Material World

The quest for technological advancement using the most extraordinary materials on the planet

INSIDE

Empowering the Next Generation of Makers

Health Care's New Dream Team

Pitching to a “Shark”
IN THE LAB

THE NEW SILK ROAD

In the Bio-Inspired and Bio-Integrated Engineering Laboratory—or “Tiger Lab,” as it is often called—mechanical engineering assistant professor Tiger Tao is coaxing something remarkable out of silkworm cocoons.

His work begins by extracting and purifying fibrin proteins from the cocoons using a cruelty-free method and ends with a 100 percent organic liquid silk solution. That solution can be transformed into a film that can then be customized to degrade at different speeds, enabling fully dissolvable programmable electronics that could be placed inside the human body, eliminating the need for antibiotics.
Welcome

A New Era

I am proud to introduce Texas Engineer, a new annual magazine that captures the spirit, energy, and innovation of our Cockrell School of Engineering students, faculty, and alumni—a diverse community that is truly world-class.

I hope you take a moment to read the stories and enjoy the features in this inaugural issue—see how the new Engineering Education and Research Center will transform the Forty Acres, learn how advanced materials are creating extraordinary possibilities for research and industry, and discover how our inventive faculty are collaborating with physicians to redefine patient diagnosis and treatment.

At The University of Texas at Austin, we have embarked on an exciting new era in engineering education, and we want you to be a part of our future. Thank you for all you do to help advance Texas Engineering as one of very best engineering schools in the world.

Hook ‘Em Horns!

Sharon L. Wood
Dean
Cockrell Family Chair in Engineering #14
Jack and Beverly Randall Dean’s Chair for Excellence in Engineering
Contents

Texas Made
04  Made It
06  Pitching an Entrepreneurial Dream
08  Tech Chat with Joe Beaman Jr.
09  Research Roundup

Student Spotlight
11  Research: The Ultimate Teacher
12  Spinning Wheels

In Focus
14  The Texas Engineers’ Guide to Space Exploration
16  Investigators of the Field

Features
17  The Engineering Education and Research Center
20  Material World
26  Engineers and Physicians
30  Keeping it Simple

Notes and Perspectives
32  Faculty Opinions
34  Q&A: Alumna Follows American Dream to the Top of American Airlines
36  Chemical Engineering Alumni Show Gratitude with a Chain of Giving
37  Alumni Notes
39  By the Numbers
Shaping the Future of Mobile

As head of Samsung’s Mobile Innovation Lab, Meng Chee leads a high-powered team of user researchers, engineers and designers to invent the next mobile device features that consumers don’t even know they want yet.

“Today’s mobile experience centers on the phone. In the next five to 10 years, we will no longer be operating within the boundaries of a single device,” Chee says. “We’re working on developing interconnected mobile experiences that will influence how you live your life — in your car, at your office and in your home.”

Chee’s innovation lab operates with the speed and agility of a startup, and the resources and technical capabilities of a global corporation. In addition to developing experiences for Samsung’s flagship phone and wearable devices, his team analyzes observations from user studies conducted around the world to define the future of mobile.

A Cockrell School student in the early days of the Internet, Chee has long been fascinated by the interaction between software, hardware and design. Before joining Samsung four years ago, Chee helped launch two successful software startups and invented products for some of the world’s largest companies, working as CTO for Frog Design and Entrepreneur-in-Residence for Nokia. Samsung offered him the perfect opportunity to combine his passions by creating a new incubator for innovations at the intersection of technology and user experience.

“I’d built a network of talented people and was ready to push the scope of our inventions,” Chee says. “At this company, I knew I could help develop experiences for all imaginable devices — even ‘smart’ buildings.”

When the Mobile Innovation Lab started, Chee charged his team with creating a fresh experience for a core mobile feature close to any user’s heart: music. Milk Music, Samsung’s highly visual radio app, spans the company’s devices — phones, watches, TVs and computers. Since launching at SXSW in 2013, the app has won four global awards for its design and user interface.

“Milk Music’s success felt really good, and it was great that the team got that recognition,” he says. “It shows that the way we’re doing things — in this rebellious, different way — is working.”

