. Seniors solve real-world problems posed by companies and professors, giving students the opportunity to have valuable and meaningful experiences and gain a deeper connection within their field.



An Examination of Au-Ni phase diagram for Magneto-Plasmonic Applications

Team Members

John Carothers, Michael Roulier, Brandon Rowell, Chris Walker

Advisors

Jason Fowlkes, Philip Rack, David Garfinkel

Company

UT Department of Materials & Science Engineering

Summary

The group looked at multiple gold-nickel thin films, studying their structural and magnetic properties. The technique allowed the team to look at a wide range of compositions without the impact of variables in the synthesis process. What was found is that plasmonic performances were maintained or improved until we reached a 12.5 percent level of nickel, at which point any improvements over pure gold ceased. What this showed is that greater cost effectiveness could be achieved through the use of nickel, up to a point.

Investigation into Failure Mechanisms of John Deere Manual Transmission Shifter Forks

Team Members

Austin Ngo, Gavin Dorrity, Andrew Kocak, Xiaoyang Hu, Cameron Hilliard

Advisors

Kurt Sickafus, Maneel Bharadwaj, Randall Long, Grace Pakeltis

Company

John Deere Coffeyville Works

Summary

The group was asked to conduct a failure analysis project to determine the mechanism behind several shifter forks that experience failure mere hours in service in a new application, instead of the predicted lifetime of over 10 years. Fracturing was found to initiate from stress concentrations in particular areas of the shifter forks, and mechanical factors contributing to fracture were identified. Review of the shifter fork manufacturing process, literature survey of similar failure occurrences, and analysis of the microstructure have led the team to propose several design and material changes which would improve the properties of these shifter forks and reduce the occurrence of failure.

Development of a 3D Printable Polypropylene Filament

Team Members

Madeline Wimmer, Daniel J. Rutstrom, Cody Pratt, Lifu Zhang

Advisors

Roberto Benson, Robert Minneci

Company

UT Department of Materials & Science Engineering

Summary

Polypropylene recrystallizes at a rapid rate making it unsuitable for additive manufacturing technologies in its current form. However, the high tensile strength, chemical resistance, and low cost make it an attractive option as additive manufacturing rises in popularity and use. The group explored polypropylene blends for their potential as 3D printing filament. Thermal properties were also investigated by differential scanning calorimetry to better understand how the blends affect crystallization. Preliminary test prints using maleated polypropylene filament were successful and showed improved structural integrity and adhesion over prints attempted with unmodified isotactic polypropylene.

Characterization of Ceria-Based Catalyst Supports

Team Members

Christina Cox, Caitlin Duggan, Quentin Eustace, Grant Hanthorn

Advisors

David Keffer, Chris Wetteland, Greg Wagner, John Salasin

Company

Advanced Catalyst Systems LLC

Summary

Toxic gases and pollutants are produced from fuel used during the operation of an internal combustion engine. Advanced Catalyst Systems, LLC, was interested in experimenting with a coprecipitation process of their CZL formulation and seeks to understand a significant performance enhancement. In this project, structure was the missing link in the processing-structure-performance relationship. The structure was investigated at both the microstructural and atomic level using a variety of characterization techniques, including transmission and scanning electron microscopy, x-ray diffraction and particle size distribution. It was suggested to ACS that crystallite size varied among formulations as a result of a change in their manufacturing process, leading to improved catalytic performance.

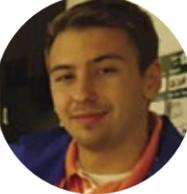
Undergrad Research Highlights

Department of Materials Science and Engineering is committed to providing its undergraduate students with a comprehensive engineering experience that goes beyond classroom education. Through the college's excellent academic support programs,

students are encouraged to perform co-op and internship assignments with global industrial partners and investigate solutions to engineering challenges. Here are some examples of the work being done by MSE students.




Christina Cox—currently working at Textron Aviation, Wichita, Kansas.
Year Graduated: 2018
Place of internship: Colorado School of Mines, Golden, Co.
Summary: I completed an NSF Research Experience for Undergraduates (REU) focused in energy. I helped to prove a revolutionary technique for forming clathrate hydrates to make them an economical means for storing energy and cater to the growing demand for natural gas.
Benefit to MSE Career: The collaboration, communication, and problem-solving skills honed in this internship are indispensable in my current full-time position at Textron Aviation.



Brandon Rowell—currently at New Mexico Tech in Socorro, New Mexico.
Year Graduated: 2018
Place of internship: Shull-Wollan Center / Center for Materials Processing
Summary: I assisted on two different research projects. The first was to design and develop high pressure diamond anvil cells for testing of superconducting oxides at the Shull-Wollan Center in ORNL. The second was with the CMP at JIAM, to assist in characterization and synthesis of novel oxides, and ceramics.
Benefit to MSE Career: The research I performed allowed me to excel in experiment design and application, as well as helping to work within the collaborative environment of a research consortium.



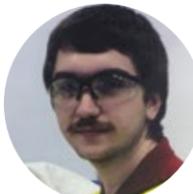
Chris Walker—currently at Texas A&M, College Station, Texas.
Year Graduated: 2018
Place of internship: Nanomechanics Inc., Oak Ridge, Tennessee.
Summary: I was an applications engineering intern specializing in nanoindentation. I evaluated the best way to test samples for analysis and then perform the testing and write a detailed report explaining the testing process and the results to the customer.
Benefit to MSE Career: Having the opportunity to work at Nanomechanics has given me the connections I needed to go to graduate school.



