Springing forward

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Photo courtesy of John Barnett (Instagram@johnbarnett)

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College of Engineering and Natural Sciences Magazine

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It’s been a productive winter season here in the College of Engineering and Natural Sciences. Our students and faculty returned in the new year with a renewed zest for their classes and research agendas, and it shows. I’m always so proud to run into students in the hallways of Keplinger and the other engineering buildings long after sessions have ended for the day. They stay late to work on projects, study with classmates or meet with their mentors. I have no doubt they’re making the most of their TU experience, and it’s very rewarding to witness their dedication.

Our faculty and staff also devote their fair share of extra hours to student objectives, and their passion for teaching doesn’t go unnoticed. In this issue of the magazine, we feature a few of the college’s young faculty members who add an extra element of creativity and ambition to the teaching profession. It’s important to note we don’t overlook the fine professors who already have given decades to TU and serve as the backbone of our college. However, it’s always encouraging to look ahead to the next generation of faculty who are establishing themselves within their respective departments.

Recently, we hosted University of Florida Distinguished Professor of Physics Clifford Will for the college’s Norman M. Hulings Jr. Memorial Lecture. There’s a lot of exciting news circulating in the world of physics today, and it was a pleasure to welcome Dr. Will and his presentation, “Black Holes, Waves of Gravity and other Warped Ideas of Dr. Einstein.” The topic was very timely considering the groundbreaking discovery of gravitational waves announced in February. The lecture attracted a full house at Gilcrease Museum including TU students, faculty and staff as well as physics enthusiasts from the Tulsa community. I’m pleased with our efforts to reach Tulsans off campus who share a passion for engineering, science and technology.

In closing, I ask you to take some time to read through this magazine. It’s packed full of articles and profiles about our successful alumni, devoted faculty and driven students. Read about the Drumright, Oklahoma, classroom of alumna Sarah Hagan in Math=Love or how alumnus Philip McAllister is a key team member of Instagram in Tulsa Roots in Silicon Valley.

Looking ahead to spring, I’m confident our college will continue to prosper. Our multiphase renovation continues in Keplinger Hall, and soon we will graduate another amazing class of promising alumni. I wish the best of luck to all of those receiving their diplomas in May. Many opportunities await!

Sincerely,

James R. Sorem, Jr.
Physicist Clifford Will speaks at Hulings Lecture

The Norman M. Hulings Memorial Lecture hosted physicist Clifford Will on March 4 at Gilcrease Museum. Will is Distinguished Professor of Physics at the University of Florida and the author of more than 200 scientific articles and three books. He is a fellow of the American Physical Society and the U.S. National Academy of Sciences.

In celebration of the 100th anniversary of Einstein’s theory of general relativity, Will’s presentation was titled “Black Holes, Waves of Gravity and Other Warped Ideas of Dr. Einstein.”

Tandy Endowed Chairs

The Tandy School of Computer Science has established two new endowed chairs: Rose Gamble is the Tandy Professor of Computer Science Engineering, and Tyler Moore is the Tandy Assistant Professor of Cyber Security and Information Assurance. They were honored at a reception in January. (Left to right): Carol Tandy, Tyler Moore, James Sorem, Rose Gamble and Rant Tandy.
TULSA ROOTS

In Silicon Valley

Alumnus finds success as an Instagram engineer.
With more than 400 million monthly users, Instagram is the world’s top photo-sharing mobile app, capturing life’s moments in photos and videos for an online audience. During the past five years, Instagram has become a household name with the help of Philip McAllister (BS ’04).

The eighth original employee, McAllister joined Instagram on the ground floor when it resided in a tiny office space in San Francisco’s South Park neighborhood. McAllister previously worked at another social networking start-up, Gowalla Inc., which allowed users to check in and share their location with friends. Valuable experience as an Android engineer groomed him for his upcoming important role at Instagram.

“I saw a lot of potential because Instagram didn’t have an Android app,” McAllister said. “It was a huge opportunity to accelerate the business.”

About a week after Instagram launched the Android app, Facebook announced it would acquire the company. Instagram boomed in nearly every aspect of its business, and McAllister transitioned from an individual engineer to eventually managing the mobile engineering department.

“Our company is constantly scaling and changing,” he said. “My largest responsibility now is helping build a team that makes sure Instagram is the place you visit to see the world’s moments — to ensure it’s a well-engineered, fast, high-quality app.”

McAllister never dreamed he would one day work in an office located at Facebook headquarters in Menlo Park, California, but he has paid his dues. Before joining Instagram four years ago, he worked at several other Silicon Valley start-ups where he felt comfortable in small team environments. It reminded him of TU and his collaborations with Professors John Hale and Sujeet Shenoi.

“Because I went to TU and worked in an engineering lab, I was attracted to start-ups,” McAllister said. “Large companies felt foreign to me.”

A native Tulsan, McAllister graduated from Jenks High School. After hearing about the quality of TU’s engineering programs and with encouragement from his grandfather, McAllister pursued a degree in computer science. His fascination with the liberal arts led to a brief stint as a history major in TU’s Kendall College of Arts and Sciences, but McAllister soon realized his academic strengths were best suited for the engineering college.

“My dad bought a computer for me when I was really young, and I picked up books from the library about programming,” he said. “I highly encourage everyone to get at least some exposure to computer science education.”

McAllister graduated from TU’s nationally recognized Cyber Corps program and worked two years at the Naval Research Laboratory in Washington, D.C. Career stops in California, parts of Asia and Austin, Texas, led him back to Silicon Valley where he continues to keep in touch with several of his TU classmates. The computer science class of 2004 has proven to be an exceptional group of professionals, including St. Louis oncologist Jesse Keller, Intel software engineer Todd Kosloff, cybersecurity engineering manager Tony Meehan, TU Assistant Professor Tyler Moore and Silicon Valley attorney Jon Novotny.

“They all went on to do really incredible things,” McAllister said. “The caliber of students I studied with at TU can stand toe-to-toe with the professionals of Silicon Valley’s top technology companies.”