While Chee couldn’t give us details about the Mobile Innovation Lab’s current projects, he did emphasize the ever-increasing importance of user experience in the future of mobile.

“A product’s success is no longer just about its technical features and functions,” Chee says. “In the next five years, the battle for consumers will be won by how much people love the ways their mobile devices connect them with the world.”
Empowering a New Generation of Makers

As CEO of Other Machine Co., a hardware startup based in San Francisco, Danielle Applestone is creating a world where all makers have the tools necessary to build anything they dream up.

Applestone’s 21-person team designs and manufactures the Othermill, a desktop milling machine that allows students, craft hobbyists and small businesses to turn digital designs into intricate 2-D and 3-D objects made from metal, wood and other materials.

A maker at a young age, Applestone spent her childhood in rural Arkansas learning from her father, an enthusiastic craftsman himself who was confined to a wheelchair. Her family moved into a new home when she was six, and her father designed plans to make an accessible woodworking shop. He called on his daughter to help build it.

“My dad and I worked to modify things and make them easier or more accessible,” Applestone says. “I was always trusted with real tools and asked for my opinion on design. It made me feel like I could improve things for people through building better solutions, even though I was just a child.”

Today, Applestone is empowering a new generation of artisans with the affordable, high-powered and easy-to-use Othermill. Weighing just 17 pounds, the machine is so light and safe that it can be used on any workstation, whether a dorm room desk or a kitchen table.

Every day, Applestone is astounded by what users decide to build with the help of Othermill. For instance, one customer used his to produce a small plastic structure that he equipped with sensors to collect data on a mouse’s metabolism.

“People are so creative and motivated,” Applestone says. “These kinds of tools help makers express themselves, whether they’re creating jewelry, robots or biomedical devices.”

Under her leadership, Other Machine Co. has attracted more than $5 million in investment and raised $300,000 in a Kickstarter campaign. Incorporating feedback from 200 Kickstarter backers, the startup produced a commercial version of the Othermill in late 2014. The company has since sold machines to engineers and hobbyists, as well as engineering and design programs at universities across the country.

Applestone hopes to help advance the thriving maker movement as Other Machine Co. increases production of the Othermill and expands its reach.

“In the future, I see experts coming together with novices to educate these makers and advance their craftsmanship. I hope we see a rebirth of artisans and craftspeople,” Applestone says. “And I want to see small businesses, like those based around Etsy.com, become the norm rather than the exception.”

— Kristin Tommey

DANIELLE APPLESTONE
CEO, Other Machine Co.
Ph.D. Materials Science and Engineering 2012
PITCHING AN ENTREPRENEURIAL DREAM

The MicroMulsion team, Daniel Min, Ani Sharma and Nishant Mehta, in Silicon Valley. Right: The team with Mark Cuban after their pitch in 2013.
Two years ago, biomedical engineering alumnus Anirudh “Ani” Sharma was pitching his team’s biotech startup, MicroMulsion, in hopes of winning over a large audience of his peers, his mentors, local entrepreneurs and one notable guest. In the audience that night was Mark Cuban, the billionaire tech entrepreneur, owner of the Dallas Mavericks and investor on reality TV show “Shark Tank.”

Sharma was representing one of more than half a dozen teams during the Longhorn Startup Program’s Demo Day, a semi-annual event that gives Texas Engineering students the opportunity to pitch the businesses and products they spend a semester developing. Cuban was invited to be the featured guest by Bob Metcalfe, Longhorn Startup Program mentor and Cockrell School professor of innovation.

Understandably, it was a bit nerve-wracking for Sharma, then a senior. But his baritone voice and knack for breaking down technical biotech concepts served him well. He succeeded in delivering a strong and accessible pitch in less than six minutes — one that intrigued Cuban. Backstage, Cuban approached Sharma and his fellow startup partners, biomedical engineering alumni Nishant Mehta and Daniel Min.

“Speaking to Mark that night was surreal,” Sharma says. “He came up and asked a few questions about what we needed, and said he’d like to invest. To hear a billionaire make us a significant offer was incredibly exciting, though we were a little skeptical that he was serious.”

Cuban was serious.