Austin Ngo—currently at Case Western Reserve University, Cleveland, Ohio.
Year Graduated: 2018
Place of internship: Oak Ridge National Laboratory, Summer 2017
Summary: I held an undergraduate research summer internship in the Corrosion Science & Technology Group at ORNL. Supervised by a staff scientist, I studied the effects of high-temperature corrosion on alloys processed by additive manufacturing.
Benefit to MSE Career: This research internship allowed me the experience of working at a national laboratory, which hosts scientists from around the world and experimental facilities that few universities or industrial companies could ever provide.



Andre Hillsman
Year: Current Senior
Place of Internship: Columbia University, New York City.
Summary: My research focused on the sputtering of Niobium-Titanium alloys in order to produce high critical field superconductors to be used for quantum computing applications. The objective was to reach a goal composition with high film quality.
Benefit to MSE Career: This experience definitely provided me with a lot of confidence as I continue my academic career. It allowed me to figure out what direction I wanted to go post-collegiately, and will hopefully set me up for further opportunities.



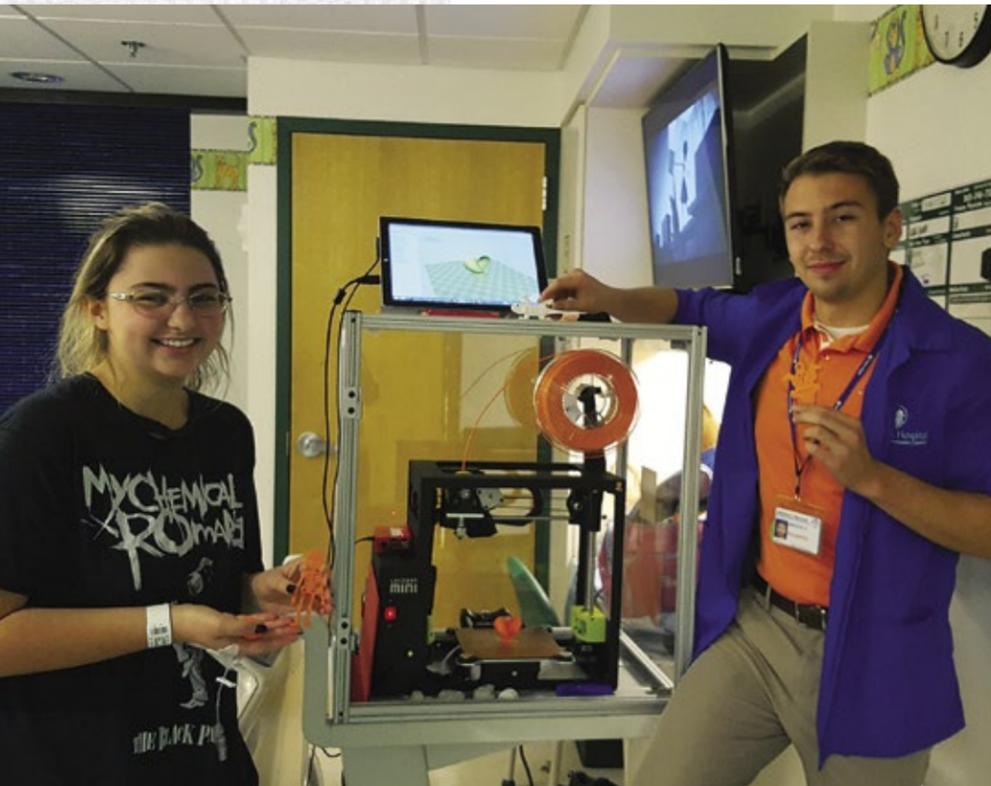
Bradley J. Straka
Year: Current Senior
Place of Internship: Thomas Jefferson National Accelerator Facility, Newport News, Virginia.
Summary: I performed Bipolar Pulsed Electropolishing (BPEP) on niobium Superconducting Radiofrequency (SRF) cavities in order to determine BPEP's effectiveness at polishing them.
Benefit to MSE Career: I have met many great people who work with the DOE who can write great references and I learned many great things that relate to both MSE and physics.

Printers for Patients

Tickle College of Engineering, Children's Hospital Introduce Kids to 3D Printing

By David Goddard.

The college has teamed with East Tennessee Children's Hospital to entertain and educate patients through the use of a portable 3D printer.



MSE graduate Brandon Rowell (right) pictured with an ETCH patient.

Faculty members and students in the college came up with the idea of creating a mobile science lab to demonstrate science and engineering techniques to children and give back to the community.

The project has become a cross-departmental collaboration and a service-learning activity for students.

"This project is perfect for the engineering student who wants to give back while practicing the skills they're gaining in the class room and lab," said MSE student Natalie Wieber. "It is so important to cultivate these skills, and what better way to do so than helping others."

Wieber said that they hope to expand the project to UT Medical Center as well as STEM nights hosted by local elementary schools.

She added that there are 19 members, hailing from mechanical engineering, biomedical engineering, and material science and engineering.

Brandon Rowell, a recent MSE graduate, volunteered at the hospital beginning in high school and was part of its Childlife program, which is devoted to caring for and enhancing the lives of the children undergoing treatment.

Rowell connected his supervisors at the hospital—Cheryl Allmon and Alexis Niceley—with the college, and both sides agreed to take the device to the pediatric oncology, surgery, and infectious diseases departments.

"Anything that can help them focus on something else for a moment, help pass the time, and maybe take their minds off the stresses of treatment is a win," said Rowell. "It's been wonderful to see the reaction of the kids to the printer and their curiosity in how it works."

Eastman Assistant Professor of Practice Matthew Young and Associate Professor Chad Duty, both of mechanical, aerospace, and biomedical engineering, had their classes contribute patterns for the team to use.