Instagram’s popularity and functions continue evolving, but McAllister said his TU degree prepared him for such an innovative role.

“I received a truly well-rounded education,” he said. “It was tremendous for me.”
The classroom’s old wooden floor boards creak under Sarah Hagan’s feet as she paces back and forth with her smart marker, drawing slopes and intercepts on a screen. Late in the afternoon at Drumright High School, she’s teaching with as much fervor and energy as she did her first session of the morning, enthusiastic while facilitating open discussion. A 2012 graduate of TU’s mathematics and education programs, Hagan is in her fourth year of teaching at a small, rural high school in central Oklahoma in an aged facility built more than a century ago. Resources are sparse, and many of the students are underprivileged, but Hagan wouldn’t have it any other way. Her personal blog about teaching, Math=Love, has millions of views, and she was named one of the “50 Great Teachers” by National Public Radio’s education team last year.

Hagan’s classroom is an experience and the exact opposite of a stereotypical math learning environment. Inspirational quotes and mathematical equations illustrated in bright, vibrant colors are taped to the walls and hang from the ceiling. Signs read “Mistakes help me improve,” and “Find what you love. Do more of that.”

Storage bins brimming with supplies she uses in creative math puzzles and games are stacked in every corner of the room. It’s so cozy and comfortable that students want to be here. Hagan’s advanced math class consisted of five or six students her first year of teaching. A total of 22 enrolled in 2015.

“More kids are willing to try the advanced classes now,” Hagan said. “It’s been a gradual process seeing students progress now that I’ve taught these seniors all four years.”

Growing up in Coweta, Oklahoma, Hagan dreamed of becoming a teacher. In fact, she compiled a list of all her favorite school activities to one day incorporate them into her own classroom. In high school, math wasn’t Hagan’s favorite, but she was good at it.

“I tutored a lot of my classmates and realized I could explain it pretty well,” she said.

A National Merit Scholar, Hagan said her math classes at TU were extremely challenging, and she began to look at math in a different light.

“I realized these aren’t just formulas I can memorize,” she said. “It’s a beautiful thing I can’t wrap my head around.”

At TU, Hagan had an opportunity to observe and teach in
several Tulsa-area classrooms where student demographics varied widely. The real-life exposure was a precursor to her current role at Drumright High School.

“The socioeconomic level is pretty similar from Tulsa to Drumright,” she said. “Some students don’t have great home backgrounds, and it’s an experience similar to working with kids who don’t necessarily love school.”

During her student teaching, she began writing a blog, documenting her daily encounters with students, teaching applications and the learning curve of becoming an educator.

“I kept it anonymous at first, but as I logged more posts, I thought, ‘I’m not ashamed of this. I’m going to put my name on it,’” Hagan said.

 Appropriately named Math=Love, the blog features hundreds of posts brimming with her genuine passion for teaching others how math can be fun. Hagan writes about comical stories from the classroom along with innovative ideas and out-of-the-box activities she has implemented.

“I get messages all of the time from teachers who tell me they’ve been teaching for 25 years and they just learned something new,” she said. “Others will take ideas off the blog, fix them and then message me about how they made them better. I love that.”

Math=Love has been viewed more than 4.7 million times, and Hagan has received feedback from readers around the world. She said writing it is therapeutic and an effective way of reflecting on her work.

“When I write about the lesson, I get more out of it,” she said. “I write reminders to myself on what to do different next year.”

A budding educator, Hagan has enormous potential to change the historic perceptions of STEM (science, technology, engineering and mathematics) careers. Drumright was her first job offer, and she’s often asked why she stays. For Hagan, it’s not about the money but the freedom — she can teach math however she wants and make a difference where many students sometimes fall through the cracks.

“I’m trying to get the lower level kids up to where they need to be while not boring other students,” she said. “They come to class with preconceived notions about math. You have to work with them.”

When she arrived in Drumright, the math textbooks provided were the exact versions Hagan had used as a high school student. It reminded her of the textbook shortage she witnessed as a student teacher in underprivileged areas of Tulsa. She decided her students would write their own.

“There’s 15 to 18 kids in each class, and I have no curriculum map, no guidance, no textbooks,” Hagan said. “I’m allowed to be more creative, and it’s made me realize I have a lot of autonomy in this job and in this district.”

She teaches rationals before radicals and sometimes begins the semester in chapter 12 instead of chapter 1. Nothing is off limits, and along the way students gain confidence in their abilities.

“I’m looking for the best way to introduce seemingly disconnected ideas,” Hagan said. “These methods aren’t what I was taught in high school. There has to be a better way, and the experience has reaffirmed that education is where I’m supposed to be.”

Hagan wears a Pi-shaped pendant necklace each time she steps into the classroom — a tangible reminder of her goal to keep math fun. As she teaches students about math, they “teach her about life,” and the education circle is complete. She found more than equations and formulas along her mathematical journey; in 2014, a math teacher from Australia began leaving messages on her blog. They began dating and plan to marry this year.

For Hagan, math truly equals love.

Visit her blog at http://mathequalslove.blogspot.com/.

Hagan and her class play a game of Slope Dude.
The expert guidance Collin McMillan (BS ’07) received at TU helped reveal his calling to share knowledge with students. As one of the youngest assistant professors in the Notre Dame Computer Science and Engineering Department, McMillan is an influential mentor who carries on TU’s mission of service-based engineering. In 2015, he received a National Science Foundation Faculty Early Career Development (CAREER) Award in recognition of his potential in academic research.

McMillan specializes in automatic software documentation and is working to develop an algorithm that reads source code and automatically generates an English description. The NSF CAREER project, “Understanding Program Comprehension for Automated Software Documentation Generation,” examines what McMillan said is a classic problem programmers face when writing documentation.

“Nearly 90 percent is undocumented, but the idea is not to take the human out of the loop entirely,” he said. “We hope to see a 10 percent to 30 percent increase in the amount of documentation programmers write or share.”