In a little over two years, these young entrepreneurs developed their product, built their startup and benefitted from the guidance and mentorship of Cockrell School faculty, such as biomedical engineering associate professor Laura Suggs, an early mentor who is now MicroMulsion’s chief technology officer. They also put together an enviable board of advisers, which includes Cuban and Metcalfe.

MicroMulsion’s product is a microgel that can provide binding and controlled release of growth factors — a sort of “food for cells” — that are used to stimulate cell growth and function. Researchers and scientists use growth factors to nurture cell cultures used for experiments. Two typical problems with growth factors are their high cost and short life span. The team says their product’s controlled release feature will help maximize the growth factors, making them more efficient and cost-effective for scientists to use.

The team first learned about microgels in one of their biomedical engineering labs, but the business idea really took off when Suggs suggested they adapt the product for use in cell cultures. After solidifying the concept, Metcalfe provided the team with thoughtful guidance on their business proposal, asking the tough questions an investor would and pushing them to do better.

Thinking back, Mehta says, “It was a five-minute conversation with Cuban, but we worked for the next five months drafting a proposal.”

The result was the first investment in the company — $75,000 from Cuban.

In May 2014, armed with the investment and their newly obtained biomedical engineering degrees, Sharma and the team headed to Silicon Valley.

Sharma is MicroMulsion’s CEO and Min is head of engineering. Mehta is leading research and product development for the company.

Because the microgel is in the latter phases of research and development, Sharma does not have an expected time to market. For now, the team is focusing on perfecting the product and further understanding their target markets, which include biotech companies and universities.

As they start discussions with potential clients and partners, Mehta says that having Cuban and Metcalfe on the board is helping to open doors.

“In a rapidly growing biotech market, it’s difficult for a company like ours to stand out, but if you mention Mark Cuban, they’ll listen,” Mehta says.

The team often draws from what they collectively learned from faculty, their Austin mentors and even Cuban in that very short first conversation — everything from putting an investment proposal together to how to think through decisions.

One thing is certain: The team has their pitch down.

“Overall, an incredible moment for our team,” Sharma says, recalling the pitch. “I still can’t quite believe how well everything turned out for us since then.”

— Sandra Zaragoza
Tech Chat with Joe Beaman Jr.

The modern manufacturing landscape would be far less dimensional had a young Joe Beaman Jr. not taken a driven undergraduate student with a big idea under his wing back in the 1980s. Together, they developed a landmark additive manufacturing (or 3-D printing) technology called selective laser sintering that is still considered one of the world’s most promising manufacturing methods.

Thirty years later, Beaman continues to inspire students and push the boundaries of manufacturing in the Department of Mechanical Engineering, which he chaired for 11 years. Most recently, he is close to unveiling a first-of-its-kind 3-D printer that creates very high-performance and high-temperature polymer parts.

Was there an early life experience that incited your trajectory of research? The thing that pops into my head is building a strobe light in high school. It was our “senior day,” what we called the last game day of the basketball season, and we shined the strobe light on the crowd while Jimi Hendrix was playing, and everyone was mesmerized. I’ve always been interested in doing things that make people react in a positive way. I like doing research that will ultimately make a difference to people.

3-D printing and additive manufacturing are terms that are often used interchangeably. Is there a difference? I make a distinction between very inexpensive, hobby-type systems, which I classify as 3-D printing, and additive manufacturing. The inexpensive systems are extremely important. They’re wonderful for students and for anyone who wants to build something. But if you’re building a critical part for an airplane, for example, you really don’t want to build it with that particular piece of equipment.

In terms of technological advancement or shift, do you think there is a historical innovation equivalent to additive manufacturing? Lately I’ve been thinking about how machining has been around for several hundred years. It was one of the major factors in the Industrial Revolution, and those machining techniques have been well developed over time.

Additive manufacturing technology, on the other hand, has only been around since 1986. With this technique, we’re actually building both the ingot (material molded into a shape for additional processing), if you like, and the geometry at the same time, so it’s a little more complicated. But what you get is the complexity everyone wants. You can now essentially grow things.