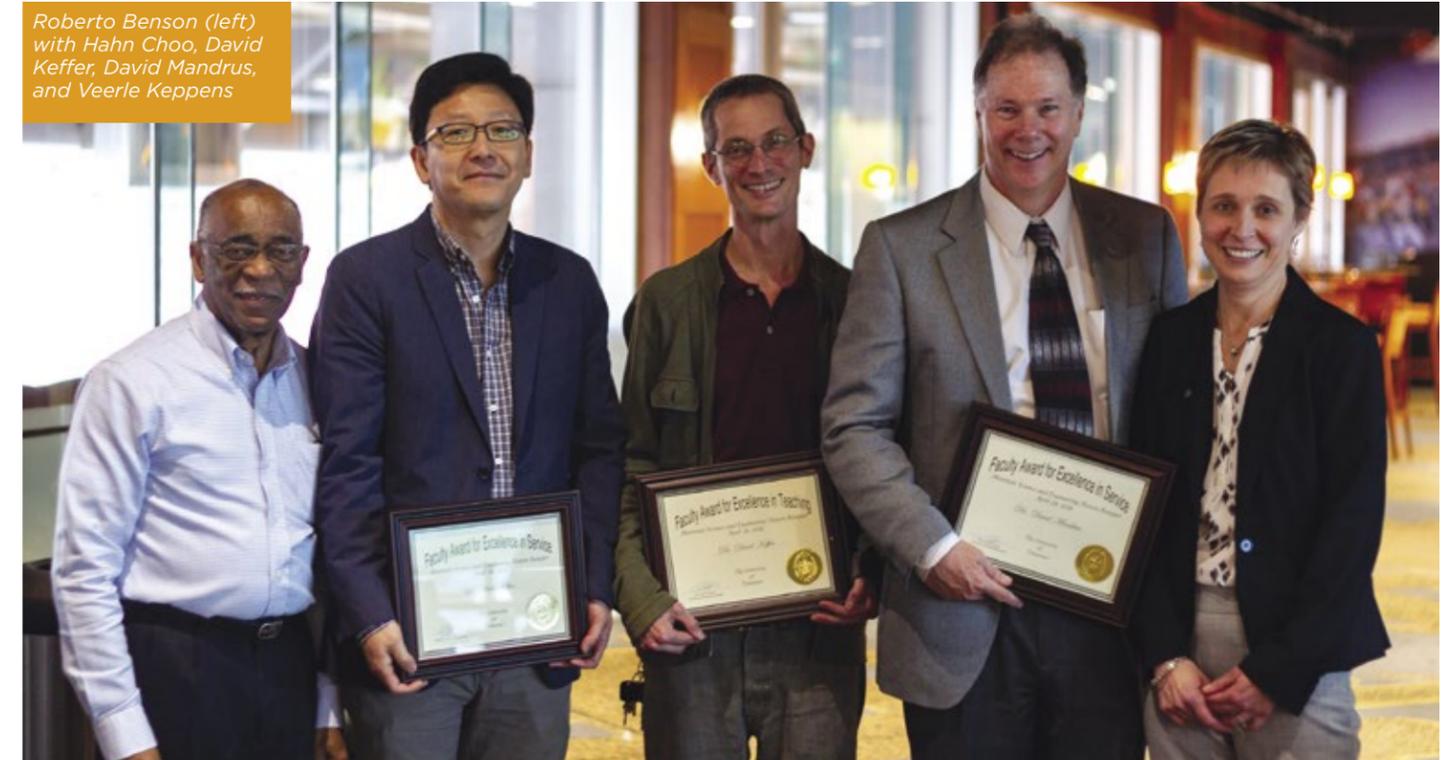
Rowell and Chris Wetteland, a lecturer in materials science and engineering, thought the kids would enjoy personalizing a 3D printed design with their name.

"This is a true team effort, and has helped meet both of those goals and will provide more opportunities for students to get involved moving forward," Wetteland said.

The team hopes to have enough machines that they can leave some at the hospital and provide them in waiting areas as well, and has created a Volstarter page to help reach that goal.

2018 MSE Department Awards

At the MSE Awards Dinner this year, we were proud to honor our faculty, students, and alumni for their significant dedication to service, teaching, research, and the profession.



Roberto Benson (left) with Hahn Choo, David Keffer, David Mandrus, and Veerle Keppens

Graduate Student Award for Excellence in Service

Brianna Musico

Award for Excellence in Teaching

Alex Hanson

Joseph E. Spruiell Award for Excellence in Research

Matt Lloyd

Rui Feng

Undergraduate Student Award for Excellence in Service

Brandon Rowell

Madeline Wimmer

Raymond A. Buchanan Award for Outstanding Junior

Susan Schickling

E. Eugene Stansbury Award for Outstanding Senior

Austin Ngo

Roberto Benson Award for Excellence in Undergraduate Research

Daniel Rustron

Outstanding Staff Award

Tonya Brewer

Faculty Award for Excellence in Service

Hahn Choo

David Mandrus

Faculty Award for Excellence in Research

Mariya Zhuravleva

Faculty Award for Excellence in Teaching

David Keffer

Hall of Fame

Carl McHargue

Million-Dollar Idea Helps Fulfill Tennessee Promise

By David Goddard. Photo by David Keffer.

Gov. Bill Haslam created the Tennessee Promise program—which provides two years of free community college to the state’s students—as a way to increase the number of Tennesseans with at least some college education.

Wanting to help encourage those students to pursue four-year degrees, a group of faculty members in UT’s Tickle College of Engineering met to come up with a plan to accommodate transfer students and position them for success in the college.

For transfer student Michael Thompson, the program was truly life-changing.

“I’d been out of school a decade and had a family,” said Thompson, who came to UT from Cleveland State Community College. “This program not only provides the needed financial help for a lot of us, but also set us up with connections so that once we got to UT we’d have some familiarity.”