The project includes building a model for software documentation and using it to create algorithms that automate the process. According to McMillan, writing documentation is one of the largest expenses involved in software development, but automating parts of the process will reduce those costs. As a result, programmers not only will improve their efficiency, but also achieve an important service aspect. Automating documentation will give individuals with visual impairment more opportunities to participate in the process, and software descriptions discovered in the research will enable blind programmers to read source code. McMillan said his Notre Dame research group is teaming up with the Indiana School for the Blind and Visually Impaired to help blind students pursue careers in software development.

“Those who are visually impaired read 50 words in source code for every three or four a sighted person reads,” McMillan said. “They have to read every single word.”

In addition to his NSF grant, the TU alumnus strives to involve Notre Dame students in other projects of relevant, real-world application — a key academic component he witnessed as a TU student.

McMillan, who grew up in the Kansas City area, originally had planned to attend the University of Illinois before visiting Tulsa. As an undergraduate, he worked in TU Professor John Hale’s lab and contributed to several research publications. He advanced his education with a doctorate at William & Mary, but McMillan’s TU experience remains one of the most defining eras of his life.

“TU was a great choice for me,” he said. “The community was very down to earth. People worked hard but still were very focused on their lives, families and what matters.”
N12 Technologies CEO Brad Berkson (BS ’85) has big expectations for the Cambridge, Massachusetts, startup he joined in 2013 as a board member and the company’s largest investor. A pilot and expert in aerospace and defense strategy, Berkson saw untapped potential in N12 products.

The company’s NanoStitch™ material is installed between plies during production to reinforce weakness in composite structures. Berkson helped raise more than $23 million in critical startup funding last year to expand operations. N12 serves some of the most powerful players in the aerospace industry such as Boeing and Airbus along with manufacturers of golf clubs, hockey sticks, automobiles, race cars and wind turbine blades.

“We’re developing nanotechnology to improve mechanical performance, reduce weight and improve the strength of carbon fiber composites,” Berkson said.

His leadership at N12 is enhanced by the experience he gained as director of program analysis and evaluation in the Office of the Secretary of Defense. He advised Secretaries Donald Rumsfeld and Robert Gates on alternative weapon systems, the development of defense program alternatives and the cost effectiveness of defense systems.

“It’s one of the most interesting and rewarding jobs I’ve ever had,” Berkson said. “What I did at the Pentagon was very impactful and purposeful. We did things that people’s lives depended on — if not now, then in the future.”

Fascinated with military history for most of his life, Berkson connected with his Department of Defense colleagues and admired their level of professionalism. He was awarded the DOD Distinguished Public Service Medal in 2009.

“You figure out how it matters and make it matter. If you have too intense a focus on one thing, it can leave you missing the big picture.”

Berkson said his undergraduate experience introduced him to the different talents, temperaments and convictions of his peers and taught him how to communicate effectively in a group dynamic. The brothers he met in TU’s Sigma Chi fraternity are lifetime friends, and 30 years later many of them support Berkson by investing in N12.

“In many senses, my TU friends are my family,” he said. “The people you meet in school and relationships you form at the end of the day are lasting and more important than any particular class. They are truly valuable.”
Tony Vaughn’s (BS ’82) college experience began as a tennis player at Oral Roberts University and ended as a petroleum engineering graduate from The University of Tulsa. A part-time job at a small engineering firm introduced Vaughn to the field, and he never looked back. Today, he serves as an executive at Devon Energy Company in Oklahoma City.

Vaughn was an ORU business management student on a tennis scholarship when family-owned Hudson Consulting in downtown Tulsa gave him the opportunity to explore a technical skillset. He discovered how much he loved the engineering discipline and decided to apply to TU. Although his math scores were low, persistence at TU paid off.

“After about the fifth or sixth time I visited the admission office, I was told, ‘OK, if you finish your degree at ORU, we’ll give you a shot,’” he said.

Seven years later, Vaughn completed the second degree and began his petroleum engineering career at Amoco Production Company in the Rockies. Later, he moved to Kerr-McGee where he worked in its offshore business while working in a reservoir engineering capacity.

“I reported to the production division while working in the exploration division. This combination provided a good technical foundation,” he said. “It was exciting work.”

When Devon offered Vaughn an interview in 1997, he seized the opportunity to join a new crop of engineers excited to revolutionize the industry. In a time when Devon was growing through mergers and acquisitions, Vaughn served in separate roles as an operations supervisor and reservoir engineering manager. He transitioned to Devon’s strategic planning group and also managed its offshore ventures in ultra-deep water. Vaughn was promoted to chief operating officer in February 2016.

One of his favorite parts of the job remains interacting with Devon employees in the field. Many graduates from the TU College of Engineering and Natural Sciences and the energy management program in the Collins College of Business have been hired by Devon.

“The most fun I have is when I’m with the guys working directly on projects and witnessing the creative solutions they have,” he said. “I especially enjoy seeing those ideas come from young people with fresh ideas.”

Vaughn’s broad range of work experience and technical skills allow him to easily connect with younger engineers as a valued mentor. He’s a trusted leader within the company and a voice of reason when oil and gas prices show instability.

Excited about the company’s future, Vaughn said Devon has grown 20-fold in less than 20 years and has built new resources and production growth through ingenuity, technology and creative thinking.

“In tough times, companies back off spending on major projects,” he said. “Look beyond the current short-term business environment, and the industry will be robust and growing.”
The College of Engineering and Natural Sciences is home to a diverse group of ambitious 30-something professors whose fresh ideas and daring research agendas are big selling points for potential students. For some of these young faculty members, the journey to TU began thousands of miles away while others grew up in Tulsa. Each of these new faculty followed their own path to TU and offers a special set of research and teaching strengths. While long-time professors remain the backbone of the college, the following three faculty represent a new generation of scholars emerging onto the academic scene.
Born on an island in the Indian Ocean 10,000 miles away from Tulsa, Assistant Professor of Chemical Engineering Hema Ramsurn is a native of the Republic of Mauritius. She earned her bachelor’s degree from the University of Mauritius before completing graduate degrees at Brunel University in West London UK and Auburn University in Alabama. She’s always loved applied mathematics and is fascinated with the optimization processes of chemical engineering. When she interviewed at TU in 2014, helpful peers and a positive working environment made her feel right at home.