You’ve discussed before that there are misconceptions about what additive manufacturing technology is capable of and what we think it’s capable of doing. What are some of the limitations? The limitations are the strength of the part, the size of the part and the use of multiple materials at the same time. Also, many people are unaware of the amount of post-processing that has to be done after the additive manufacturing part, at least with today’s machinery; the objects don’t typically emerge from the machine ready to use. Surfaces often need to be smoothed and supports removed.

Do you think we are close to having printers or systems in our home workshops, kitchens and garages and buying designs much as we do digital music? In some ways, yes. There has been some very cool 3-D printed artwork created, and some of those are from digital files. On the other end of the arena, in workshops, I can imagine people wanting to have one of these systems, if for nothing else than to make beautiful, strange or useful things.

You could have stopped with your invention of selective laser sintering. What keeps you motivated to continue your work today? I don’t say no to projects very often. (A lot of them fail, by the way.) I like exploring new things and this technique gives us the opportunity to do a lot of that. I think if you’re not learning almost continuously then it’s not much fun. And I think you should be having fun if you’re doing research.

— Ashley Lindstrom
Research Roundup

A Rehab Robot Named HARMONY

The challenge: When it comes to physical therapy for patients with spinal and neurological injuries, mechanical engineering assistant professor Ashish Deshpande and his team of graduate students from the Rehabilitation and Neuromuscular Robotics Lab think existing treatment methods need to evolve.

The breakthrough: Deshpande and his team have introduced HARMONY, a robotic exoskeleton designed to work with physical therapists to deliver full upper-body therapy with natural motion and tunable pressure and force. HARMONY is different from many therapeutic devices in that it feels weightless to patients. And, unlike conventional rehab, HARMONY can provide real-time data to assist therapists in customizing exercises for patients. The rehab robot is programmed to maximize the patient’s participation in the therapy exercise, which is important for a speedy recovery. HARMONY can also determine if a patient isn’t performing an exercise correctly, which is critical to preventing further injury. The efficiency of such data-driven care could improve therapy outcomes and eventually help lower the cost of rehabilitation.

GPS Tracking on a Granular Scale

The challenge: Today, the GPS technology in our mobile devices can tell our location anywhere on Earth to several meters of accuracy. That might be fine for Google Maps, but aerospace engineering associate professor Todd Humphreys and his team of graduate students in the Radiodavigation Lab think that GPS technology should be better and enable more applications.

The breakthrough: Humphreys and his team built the first centimeter-accurate GPS receiver for a smartphone. The key to the system is a powerful and sensitive software-defined GPS receiver that can extract centimeter accuracies from the inexpensive antennas found in mobile devices.

The researchers are working to perfect the technology, but they can already envision unmanned aerial vehicles delivering packages to a specific spot on a consumer’s back porch, improved collision avoidance technologies in cars and virtual reality headsets used to play multi-player games outdoors.

A TSUNAMI Hits Cancer

The challenge: In the fight against cancer, every tiny molecule and its movement matters. So when a team of biomedical engineers spotted a void in the ability of researchers to track molecular movement of single epidermal growth factor receptors (EGFRs)—an important membrane receptor in cancer growth—they went to work.

The breakthrough: Evan Perillo, a biomedical engineering graduate student working with professor Andrew Dunn and assistant professor Tim Yeh, designed a super-resolution microscope that could help researchers better understand cancer.

The imaging system, called TSUNAMI, can image molecular movement of EGFRs traveling at high speed, with a time resolution much faster than what a camera can achieve. TSUNAMI is also capable of imaging at a very small scale, 10 times smaller than the current standard.

By tracking where these super-fast receptors travel, researchers will gain a better understanding of the disease’s behavior and be better informed to provide approaches for prohibiting cancer growth.

A Nature-Inspired, Non-Toxic Flame Retardant

The challenge: Manufacturers place flame retardants in everything from mattresses and sofas to car upholstery and baby products to help buy valuable time in the event of a fire. But as scientific evidence mounts about the dangers that flame retardants pose when their chemicals leak out of products into our environment, people are searching for alternatives.

The breakthrough: A team led by chemical engineering associate professor Christopher Ellison found that a coating of polydopamine can be used as a highly effective, non-toxic and water-applied flame retardant for polyurethane foam.