The first TranSCeND cohort included eight students. Pictured left to right: Simon St. John (CE Major, transferred from PSCC). Forrest Davenport (ME Major, transferred from PSCC). Juan Vidal Murphy (ME Major, transferred from PSCC). Abhi Mistry (AE Major, transferred from CSCC). Andrew Rolan (MSE Major, transferred from PSCC). Tori Villella (CE Major, transferred from PSCC). Serena Beauchamp (MSE Major, transferred from PSCC). Michael Thompson (MSE Major, transferred from CSCC).

In 2017, they launched TranSCeND—Transfer Success Co-Design in Engineering Disciplines—to help those students navigate the transition, gaining \$1 million in support and recognition from the National Science Foundation (NSF) in the process.

“Transfer students face a unique set of challenges compared to traditional students,” said Materials Science and Engineering Professor David Keffer, leader on the project. “We sought to develop a program, based on input from many directions, to create an experience for transfer students which addresses well-identified academic and social obstacles to successful completion of their degree.”

The initial NSF grant lasts through 2022, when it will come up for renewal based on the plan’s success.

To help ensure that happens, the team focused on the five-year graduation rate for engineering transfer students—71 percent, compared to 85 percent for traditional students who enter as freshmen.

The team is now working on a program that covers all five years of the students’ experience at both institutions. Chris Wetteland, a lecturer in materials science and engineering, is developing a summer research program to improve the transitional experience, while Rachel McCord, a faculty member in the college’s engineering fundamentals program, is developing methods to improve student success.

Thompson said that the benefits of the program have helped him feel more at ease and confident as he continues his education.

TranSCeND members considered other factors facing transfer students in comparison to traditional students who enter the program as freshmen. Among their findings, they learned that transfer students:

- are almost twice as likely to be first-generation students
- have more than double the unmet financial need of traditional students
- face stresses over class sizes and communication with faculty
- often find it challenging to become a part of peer groups, some of which have already worked together for two years

The goal is to increase support for transfer students to bring retention and graduation rates to a comparable level with those of traditional undergraduates.

“These elements will maximize the benefit of the state’s investment in its future via Tennessee Promise,” said Keffer. “Once we demonstrate that the TranSCeND program works here, we will share it with other institutions.”

The TranSCeND team’s efforts now involve Tickle College of Engineering staff, researchers, and administration; UT’s admissions office; and faculty from Pellissippi State Community College.

“This program not only provides the needed financial help for a lot of us, but also set us up with connections so that once we got to UT we’d have some familiarity.”

Michael Thompson



Photo by Shawn Poynter.

A Transcendent Opportunity

Unlike other transfer scholarship opportunities, TranSCeND does not require that students take part within three years of high school graduation.

That is a critical component for students who have entered the workforce and are returning to finish their educations years later, as is the case with Michael Thompson.

Thompson, from Cleveland, Tennessee, spent almost a decade as a professional butcher.

Approaching 30, and with a wife and two children, he wanted to chart a career with a more stable schedule and family time.

“When I started at Cleveland State Community College in 2015, I had to find a way to go to class around a full work load,” said Thompson. “A lot of

people were cynical that I could make it work, but now I’m at UT, I’m serving internships with ORNL, the future is bright, and it all goes back to this program being there to support me.”

He credits senior Lecturer Chris Wetteland and professor David Keffer, both of the Department of Materials Science and Engineering, with helping him navigate the program.

Thompson also said that other advantages of the program are that it is directed at community college students, it has brought together a cohort of non traditional students such as himself, and it allows for the transfer students to start out knowing fellow participants in the program, giving them familiar faces in an unfamiliar landscape.



Rack Named Fellow of American Vacuum Society

Professor Philip Rack has built a career out of the study of thin films, materials that can be smaller than a nanometer in thickness yet hold tremendous promise for fields such as electronics and computing.

Rack, the Leonard G. Penland Chair in the Department of Materials Science and

Engineering, utilizes vacuum conditions at pressures well below atmospheric levels to help in his studies.

In recognition of his expertise in such technology, the American Vacuum Society (AVS) has named him a 2018 fellow of the society.

“Earning recognition from your peers is a tremendous honor,” said Rack. “It is a validation of years of research and effort, and I couldn’t be prouder to have been selected.”

AVS was founded in 1953 to help bring better connectivity between materials science and related fields. It now counts more than 4,500 members across a number of divisions.

In addition to being named a fellow, Rack has been program chair and served on the executive committee of the Thin Film Division for AVS.

He has helped author approximately 200 refereed journal articles and presented/contributed to more than 300 presentations at conferences around the world.

Since coming to UT in 2001, Rack has won the department’s engineering faculty research award; the college’s research fellow award and Allen and Hoshall Engineering Faculty award; and the chancellor’s award for research and creative achievement.



MSE Advisor Spotlight: Hannah Raines

By Randall Brown.

Hannah Raines made her way across the state over the years to join the department as the department’s undergraduate student advisor. She grew up in rural West Tennessee near Jackson, attended UT Chattanooga for her bachelor’s degree, and moved to Knoxville a few years ago to attend graduate school at UT.

In her position as advisor, Raines helps MSE undergrads schedule courses, establish their graduation plans, and connect with campus resources and services that will allow them to be successful at UT and beyond. She likes to let them know that faculty and staff are accessible to them, and to see them connect to the department’s abundance of research opportunities. She can also offer guidance when sudden scheduling emergencies occur.

“When the unexpected happens, I try to calm nerves and help students regroup and find solutions,” said Raines.

In addition to individual assistance, she advises the team of MSE Ambassadors, working with them to plan department events.

“I use Microsoft Word to make awesome flyers for said events and low-key think I might have a future in graphic design,” she said. “One day I plan to learn how to use Publisher.”

While Raines is forward-thinking with her skillset, she already has the chops for the advising game, having earned her MS degree in social work at UT in 2017. She completed internships during her graduate studies at UT and Maryville College and “fell in love” with the higher education environment.