“My colleagues are very supportive, and my department chairman is always here for me,” Ramsurn said. “I can’t say enough about their support, especially in my first year.”

Solving open-ended problems gives Ramsurn the freedom to focus her research in many different areas. With emphasis on supercritical fluids for biofuels and converting catalytic gas to liquid, Ramsurn is passionate about exploring renewable and nonrenewable sources for a more sustainable planet. She has received funding from the Petroleum Research Fund to study the fundamentals of converting catalytic gas to liquid reactions.

One year prior to Ramsurn’s arrival, another young female scientist joined TU’s prestigious faculty ranks. Erin Iski (BS ’05) is an assistant professor of chemistry and one of the college’s most active advocates for STEM outreach. Following her undergraduate degree at TU, she completed her doctorate at Tufts University. Although she never expected to return to her alma mater, she’s glad she did.

“The students are exactly as I remembered — genuinely interested,” Iski said. “Some of the same professors are still here, and I value their relationships as mentors just as much as teachers when I was a student.”

A specialist in liquid scanning tunneling microscopy, Iski investigates the structures of amino acid molecules on metal surfaces. She invites undergraduates and graduate students to join her in recording the images and studying the subsequent interactions of single atoms and molecules on metal surfaces immersed in liquid. An additional project is based on an extension of her graduate work at Tufts in which she studied an atomically thin layer of silver on gold. Iski said this research holds potential for unlimited real-world applications.

“The silver layer is incredibly thermally stable and can withstand temperatures up to 730 degrees Celsius,” she said. “We’re talking to scientists at NASA who are interested in using the technology to help protect metal electrodes for batteries.”

Iski collaborates with the TU Erosion/Corrosion Research Center as well as with faculty in the Department of Physics and Engineering Physics and TU CoRE. Off campus, she shares her work with Tulsa-area students and strongly believes in the power of teaching through research.

“This is what drives me. I love teaching because our students see the practical side of what they are being taught. Many of them go to industry for internships, and they come back telling me they used what they learned — it’s so gratifying.” — Hema Ramsurn
“We’re doing fundamental chemistry for elementary and middle school students, explaining ‘Here’s what an atom actually looks like,’ making that visual connection,” Iski said. “We’d like to purchase a portable microscope to bring into the classroom.”

Her outreach efforts also include directing the core chemistry course for Tech Trek, a week-long STEM summer camp for middle school girls supported by the American Association of University Women. Iski’s graduate and undergrad students helped develop the event’s curriculum, an opportunity to place those students at the top of the mentoring chain.

The only tenure-track female faculty member in chemistry, Iski is blazing a trail not only in her research field but also among women in science. “We’ve taken a lot of stands to make the issue more important,” she said. “I like the history I have with my faculty, and I know I’m supported in those measures.”

“It was lab work and research in CSURP (Chemistry Summer Undergraduate Research Program) that personally drew me to chemistry when I was an undergraduate at TU. In that vein, I try to do as much outreach as possible with TURC (Tulsa Undergraduate Research Challenge), Junior TURC and CSURP students in my current position.” — Erin Iski

Assistant Professor Tyler Moore also has fond memories of life-changing undergraduate research. Much like Iski, he grew up in Tulsa and attended TU for the chance to participate in TURC. He joined Professor Sujit Shenoi’s research team the summer before his freshman year.

“I got to do exciting work that makes a difference — writing peer-reviewed papers, presenting research to leaders at telecommunications companies and the White House,” Moore said. “Probably the most surreal experience was the phone call I received while shopping at Wal-Mart from the infamous hacker Kevin Mitnick, asking about my research.”

After graduation, Moore was awarded a Marshall Scholarship to study cybersecurity at the University of Cambridge in England. He served as a postdoctoral fellow at Harvard’s Center for Research on Computation and Society and taught at Wellesley College.

“I knew I wanted to work at a university that combined top-quality research with a genuine commitment to undergraduate teaching,” he said.

Moore returned to TU in 2015 to fill the role of Tandy Chair in Cyber Security and Information Assurance. He studies the economics of information security, cybercrime measurement and cybersecurity policy while serving as director of TU’s Security Economics Laboratory, a center dedicated to better understanding the behaviors of attackers and defenders. Moore also is director of StopBadware, a nonprofit anti-malware organization, and founding editor-in-chief of the Journal of Cybersecurity, an interdisciplinary journal published by Oxford University Press. He frequently collaborates with fellow researchers from world-class universities in the United Kingdom, the Netherlands, Austria, Israel and the United States.

Moore’s fellow TU computer science classmates from the class of 2004 include other leading industry professionals such as Insta-gram engineer Philip McAllister (see story on page 6). While much has changed at TU in the past 12 years, Moore is ecstatic to be amongst long-time professors and a new group of aspiring young faculty eager to share their research and mentoring abilities.

“It’s definitely an exciting time to be at TU, and the infusion of new faculty is a big reason why,” he said. “I know there’s an excellent foundation in place here to succeed — supportive faculty, engaged students and an institution that values research and teaching.”

“I appreciate the opportunity to be an ambassador for the university, city and state. There are many institutions where I could have happily worked, but there’s something extra special about building a program at your alma mater.” — Tyler Moore
Teaching the job
New NSF grant aims to improve the professional development of grad students

Engineering graduate students are some of the most technically trained students on a university campus, but sometimes they lack the personal skills acquired in professional development such as leadership, conflict management and adaptability. No matter how well students excel in their graduate degree curriculum, they often feel unprepared to fill the role of “employee.”

“For some students, it’s a pretty tough transition to the workplace and a hard interview when applying for a job,” said Brad Brummel, associate professor of psychology in the Kendall College of Arts and Sciences.

Brummel, who has researched professional development coaching, was asked to lend his expertise to a National Science Foundation project facilitated by Michael Keller, TU associate professor of mechanical engineering.

“My job is to produce the next generation of engineering and science researchers, but there’s not a program out there that focuses on teaching the importance of professional development,” Keller said.