The researchers’ flame retardant is derived from the natural compound dopamine, a neurotransmitter that plays various roles in the human brain and body.

The dopamine was transformed into the polymer polydopamine that cannot easily leech out or be absorbed by humans. The team was inspired by the way marine mussels secrete the compound to stick to virtually any surface—an important quality for flame retardants, which are often applied as coatings onto
The team found that the polydopamine coating on foams leads to a 67 percent reduction in peak heat release rate, a measure of fire intensity and imminent danger to a building’s occupants or firefighters. In lab tests, the polydopamine fire retardant reduced the fire intensity by about 20 percent over many existing flame retardants.

The challenge: The April 25 earthquake and aftershocks that hit Nepal caused more than 3,000 landslides in the small country, some of which wiped out entire villages and further destabilized the geology of high-altitude mountains, glaciers and glacial lakes. Luckily, none of the 21 glacial lakes in the Nepal region have burst out of their natural environments in the mountains, but the threat remains.

The breakthrough: In May, environmental engineering professor Daene McKinney and a team of experts deployed to Nepal to make a rapid assessment of several of the potentially dangerous lakes, including Imja Lake in the Khumbu region.

The RAPID response mission was part of the High Mountains Adaptation Partnership (HiMAP), created and managed by The University of Texas at Austin and The Mountain Institute, a Washington, D.C.-based nonprofit focused on the conservation of mountain environments. HiMAP received $100,000 for this effort from the United States Agency for International Development, UT Austin, the American Society of Civil Engineers and private donors to cover travel, field support, helicopter costs and other project costs.

Between June and August, the researchers conducted detailed remote sensing and field-based assessments of the glacial lakes. By fall, the team was able to deliver their post-earthquake assessment report of three glacial lakes in Nepal, providing the Nepalese government with risk-reduction engineering methods to keep the lakes in place.

Beyond the Selfie

The challenge: We take out our smartphones to snap a picture of our gourmet dinner or shoot a video of our family vacation. But depending on lighting and the steadiness of the photographer’s hand, these photos may be grainy or otherwise distorted. Electrical and computer engineering professor Alan Bovik and his team are accepting the challenge of developing better cameras for our mobile phones and devices.

The breakthrough: With a $450,000 grant from the National Science Foundation, Bovik is developing “distortion-aware” computer vision models and algorithms suitable for today’s mobile camera devices. Beyond better selfies, this research could help improve critical devices, including mobile medical camera devices and low-cost surveillance and security cameras.

Bovik’s team will use new and emerging models of visual neuroscience (how people see) and detailed and accurate statistical models of the 3-D visual world (called natural scene statistic models). They plan to incorporate natural scene statistic models into sophisticated computer vision algorithms for object detection and categorization, and 3-D scene understanding.

Digital Rock Age

The challenge: Our understanding of rocks and soil is important to society and various industries, including construction, energy and medicine. But for now, the vast and valuable rock microstructure data collected by scientists and engineers is not easy to access.

The breakthrough: Petroleum and geosystems engineering assistant professor Maša Prodanović and a team of leading UT Austin scientists are taking on the big task of changing the way researchers use and collect large volumetric datasets of geologic materials.

The National Science Foundation selected Prodanović, research associate Maria Esteva of the Texas Advanced Computing Center and professor Richard Ketcham of the Jackson School of Geosciences for a two-year, $600,000 grant to build a Digital Rocks Portal utilizing the latest technologies in data storage.

Recent advancements in high-resolution imaging techniques have provided a wealth of 3-D datasets that reveal the microstructure of rocks and soil, which in turn serve as the basis for sophisticated computer modeling of fluids moving through pore networks.

The project will result in a large, highly organized platform for sharing and downloading rock data. This emerging research can inform important decisions in petroleum, environmental and civil engineering.

— Sandra Zaragoza
Gary Pope, a professor in the Department of Petroleum and Geosystems Engineering and founder of the Chemical Enhanced Oil Recovery Research Project, and his students are working to find new molecules, such as solvents or detergents, which can be tailored in just the right way to free up crude oil trapped in fine-grained rock.