“I became specifically interested in advising because it is a role that directly supports student success and allows me to interact with a variety of students,” she said.

Raines and her fiancé Philip enjoy playing with their puppies Liz and Iris, and generally spending time outside, especially in national parks.

“I am in the Smokies about every other weekend and have visited several others,” said Raines. “I am a big fan of folk and Americana music and occasionally strum a ukulele.

After a day of advising or enjoying the outdoors, Raines likes to kick back by reading memoirs and re-watching classic episodes of “The Office” and “Parks and Recreation.” She also claims to “make a mean casserole.” That might technically count as a materials science, so she’s in the right department.

An interview with Professor Emeritus Roberto Benson

by MSE seniors Codi Ferree and Amy Godfrey.

When and how did you decide to go into polymers and materials science in general?

I attended Florida State University with the desire to learn something different. I approached a professor who had worked for Paul Flory (a Nobel Laureate known for his achievements in polymers) and asked to work for him during the summer, where we focused on the crystallization of polymers.



Roberto Benson with Codi Ferree and Amy Godfrey

What brought you to Tennessee?

While completing post-doctoral research at the University of Utah, Paul Phillips, a recruiter for UT, asked if I wanted to come to the University of Tennessee. I was impressed by the cohesive manner of the department. All the professors used to sit down and have lunch together to talk and work out any problems the department was having; there was a friendly, team environment.

What have been the highlights of being in the MSE department here?

Mentoring students of great diversity and seeing them graduate and go on to fulfilling careers, specifically those I’ve helped during their time here.

What part of your role did you find the most satisfying/rewarding?

I enjoyed being able to deal specifically with students who needed someone to confide in. I take pleasure in being able to guide students.

What advice do you have for current and future MSE students?

To be more engaged and less passive in and out of the classroom. To ask more questions. I like to see students who are more involved in their learning and understanding of the material, no matter the subject.

Who was your role model in your professional life?

Leo Mandelkern – he was my mentor while I completed my PhD. He was tough, but he treated us humanely. Don Lyman – I completed my post-doctoral research with him at the University of Utah, where we focused on artificial blood vessels. He was very patient with me considering I came from a strictly polymers background rather than biomedical engineering.

What do you like to do in your free time?

When I was younger, I enjoyed painting and drawing, but now I take pleasure in gardening. I enjoy growing a variety of peppers and tomatoes.

Of the classes you taught, which one was your favorite?

I enjoyed teaching the advanced polymer chemistry classes such as MSE 540 and 544 the most. I’m sad to see the number of polymers classes being offered is reduced.

What will you miss most about teaching?

I will miss the students the most. I would frequently get together for lunch with my students, so I will miss that interaction.

What will you do now?

I plan on visiting family in Panama and California. I have traveled quite a lot in my life, however, I would still like to visit Rome, Peru, and Alaska with my wife.

Benson Retires After 32 Years with Department

One of the department’s most familiar faces decided to retire this year, but don’t worry: Roberto Benson isn’t going anywhere.

“I felt that the time was right to make the move, but I’m not about to just stop everything,” said Benson, who joined the department in 1986 and served as associate department head as well as professor. “I’ve always liked the team atmosphere in the department and the way we help shape students into researchers. I wanted to stay a part of that.”

In addition to classroom duties, Benson played a role in the Educational Advancement program, the Office of Engineering Diversity Program, and the UT Commission for Blacks, saying that, as a minority, he felt happy to give back to the students and campus.

Benson encouraged students to actively engage during class, asking questions and seeking solutions that would expand their knowledge, but that he also expected them to be able to take needed criticism and have respect for themselves, their peers, and their instructors.

“I like to joke that if engineering were easy, they’d just hand out degrees,” he said.

A native of Panama, he came to the US first as a college student, earning his bachelor’s degree in chemistry at Lewis University in 1972 and his doctorate in physical chemistry at Florida State University in 1978.

After working on post doctoral training at the University of Utah, Benson began work there in bioengineering, later leaving to become director of research at Vascular International Corporation in Salt Lake City, where he helped model stresses on artificial hearts.

From there, he came to UT, where he’ll continue to be a presence.

Even in retirement.

NEW FACES IN MSE

By Randall Brown.



Assistant Professor **Dustin Gilbert** came to the department this summer from a position with the neutron scattering facility at the National Institute of Standards and Technology in Gaithersburg, Maryland. Before that job, he earned his undergraduate degree at the University of California, Santa Cruz, and his PhD at UC Davis.

“I more or less grew up in San Diego,” said Gilbert. “Outside of NIST and school, I worked at Seagate building hard drives and the US Naval Postgraduate School building railguns.”

Gilbert brings that varied background to his current work in nanotechnology, focusing on magnetism and spin phenomena.

“This field impacts your daily life in the development of hard-drive technologies and permanent magnets (for generators and electric motors) and will continue to impact it with new fields, such as spintronics, quantum computing, and topological materials,” he said. He uses neutron scattering and X-ray spectroscopy as specialized tools to glean detailed information about these materials.

Gilbert spends most of his time in his lab at the Joint Institute for Advanced Materials, and also keeps an office in Ferris Hall, where he enjoys having the “almost-secret stairwell” near his office to help him shoot back and forth to his lab.

Gilbert and his wife, Anne Murray, met while working in food services at the San Diego Wild Animal Park. She is also here at UT in a postdoctoral position in food sciences.

When he can catch some spare time, Gilbert enjoys walking with his dogs and kayaking—the “calm, sight-seeing kind,” he clarified, not “whitewater stuff.”



Adam Cain joined the department almost a year ago as Senior IT Technologist. Originally from Bloomington, Indiana, he and wife Shannon moved to Knoxville in 2017 after living in Roanoke, Virginia for several years. She is working toward her PhD in social work here at UT.