TU’s NSF proposal, “Workplace Inspired Approaches for Improving Graduate Student Professionalism,” won a New Research Traineeship award in 2015 and provides Keller and Brummel with three years of research funding. Two additional faculty members from the College of Engineering and Natural Sciences, Assistant Professor of Petroleum Engineering Rami Younis and Associate Professor of Chemical Engineering Daniel Crunkleton, will assist with the research. The group’s goal is to develop a technique that enables the intentional practice of nontechnical skills. They aim to determine the competencies that are essential for successful grad students and whether increased professionalism improves productivity, retention and success.

The pilot project involves asking TU graduate students in mechanical, petroleum and chemical engineering to follow similar competency models that companies use to strengthen oral and written communications, conflict management, fairness and cultural adaptability. They will complete assessments about themselves and identify activities they can begin in graduate school and continue in the workplace.

“They’ll learn the language of professionalism and development,” Brummel said. “Hopefully, it will motivate them to attend TU’s etiquette dinner, join their professional societies and use their collegiate experiences as hooks for self-development.”

Software designed by industrial/organizational psychology alumnus Chris Wright (BA ’94, MA ’95, PhD ’00) will track the human measurement aspect of the project, including the student self-assessments as well as satisfaction surveys from their peers and advisers. Wright’s Tulsa technology firm, Reliant, provides talent management software solutions to companies worldwide.

“Professional development is so nebulous,” Brummel said. “That’s why competency markers are used to target areas for improvement. Students must ask themselves, ‘Can I talk to a technical audience and a lay audience, or what do I need to do to get where I need to be?’”

Brummel says one of the project’s biggest challenges is convincing graduate student advisers that preparing for employment is different from writing research papers.

“We’re looking at how to convince advisers that it’s worth their time,” Brummel said. “There’s a huge need for help in transitioning from a star performer student to an effective manager or leader as an employee.”

The TU interdisciplinary team hopes to begin identifying student participants for the project this spring.

“We get caught up in using research papers as metrics for graduate students,” Keller said. “It’s easy to know when a math problem is right or wrong, but students must know how to handle themselves in a diverse workplace, give effective presentations and respond with grace and authority.” —Michael Keller

(Left to right): Professors Bradley Brummel, Rami Younis and Michael Keller are studying the professional development of grad students.
Research goes commercial

TU’s venture into the commercialization of a small group of research projects during the past few years has introduced tangible, effective products to local and worldwide markets. Two examples of commercialized research that support TU’s entrepreneurial climate are described here.

Synercon Technologies LLC, established 2013

Developed by Associate Professor of Mechanical Engineering Jeremy Daily, Synercon provides a line of equipment and software for use in heavy vehicle crash investigations and serves a niche market of state highway patrol organizations nationwide. Products include the Forensic Link Adapter, a “black box” for heavy duty trucks programmed to download engine control module data after a crash, along with a Smart Sensor Simulator and Truck-CRYPT software.

“We ultimately help people who have suffered tragedy by providing clear information on what happened,” Daily said. His interest in crash forensics welcomed mechanical engineering, computer science and electrical engineering students to assist with the research. In true grassroots fashion, the prototypes were built in Daily’s home garage.

“I don’t know how I would’ve done it without TU’s help,” he said. “Commercializing a product is drastically different from typical academic research. You realize how your efforts really matter and see how you can actually use the product.”

The startup currently employs four people and has an office in downtown Tulsa.

Sulfur-Limonene Polysulfide, established 2015

TU is partnering with Flinders University in Adelaide, South Australia, to commercialize research that began two years ago in a TU chemistry laboratory. As participants in the Tulsa Undergraduate Research Challenge, senior Austin Evans and alumnus Michael Crockett (BS ’15) worked alongside Justin Chalker, former TU assistant professor of chemistry, to develop a polymer that removes mercury from water and soil. Nontoxic and inexpensive to make, the compound is made entirely of waste generated by the petroleum and citrus industries. Chalker, who is now a professor at Flinders, said the compound appeals to a global market, targeting the serious environmental problem of mercury pollution.

“We’re currently in discussions with fine chemical companies, geoscience firms, mining agencies and remediation companies,” he said. “I’m most interested in seeing our discovery make a positive impact on the environment.”

Both institutions will share revenue generated from the polymer’s commercial license agreements. Bill Lawson, TU director of technology commercialization, said development for commercial sale is in the preliminary stages and has heightened TU’s international reputation. “We’ve already talked to 17 different entities from four different continents. It’s some of the most exciting work I’ve gotten to do.”
In a new research project sponsored by NASA EPSCoR (Experimental Program to Stimulate Competitive Research), a group of faculty from the College of Engineering and Natural Sciences will study how to develop a biologically based life support system for space travel.

“The idea is to use algae as a source of nutrients and find a way to harness harmful or wasted wavelengths in space that are not normally used,” said Daniel Crunkleton, associate professor of chemical engineering and director of TU’s Institute of Alternative Energy. “We want to optimize the production of algae by using the maximum possible number of wavelengths in the spectrum with nanoparticles.”

Through the deployment of light’s extra wavelengths in space, the TU team plans to perform photonic conversions that allow for chlorophyll absorption. Photovoltaic (PV) wavelengths will be converted into energy capable of executing algae photosynthesis, but the researchers are quick to emphasize the reaction would not produce a stand-alone food source.

“It’s more nutrients than food, but there are other benefits to algae,” said Tyler Johannes, associate professor of chemical engineering. “It produces oxygen and filters out carbon dioxide and is also rich in fatty acids and vitamins.”

The three-year, $750,000 grant is a collaboration between TU’s Institutes of Alternative Energy and Nanotechnology. Other researchers include Associate Professor of Chemistry and Biochemistry Ken Roberts, two graduate students, two undergrads, Professor of Chemistry Allen Aplett from Oklahoma State University and Assistant Professor Ian Sellers from the University of Oklahoma Department of Physics and Astronomy.