Pope is enthusiastic about the potential outcomes and discoveries of this research, but like many of the Cockrell School’s world-class professors, he is also very passionate about how his labs are educating undergraduate students. His research provides unique training for these students, cultivating the understanding they need to apply such complex technology in the real world.

“I am motivated because I know the students’ experience in my research labs is helping turn them into better engineers,” Pope says. “They are so much better because they actually understand what is being measured and the uncertainty of the measurements. It’s real. It’s not just a computer calculation.”

Pope created his undergraduate research program nearly 30 years ago to give students the opportunity to take what they’ve learned in the classroom and apply it to hands-on research. The program pairs undergraduate students, primarily from engineering or the sciences, with graduate student mentors. By the time these students are seniors, they are conducting research on a graduate-student level and are prepared for either graduate school or advanced jobs in industry.

Lauren Churchwell, a senior in UT Austin’s Department of Chemistry, says she didn’t know much about engineering before she started working in Pope’s lab. She’s now planning to apply to graduate school in the Department of Petroleum and Geosystems Engineering.

“When I first came to this lab, I didn’t even know what any of this equipment was,” she says, looking around the lab. “I have definitely grown as a chemist and as a scientist. I’ve learned a lot about analyzing data.”

— Sandra Zaragoza
Spinning Wheels

In the northwestern corner of New Mexico, massive sheets of rock shoot out of the earth 7,000 feet high. It’s Shiprock, an iconic formation found among the 27,000 square miles of the Navajo Nation, and it stands at the heart of land poisoned by four decades of uranium mining.

Today, more than 500 abandoned mines remain, and some members of the Navajo Nation still don’t have access to potable water. But Cockrell School of Engineering graduate student Lewis Stetson Rowles wants to change that, and he has an unusual secret weapon: pottery.

Rowles is part of the Department of Civil, Architectural and Environmental Engineering’s Environmental and Water Resources Engineering group. “I feel destined to pursue this research,” he says.

In the world of science, amid rigorous experiments and hard data, there typically isn’t much room for art. But when Rowles isn’t researching carbon nanotubes with multi-metallic nanoscale oxide (one of his undergraduate projects), he leaves the lab and heads for his potter’s wheel, where he has fed his creative side since first learning the skill in high school.

And it’s Rowles’ ceramics skills that elevate his engineering and put him in a unique position to help solve water contamination problems, says assistant professor of environmental engineering Navid Saleh, who, along with professor Desmond Lawler, advises Rowles.

“That’s because most water filters in developing countries today are either clay pots or plastic buckets with clay columns inside. But traditionally, engineers haven’t paid much attention to the clay. Instead, they focus on technology and developing the nanomaterials that treat the water. Rowles is doing that, but he’s also examining the problem from a potter’s perspective, redesigning the clay filters themselves to make them more durable, effective and efficient. And that approach is completely new,” says Saleh, who also taught Rowles as an undergraduate at the University of South Carolina.

Their research is still in the preliminary stages, but ultimately Rowles is working toward redesigning the shape of the bucket filter’s clay columns so that it has more surface area to interact with the water. He’ll also look at different glazing techniques for applying the nanoparticles that filter out contaminants.

“It’s a little unusual, a little bizarre,” Rowles says of his ceramics-civil engineering double threat. “But nowadays coming up with new ideas, the meshing between two seemingly different fields is really important.”

In fact, the merging of these worlds is so unusual that for a long time, it never occurred to Rowles to combine them. He studied each discipline separately, pursuing training and leadership opportunities whenever possible. As an undergraduate, he was one of five students chosen to travel with Saleh to the Navajo Nation to learn about their water treatment needs. Meanwhile, away from engineering, he helped start a ceramic program for intellectually disabled adults, teaching students how to create ceramic goods they could sell at local markets.

The idea to connect the two didn’t come until the end of his undergraduate career, and it happened almost by accident.

The Navajo Nation trip inspired Rowles to pursue a research career, and he decided to apply for a prestigious National Science Foundation (NSF) fellowship to attend graduate school. During a discussion about the application, Rowles mentioned that he was considering listing a ceramics teacher as a reference. Saleh had a flash of inspiration and suggested Rowles put his two passions together. Rowles agreed, adjusted his proposal and snagged the fellowship.