Cain previously worked as a systems administrator, specializing in networking and IP security cameras, for Fink’s Jewelers, a family-owned jeweler with stores in Virginia and North Carolina.

“I may have developed an expensive taste in watches,” he joked. “Here for MSE, I do all the IT things. Most of the time it is fixing printers or fixing assorted desktop problems with the laying-on of hands.”

When he isn’t knee-deep in Ferris Hall tech repairs, Cain enjoys hiking, photography, space and astronomy topics, and keeping tabs on gadget news. He packed a mix of these interests into the last year, snagging great pictures of both the 2017 solar eclipse and the launch of the Space-X Falcon Heavy rocket.

STUDENT NEWS

PhD candidates **Rui Feng** and **Shuying Chen** took home first and second place respectively in the 2018 Best Paper contest, at the 2018 TMS Annual Meeting & Exhibition, held in Phoenix, Arizona. Both students work with Professor Peter Liaw’s research group.



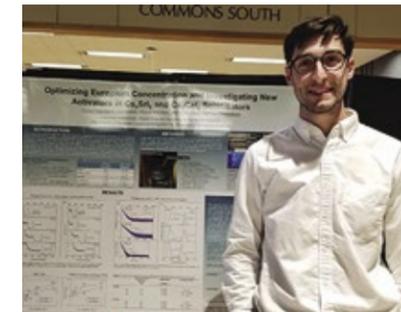
PhD candidate **Rakesh Kamath** was selected to attend the prestigious two-week National School on Neutron and X-Ray scattering (NXS-2018) this past summer. Kamath participated in lectures and hands-on experiments covering a broad spectrum of disciplines at the synchrotron source in Argonne National Lab and at the neutron sources at ORNL. Kamath is a member of Associate Professor Hahn Choo’s research group.

PhD candidate **Xue Wang** attended the Ma2JIC annual meeting in June and gave a presentation about friction stir welding numerical simulation. Wang is a member of Professor Yanfei Gao’s research group



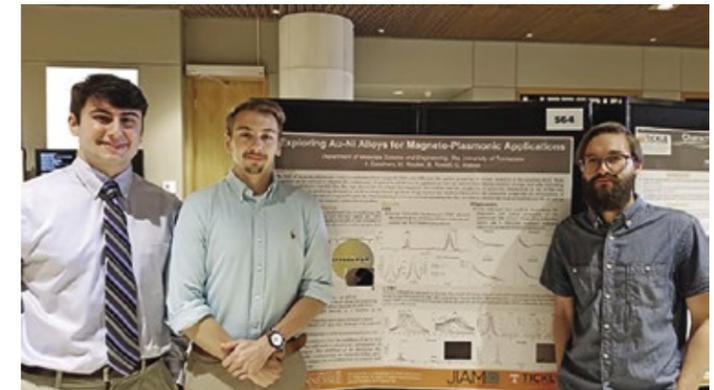
Recent graduate **Michael Stanford** (MSE, '18) earned several honors last year, including best student presentation at the MRS Fall Meeting, Excellence in Graduate Student Research from ORNL, and was the recipient of the AVS Dorothy M. and Earl S. Hoffman Scholarship.

Senior **Daniel Rutstrom** was awarded a prize in the Competition for Students at Universities with Less than \$600 Million in 2016 R&D Expenditures at the 2018 Innovations in Nuclear Technology R&D Awards. His award-winning research paper was published in the *Journal of Crystal Growth* this February.

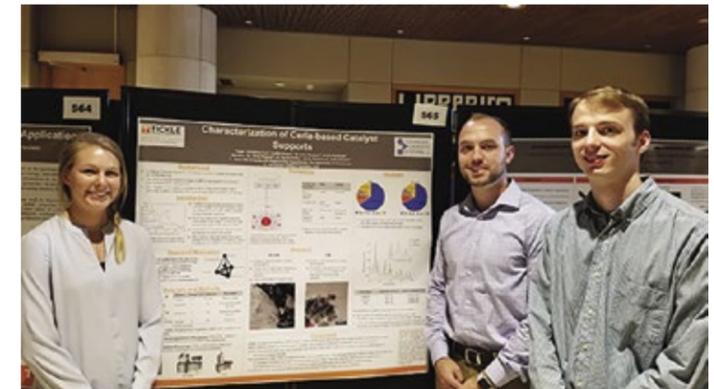


Senior **Ian Greeley** participated in the Higher Education Research Experiences program at ORNL this summer. The program provides research opportunities for undergraduate students and is designed to complement academic programs.

Sophomore **Kate Gordon** attended the Research Experience for Undergraduates program at Columbia University over the summer. She participated in workshops and completed training in lab practices and scientific writing. Her research focused on the “Synthesis of Novel Zinc Thioureaates for use in Nanoparticle Shelling Reactions.”



(l-r) Michael Roulier, Brandon Rowell, John Carothers. Not Pictured: Christopher Walker.



(l-r) Caitlin Duggan, Grant Hanthorn, Quentin Eustace. Not Pictured: Christina Cox.

The college had a strong showing at the 2018 EURCA event. The design team of **Brandon Rowell, Christopher Walker, John Carothers,** and **Michael Roulier** won second place, and the team of **Quentin Eustace, Christina Cox, Grant Hanthorn,** and **Caitlin Duggan** won honorable mention. In the research awards category, **Daniel Rutstrom** won third place.

Carl McHargue 2018 Hall of Fame Inductee

By Laura Tenpenny.



Veerle Keppens, Carl McHargue and Roberto Benson.

“Make friends. Find out what others around you are doing and how you can work together.”

—McHargue urges student engineers.