As a result of the PV and algae research, the Oklahoma PV Research Institute at TU was established in November 2015 to design and fabricate cost-effective PV cells, foster interdisciplinary research and encourage collaboration between the three universities. Parameswar Hari, NASA EPSCoR project principle investigator and associate professor of physics, said TU’s role involves identifying nanomaterials for PV studies and researching third-generation PV cells, which are polymer, photo electrochemical solar cells and organic dye-sensitized cells that are not made of silicon or fabricated as thin films.

“The researchers assembled under the institute are experts in developing the next generation of solar cells,” he said. “The lessons we learn from this project will help us obtain funding from the Department of Energy, the Department of Defense and the National Science Foundation.”
Many of the nation’s gas utility lines are made of a type of plastic called polyethylene, similar to the material used in milk jugs. This plastic is durable but cannot be detected underground by the tools of most utility companies. Construction crews often are left guessing on the location of underground lines. Proposed strategies to resolve the issue, such as installing tracer wires alongside plastic pipe, have proven to be problematic and unreliable.

“Utilities have used this kind of milk jug plastic since the 1960s, but the pipes can degrade and start to crack,” said Associate Professor of Mechanical Engineering Michael Keller.

Keller, who has conducted research for the U.S. Department of Transportation since the early 2000s, has received a new round of DOT funding to develop an alternative pipeline material. The three-year $300,000 grant also provides resources to investigate a more efficient method to locate and track underground utility lines.

The research will involve outside collaboration with Raman Singh, professor of mechanical engineering at Oklahoma State University, as well as an OSU graduate student. Other investigators include Peter Hawrylak, TU assistant professor of electrical engineering, and two TU grad students. The team will follow two strategies for fabricating underground plastic pipe capable of responding to an electromagnetic signal. The first involves incorporating micro-encapsulated magnetic nanoparticles into the plastic.

“The microcapsules will reduce some of the harmful effects conductive particles can have on mechanical properties,” Keller said. “These magnetic microcapsules will make the plastic pipe look like a metal pipe to the utility locating tools used by gas companies. We also may be able to make this material self-heal any damage that occurs during the life of the pipe.”

Keller’s background in self-healing composites will play an important role in developing a new pipe that can heal itself when damaged. The other aspect of the research involves Hawrylak’s expertise in radio-frequency identification systems (RFID); he will experiment with RFID antennas to determine the pipe’s location and read its data. The information will provide an underground snapshot of the pipe’s integrity, eliminating the need for excavation while reducing cost and the risk of accidental damage. RFID technology will help utility services identify the pipe’s type, depth, shape and size. Hawrylak said the antennas also have the potential to gather data from neighboring pipes and provide landmarks to draft a thorough underground utility map.

“We’ll use an antenna from an RFID tag to locate the pipe and then install different antennas to encode information into the pipe,” Hawrylak said. “Specific code will help us detect what type of pipe it is and maybe even how far it runs in a certain direction.”

Its “smart pipe” capabilities will allow the RFID antennas to host multiple sets of data and act as a GPS coordinate for detecting underground lines.

Keller said the goal is to fabricate pipelines that can provide a reliable plastic pipe system that is easy to manufacture, cost-effective and quickly locatable.
A study conducted by TU’s Indoor Air Program last summer shows maintaining adequate ventilation and thermal comfort in classrooms could have direct effects on student learning and performance.

Appearing August 28, 2015, in the scientific journal *PLOS ONE*, the groundbreaking research with international implications is unlike any other published to date, examining the combined effect of classroom ventilation and temperature on academic performance. Findings at a large school district in the southwestern United States reveal proper classroom ventilation and temperature could raise students’ average test scores above state standards.

The study revealed fifth-grade students’ math scores (average 2,286 points) improved as classroom ventilation increased. The estimated score increase was 74 points from the lowest observed ventilation value (0.9 liters per second/person) to the recommended minimum ventilation rate (7.1 l/s per second/person). Effects of similar magnitude were observed for reading and science scores.

Data on classroom conditions were based on measurements in 140 fifth-grade classrooms of 70 schools conducted by TU’s Indoor Air Program during the winter and spring months preceding the learning assessment.

“Adequate ventilation involves a prescribed amount of outdoor air being introduced into the classroom, with the intent to dilute and replenish stale air in the room with incoming fresh (outdoor) air,” said Richard Shaughnessy, director of TU’s Indoor Air Program. “The right amount of air exchange for a classroom depends on the number of students as well as building characteristics. In addition, in highly polluted urban areas, supply air should be filtered to prevent exposure to outdoor air pollution.”

Ventilation rates fail to meet the recommended levels in majority of schools

The American Society of Heating, Refrigerating and Air-Conditioning recommends a minimum ventilation rate of 7.1 l/s per person in classrooms. TU’s study found ventilation rates below the recommended level in 96 percent of the classrooms measured. Similar findings have been reported elsewhere in the United States and worldwide.

To view the study “Effects of classroom ventilation rate and temperature on students’ test scores” in *PLOS ONE*, please visit [http://bit.ly/1YnAyBt](http://bit.ly/1YnAyBt).
A
lumni, students and donors had an
opportunity to tour Keplinger Hall’s
latest renovations during Homecoming
last fall. Faculty offices in the Departments of
Chemistry and Mathematics have been remod-
eled and are located on the main and upper
levels. The dean’s office suite and the Russell
School of Chemical Engineering are oper-
ating in temporary Keplinger locations while
construction continues on their new offices and
classrooms.

“Everything is already so much brighter
and more spacious,” said James R. Sorem Jr.,
dean of the College of Engineering and Natural
Sciences.

Every inch of Keplinger Hall will be updated and
rebuilt by the time the $34 million project is complete.
Bright classrooms with new desks and audio visual
equipment are being reconfigured to seat up to 70
students. Sorem said construction managers hope to
complete the next round of classroom renovations by this
summer.

“It’s exciting,” he said. “We’re about 20 percent
done with construction, and 50 percent of the funding is
raised.”

To support the Keplinger Hall project, please
contact Natalie Adams at 918-631-3287,
or natalie-adams@utulsa.edu.

Chevron support is TU tradition

The College of Engineering and Natural
Sciences enjoys a successful and longstanding
relationship with Chevron Corporation. Chevron
supports many student development initiatives
as well as organization activities, internships
and the university’s Keplinger Hall renova-
tion. Chevron scholarship dollars support the
petroleum engineering, chemical engineering,
geoscience, mechanical engineering, energy
management, electrical engineering and student
veteran programs. Many TU alumni have
worked at Chevron or currently fill important
roles in the company.

In October 2015, Bill Hunter (Chevron
university affairs liaison) and Paige Samuels
(BS ’12), a Chevron recruiter, visited the TU
campus to tour engineering facilities and meet with students
and department chairmen. Hunter and Samuels presented
Dean James R. Sorem Jr. and a group of outstanding
students with a donation of $336,000.

Chevron’s generous financial assistance directly impacts
the lives of students through support of research presentations,
organization conferences, leadership seminars, competitions,
volunteer projects and science-based community outreach
events. TU is grateful for Chevron’s longstanding partnership.
As TU continues to adopt new green energy policies that promote conservation and awareness, the Department of Mechanical Engineering has begun offering a course completely devoted to the study and business of energy sustainability.

Assistant Professor of Mechanical Engineering Todd Otanicar introduced the class three years ago to present students with the many energy options that are not based on fossil fuels.

“We try to make it more than just an overview class,” Otanicar said. “We focus on electricity generation vs. transportation fuels and cover solar, wind, nuclear, thermal, electric and hydro power.”

A small class size and casual learning environment encourage students to ask questions and participate in engaging discussions about energy trends. Otanicar said the goal is to teach students a fresh perspective on what they know about sustainable energy and provide a fundamental science and engineering understanding of the industry.

“We discuss what each method means, what its system looks like, the materials used and its advantages and disadvantages,” he said. “Then we’ll study the detailed science background of how it works.”

The course is the only one of its kind on TU’s campus to feature a hands-on technical aspect of sustainability. Students demonstrate technology and conduct experiments such as upcycling an old television lens by transforming it into a solar concentrator that absorbs sunlight.

“The class is another tool for their toolbox,” Otanicar said. “It teaches them the much broader social and environmental implications that we easily lose sight of as engineers.”

Students are challenged to consider economic and environmental constraints when determining cost factors and how alternative energy sources will affect the power grid. Otanicar’s lectures cover topics such as climate change and the economics of renewable energy. Students give presentations on the pros and cons of the Keystone Pipeline, fracturing and the Environmental Protection Agency’s Clean Power Plan.

“There are some good debates, and it’s a lot of fun to teach,” he said. “Students learn it’s not just about answering the question ‘Can you make it work?’ but will people accept it?”

Last fall, mechanical engineering senior Brendan Phillips developed an interest in how energy is harvested through nuclear fission and fusion. He values what he learned along with the economic viability of sustainable energy in the future.

“If we take time to learn more about these subjects and research new methods, the technology will improve,” Phillips said. “We’ll get closer to becoming a society completely dependent on cheap, environmentally friendly, sustainable energy.”
The University of Tulsa’s Sustainable Engineering for Needy and Emerging Areas (SENEA) club continues its humanitarian work with communities and families around the world. Approximately 20 students participate in group activities year-round; and in the summer of 2015, mechanical engineering graduate student David Wright led a small mission to Mongolia.

Wright, his wife, Carmen, and mechanical engineering senior Blake Fusick visited a community within the city of Darkhan, Mongolia, in August to install a new solar water heater. The device was retrofitted to the community’s current electric heating system to preheat the water.

“Theyir electric water heater was slow and expensive to operate,” Wright said. “We designed and manufactured a stand for the solar panels on-site, using local materials for the plumbing, stand and water tanks.”

Solar panels were shipped to Mongolia for the project, and the system’s electronic control unit and pumps were donated by Harvest Solar of Tulsa. Wright said the community of native Mongolians and U.S. citizens working as farm hands reports the solar water heater is functioning above expectations.

“The system completely replaced their electric water heater most days during the summer,” he said. “Residents are able to take six hot showers back-to-back in the middle of the day and still have hot water at night.”

SENEA remains in contact with the Darkhan farming community and is gathering data on the heater’s winter performance.

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Physics Journal Club draws hundreds

More than 250 people packed into a campus auditorium last fall for a lively discussion about space suit design, quantum mechanics, Einstein’s thought experiments and other riveting topics in science. Free to the public one night a month, TU’s Physics Journal Club attracts a wide demographic of Tulsans for exploration into the limitless world of physics. Organized by Applied Associate Professor Jerry McCoy, the meetings provide a welcoming and stimulating environment for physics enthusiasts of all ages. Little did McCoy realize how popular the group would become when it first met 18 years ago.

“I wanted to help freshmen learn about the department,” he said. “We held informal group discussions on the latest and greatest things going on in physics. If 10 people showed up, it was a good meeting.”

In addition to TU students, McCoy discovered the club was an effective way to support local science teachers and connect with prospective students. Physicians, attorneys, elementary-age children and parents also began to join the group. Topics range from neutrons to the birth of stars and the ancestors of the Apollo space program. Tulsans from all walks of life regularly attend the meetings.

“I’ve never seen anything like this before and certainly nothing of this size,” McCoy said. “People tell me all the time they never knew physics could be so much fun.”
Evans awarded DAAD scholarship

Chemistry senior Austin Evans has been accepted to the Research Internships in Science and Engineering (RISE) program hosted by the German Academic Exchange Service (Deutscher Akademischer Austauschdienst – DAAD).

This is Evans’ second time to receive a DAAD research scholarship. He studied covalent organic frameworks in summer 2015 as a DAAD RISE Scholar at the Ludwig-Maximilians Universität in Munich, Germany. Evans also was named a 2016 Rhodes Scholar finalist.