Carl McHargue spent decades living out the advice he gave to his students during his time at UT as professor and later as director of the Center for Materials Processing.

“Make friends. Find out what others around you are doing and how you can work together,” McHargue urges student engineers.

His college dean gave McHargue similar advice during his time as a metallurgical engineering student at the University of Kentucky.

“He encouraged me to join professional societies, to get involved, and get to know fellow engineers, and that gave me a platform for recognition and for collaborations that enabled my work and research,” McHargue said.

He took that advice and ran with it, becoming a member of multiple societies and serving on those societies’ boards of directors, including that of the Minerals, Metals, and Materials Society and the Accreditation Board for Engineering and Technology. McHargue graduated in 1953 with the first doctorate in metallurgical engineering ever conferred by UK.

Upon graduation, McHargue accepted a position with Oak Ridge National Laboratory (ORNL) as a metallurgist. He also took part in the then-budding ORNL graduate programs as a teacher.

“I got to teach students from all over, not just from UT, and I got to see people from all kinds of backgrounds working together,” McHargue said.

With the advent of Sputnik and the space race, McHargue and a team of ORNL and UT officials led a committee to draft a proposal to the Ford Foundation that would allow ORNL employees to serve in joint faculty positions at UT. Thus began one of UT’s most significant collaborations that remains strong today.

“Because of my work and connection to the graduate training programs, I was tapped to be on the Ford Foundation proposal committee, and I became one of the first ORNL employees to serve in a joint faculty position at UT,” McHargue explained. “This opportunity set me up for much of the professional achievement that followed, including this recent MSE Hall of Fame induction.”

McHargue retired from ORNL in 1990 but continued to serve as a UT faculty member, becoming director of the Center for Materials Processing. In addition, he has had breakthrough research, especially in ion beam modification of ceramics and nanotechnology, with over two hundred academic papers, two patents, and several awards to his name; however, he is quick to point to the names of others.

“You’ll see dozens of colleagues with whom I had the pleasure to work and write on these papers,” says McHargue. “I spent time at Cambridge University in England to give a lecture at the behest of a British colleague. We met during a trip to read our papers at the same academic gathering. We got to discuss our work and discovered we were researching similar topics. During my time at Cambridge, we worked on a paper detailing our subsequent research together concerning nano-indentation and behaviors of ceramic crystals.”

Since retiring from UT in 2013, he continued to teach in MSE through the past academic year. He still spends his days researching, mainly his family tree. His collaborators include his wife, Betty, and his chihuahua, Peanut.

John G. Banker

Rancher, Alchemist, and Engineer

By Laura Tenpenny.

From a family farm in the Tennessee hills to a Colorado ranch in the Rockies, John Banker’s love for mountains has come full circle. Banker (BS Metallurgical Engineering ‘69) fell for Colorado as a child at a Boy Scout Jamboree. When the opportunity to move there came along over fifteen years later, it was an easy choice to make.

That decision was prompted by a new job at an ailing explosive forming company. Banker worked after graduation at DuPont in explosion welding, shortly following its invention by DuPont scientists and engineers. That he ever entered this niche field, he credits to serendipity.

“I had no idea what I was getting into, but it sure looked like the best option for me, and a fun thing to do,” Banker remembered.

The research he did at DuPont led to later patents on explosion welding and clad metal that enabled its industrial applications and saved the faltering Colorado company he had joined.

“Today the company, now known as Dynamic Materials Corporation (DMC), is regarded as the global leader of the explosion metalworking industry,” he affirmed.

This industry grew from a few million to over two billion dollars during Banker’s career, without which it would not exist. Explosive clad metal can provide corrosion or erosion resistance at a reduced cost without losing any of the base layer’s strength.

“Explosion welding is the only option for highly dissimilar clad such as titanium-steel and similar reactive and refractory clad metal products,” Banker explained.

He built the foundation for this knowledge and his expansive career in this specific field during his time at UT.

“The greatest value of education at UT in those years was that we were taught to understand the basics of metals and their basis in physical chemistry and physics. There was less push for us to become experts in the common metals of the era. This has served me well, as there is nothing common about my bimetallic world and the exotic materials that I enjoy working with,” Banker claimed.

His wife refers to him as an alchemist and colleagues have called him the father of the explosion cladding industry. Of his accomplishments, there are two of which he is most proud.

“My most significant career accomplishment has been firmly establishing explosion cladding as a reliable and proven industrial technology which adds value to all stakeholders. It is a niche technology to make unique things that make other things better,” Banker said.

The second, but not the least, personal accomplishment he mentions is family. These days, he enjoys spending time with them on his 250-acre, Colorado property exploring the land and riding horses.

“Although retired, what most folks call ‘work’ continues to be one of my favorite hobbies,” Banker asserted. “Nowadays, it competes with the grandkids, my beautiful wife, the ranch, the garden, the bees, the horses, and all the fantastic rides and hikes in the Colorado Rockies.”



Kim and John Banker



Family Bonds

By Randall Brown.

Materials science and engineering is a family affair for some students. At least three pairs of siblings have found their way into MSE in recent years. Their experiences echo their seamless bonds of kin with a study of the bonds that make or break the materials world.

“As a department, we are proud that one of our students would suggest to a sibling that MSE is a great place to be,” said Senior Lecturer Chris Wetteland. The family ties also inspire stronger communication within the department. “Having siblings helps break the barriers between the classes and to develop a more unified undergraduate program.”



Duncan and Ian Greeley

The department’s annual ASM Materials Camp kick-started Duncan Greeley’s interest in materials science the summer before his freshman year.

“I always enjoyed math and science courses as a kid,” said Duncan. “I feel that I have always had an innate curiosity for discovering why things work the way they do. But compared to Ian, my specific interest in engineering started at a later point.”