ENS seniors shine at Homecoming

Six of the 10 Jess Chouteau Outstanding Seniors for 2015 are students in the College of Engineering and Natural Sciences. Outstanding seniors are selected for their exceptional achievement in academic and service endeavors. The following students were honored at TU’s Oklahomacoming celebration in October:

- **Hannah Emnett**, mechanical engineering
- **Jordan Dunn Hoyt**, mechanical engineering
- **Sarah Pook**, biochemistry
- **Katy Riojas**, mechanical engineering
- **Jillian Schlecht**, biology
- **Marissa Schmauch**, chemistry and biochemistry

TU participates in STEM activities

**Tulsa Research Day**

TU’s Institute for Information Security (iSec) and Oklahoma Innovation Institute (OII), teamed up with Tulsa Research Partners to host the third annual Tulsa Research Day November 6 at the University of Oklahoma-Tulsa campus. The event welcomed talks and poster presentations from faculty and students in the Tulsa area. The theme centered upon health prediction in Oklahoma. TU students from the College of Engineering and Natural Sciences and the Kendall College of Arts and Sciences presented posters of their research.

**STEM Exploratorium**

TU manned a booth at the Flight Night STEM Exploratorium in September at Tulsa’s Expo Square. The event attracted hundreds of Tulsa-area middle school students to participate in activities related to careers in science, technology, engineering and math.

Fee earns math scholarship

TU mathematics and education senior Sara Fee has received a $3,000 scholarship from the American Mathematical Society. The award is made possible through the Waldemar J. Trjitzinsky Memorial Fund.

Following graduation, Fee hopes to teach math at a primary or secondary school.

SPE award winners

The following petroleum engineering faculty and alumni were honored at the 2015 Society of Petroleum Engineers Annual Technical Conference and Exhibition September 28-30 in Houston, Texas:

- Distinguished Member Award, **Shari Dunn-Norman** (BS ’78)
- John Franklin Carll Award, **Gem Sarica**, the F.H. “Mick” Merelli/Cimarex Energy Professor of Petroleum Engineering
- Ferguson Medal, **Shu Luo** (MS ’10, PhD ’13)
Geosciences field camp
A group of geosciences students joined peers from other universities to conduct fieldwork in Montana this past summer. The excursion was hosted by the University of Arkansas.

Master’s student John Blackwell (BS ’15) and senior Timothy Smith

TU senior Jose Van-Dunem (red shirt), Timothy Smith (tan jacket) and John Blackwell (blue sweatshirt) teamed up with other students from across the country for field research.

Martin wins OCAST contest
Chemical engineering senior Thomas Martin won first place at the Oklahoma Center for the Advancement of Science & Technology (OCAST) intern presentation contest at the Oklahoma Technology Showcase in August 2015 in Broken Arrow, Oklahoma. Martin received a $5,000 cash award. He completed an OCAST internship at Linde Process Plant in Tulsa.

Python paper breaks records
A research paper co-published in the Biological Journal of the Linnean Society by Assistant Professor of Molecular Ecology Warren Booth, Annice Ridgway (BS ’13) and biology student Devin Buxton on parthenogenesis in pythons is ranked the most viewed abstract in the journal’s history. Released in 2014, the paper ranks No. 1 of 1,152 others in the journal. Booth’s research on virgin births in certain species of snakes has gained media attention worldwide.

TU hosts Tech Trek
The College of Engineering and Natural Sciences hosted 36 rising eighth-grade girls June 14-20, 2015, for Tech Trek, a weeklong STEM residential camp.
TU partnered with the Tulsa Regional STEM Alliance to present Tech Trek, which aims to create excitement, interest and confidence among young women in the science and math disciplines. Campers from the Tulsa area participated in STEM-related activities while learning about potential careers in the field. The camp was created by the American Association of University Women.

See video of the camp at http://bit.ly/1QxLjlF
IPEC held in Colorado

The TU Division of Continuing Education for Science & Engineering hosted its 22nd annual International Petroleum and Environmental Conference in Denver, Colorado, in November. A total of 237 professionals from academia, government agencies and the energy industry attended from 38 states and 41 international locations. The event featured four plenary and 96 technical presentations along with two workshops and 29 exhibitors. Conference reviews from participants included, “Highly informative and well-balanced between industry perspective and environmental concerns.”

The 2016 IPEC will be held November 8-10 in New Orleans, Louisiana, and will include sessions on offshore petroleum environmental issues and solutions. The call for presentations opens soon. For more information, please visit www.cese.utulsa.edu/conferences.

ELITE customized for McElroy Manufacturing

The TU Division of Continuing Education for Science & Engineering partnered with Tulsa’s McElroy Manufacturing in 2015 to provide a custom four-month training program for top engineers chosen to fill valued leadership roles within the company.

CESE officials modified the Executive Leadership Institute for Technical professionals and Engineers (ELITE) program specifically for McElroy employees by tailoring classes, instructors and program material to meet their specific engineering needs.

The McElroy version of ELITE training featured a personal assessment of each participant along with the following modules: Communicating for Success; Leadership Strategies for Balanced Change Management; Risk Assessment and Management; and Managing Organizations across Time, Distance and Culture. Participants were assigned a project associated with each course topic and asked to apply the information on the job. They also prepared an executive summary describing the problem, strategic steps implemented and final results. The assignments were instrumental in improving participant skill sets. ELITE students also presented a short review to the entire McElroy group after each session, building knowledge of the course topics and providing beneficial experience in explaining related concepts and operations to a group.

The McElroy team’s ELITE training concluded in December. At a final reception, participants expressed their thoughts on the custom program as “very valuable and time well-spent.” Another commented, “I wish everyone in my team could go through this and learn these valuable tools of leadership.”

CESE plans to host additional company-specific ELITE training sessions for other Tulsa-area firms in 2016.
John Hill (BS ’59) used his TU degree to launch an admirable 33-year career at Texas Eastman Company as a chemical engineer. Now retired, Hill and his wife, Ann, actively support the university as participants in the Chapman Legacy Society.

“It was something we were passionate about, and we’ve really enjoyed the experience,” Hill said.

“It’s important to give back to your alma mater.” Chapman Legacy Society members leave a permanent legacy at TU by either establishing an endowment or remembering TU in their estate plans.

Join the Hill family in leaving a permanent legacy for future generations. Call 918-631-3287, or visit legacy.utulsa.edu