Younger brother Ian had the advantage of learning about their shared field earlier in his academic career. Duncan let him know about programs like the materials camp and the Tennessee Governor’s School for Engineering.

“Attending both programs sparked my interest, as they allowed me to get hands-on experience with numerous mechanical testing, microscopy, and spectroscopy tools while still in high school,” said Ian.

The Knoxville-native brothers work with very different materials, and in different areas of the country. Duncan is a second-year PhD pre-candidate at the University of Michigan, while Ian is in his junior year at UT.

“Our combined research spans nearly the entire field of materials science, which unfortunately means we work in quite different areas,” said Ian. “I spent the last academic year working at the Scintillation Materials Research Center, where I helped develop and characterize metal halide and metal oxide scintillators for use in medical imaging and homeland security applications.”

He also interned at Oak Ridge National Laboratory over the summer, and studied polymer binders for battery electrodes.

“I, on the other hand, focus strictly on metals,” said Duncan. “For my dissertation research, I study the effect of rare-earth element additions on the fatigue behavior of magnesiums.”

They do support each other from afar with shoptalk about research and study directions and the best practices for handling the work-study-life balance. They also find time to talk about sports and other extracurricular activities—the brotherly stuff.

Brianna and Vincenzo Musico

Brianna Musico graduated high school in Houston, Texas, and came to UT in 2012. Her entire family decided to move to Knoxville in 2014, and her brother Vincenzo followed her into MSE. Brianna is now in her third year of graduate school and Vincenzo is a sophomore.

Brianna’s involvement in sports—and “subsequent injuries,” she points out—steered her towards medicine and engineering studies.

“I really became interested in the materials engineering aspect when I started to take more physics and chemistry classes,” she said. “I started wondering what the uneven bars that I swung from were made of to give them such tensile strength and how the layered build of the balance beam gave it both energy absorption and spring.”

Vincenzo knew he wanted to be an engineer in high school, and felt fortunate to take a materials science class.

“It led me to discover a fascination with the broadness of the field and its multitude of applications in physics, chemistry, and engineering,” he said.

“I think we were both of the engineering mind at a young age,” said Brianna. “I remember butting heads and fighting over Legos.”

They got beyond territorial Lego disputes, and now enjoy sharing the campus with each other.

“It is great having him on the same campus and being able to answer questions and help him with situations that I had gone through just a few years ago,” said Brianna.

“There isn’t a downside to having someone to introduce you to everyone in the department,” said Vincenzo. “Having the ability to brainstorm with them about class and work at almost any given time is just as easy as talking to them about everyday things.”

Vincenzo currently works on computational research while Brianna says she is more of an “in-the-lab type of person.”

“Although our research areas are very different, we still often talk about different ideas and issues that come about in our research,” he said.

“Having a brother who is gaining experience with computational research will be great down the road,” said Brianna. “It will be a great resource to help fill in each other’s knowledge gaps.”

This dynamic is already in effect. Both worked at the Joint Institute for Advanced Materials this summer and enjoyed being able to drop by each other’s offices and compare notes over lunch.



Madeline and Jacob Wimmer

Madeline Wimmer, who graduated in spring 2018, had not heard of materials engineering until she was already doing research in another department.

“I got really interested in figuring out how things worked and interacted on a small scale,” she said. The principle investigator in her other research introduced her to the materials field.

“I like to pretend that I am 100% the reason Jacob is here,” said Madeline. “But I don’t actually know that to be the case.”



Jacob, now a sophomore, does credit his sister with making the connection.

“I first heard of MSE from Madeline,” he said. “Hearing about what she was doing helped with my choice. I have always found materials—and looking at how they work and what makes them different—super interesting, so there’s a good chance I would have chosen it even if Madeline wasn’t in the program.”

Their undergraduate time only overlapped for a year, but the Maryville, Tennessee, natives make sure that they cross paths regularly. Madeline maintains her campus presence as a graduate research assistant.

“It is nice knowing she is around if I need help,” said Jacob, though Madeline says he has done quite well on his own steam.

“He didn’t need much help in engineering fundamentals, and our lives kept us both pretty busy,” she said. “I feel like as he gets more into his classes, that might change—or at the very least he will come find me for textbooks.”

The self-proclaimed “outdoorsy” siblings share an interest in promoting environmental health through their studies and careers.

“I really like renewable base materials and recycling, as well as environmentally friendly aspects of materials,” said Madeline.

“We were out in the woods a lot as kids,” said Jacob. “We both want to see more sustainability in the engineering world to preserve what we have outside.”

The promise of a sustained world, from the great outdoors to the molecular level of materials, should hold strong with through the contributions of these proud MSE family members.



Join Emma. Join the Journey.

“I really admire that all materials science and engineering undergrads are able to participate in paid internships at UT if they desire, made possible by private donations. This opportunity enables students to increase their understanding of the material they learn throughout the year and provides them with a better idea of a career in that field. I truly cannot express my gratitude for not only scholarship funds to help pay for my tuition and my UT research internship, but for donors’ confidence and investment in my future. Knowing someone else believes I’m on the right path and having that encouragement is crucial and I really appreciate the support, both financial and emotional.”

—Emma Berry, merit-based scholarship recipient.

Invest in the journey and help students like Emma take advantage of international experiences. Call **865-974-3011** or visit giving.utk.edu/mse



The University of Tennessee is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA institution in the provision of its education and employment programs and services. All qualified applicants will receive equal consideration for employment without regard to race, color, national origin, religion, sex, pregnancy, marital status, sexual orientation, gender identity, age, physical or mental disability, or covered veteran status. The university name and its indicia within are trademarks of the University of Tennessee. A project of the Department of Materials Science & Engineering with assistance from the Tickle College of Engineering Office of Communications. PAN E01-1315-001-19. Job 353455.

big orange. big ideas.