“Sometimes students don’t recognize their own strengths,” Saleh says. “But Stetson has this skill that nobody else has. To actually incorporate fine arts and have somebody who’s a potter and involves the history, culture and knowledge, that’s very rare in engineering.”

Saleh welcomes the influence from another field, and says engineers, himself included, need to be more open to scholarship from outside the sciences. “Ideas don’t have a home; they can come from anywhere,” he says.

This past summer, Saleh and Rowles took another trip to the Navajo Nation to learn more about that community, collect water samples and meet with local potters. Rowles wants the pottery techniques used by the communities he’ll be working with to inform his ceramic filter designs. Right now he is examining historical glazing techniques and their interaction with nanoparticles. He is also working toward an internship with the Smithsonian Institution, with the hope of studying its massive historical pottery collection to learn about ancient techniques used around the world.

The NSF fellowship will support Rowles for the last five years. From there he hopes to become a professor and continue researching in the lab and in the field. He is already thinking about his future students and says he wants to equip them with what they need to improve the standard of living around the world.

For the Navajos, that means having an affordable, efficient method for disinfecting surface water and decontaminating toxic groundwater, removing the danger from simply drinking a glass of HzO. Rowles hopes the filters he and Saleh are working on will meet that need.

As he explained in his fellowship proposal, “It might not be as easy as making a pinch pot, but it will certainly be worth it.”

—Tracy Mueller

This article first appeared in Texas Exes’ alumni magazine, The Alcalde.
Texas Engineers have played visionary roles in some of the nation’s most successful space research missions since the inception of the NASA program more than 50 years ago. Our alumni have trained as astronauts, developed complex algorithms, innovated powerful scientific instruments and built spacecraft and satellites, all to bring discovery back home.

And now, in the 21st century, our faculty and alumni are continuing to lead missions that help us better understand Earth and its weather patterns and bring us even closer to unraveling the mysteries of the universe beyond our planet. Join us on a journey through a few of the impressive planetary missions that Texas Engineers have recently led.

**LONGHORNS IN SPACE**

**Michael Baker (B.S. ASE 1975)** is the International Space Station Program’s manager for international and crew operations at Johnson Space Center. A veteran of four space flights, Baker has spent 40 days in space.

**Alan Bean (B.S. ASE 1956)** was the fourth man and only Longhorn on the moon. He helped establish 11 world records in space and astronautics.

**Robert Crippen (B.S. ASE 1960)** piloted the first orbital test flight of the shuttle Columbia in 1981, the first true manned spaceship. He has spent 23 days in space.

**Paul Lockhart (M.S. ASE 1981)** is a veteran of two space flights to the International Space Station and has logged more than 27 days in space.

**Carl Meade (B.S. EE 1973)** is a veteran of three space flights and has spent 29 days in space. In 1994, Meade flew aboard the Space Shuttle Discovery and performed the first untethered spacewalk in 10 years.

**Andreas Mogensen (Ph.D. ASE 2007)** is the European Space Agency’s first Danish astronaut. He launched to the International Space Station in September.

**Karen Nyberg (M.S. ME 1996, Ph.D. ME 1998)** became the 50th woman in space after completing her first spaceflight to the International Space Station in 2008. She has logged 180 days in space.

**Michael Suffredini (B.S. ASE 1983)** served as manager of the International Space Station Program at Johnson Space Center and was responsible for the development and operation of the 16-nation program.

**Stephanie Wilson (M.S. ASE 1992)** is a veteran of three space flights and has logged 42 days in space.

**EARTH: GRAVITY RECOVERY AND CLIMATE EXPERIMENT (GRACE) SATELLITES**

Byron D. Tapley, professor, Department of Aerospace Engineering and Engineering Mechanics

Nearly 20 years ago, professor Byron D. Tapley realized satellites could give humans unparalleled insights about the earth. So he and now-professor Michael Watkins began encouraging NASA’s Jet Propulsion Laboratory to use twin satellites to measure small changes in the earth using its gravitational field. And the GRACE mission was born.

Launched in 2002 and led by NASA, the GRACE mission has enabled engineers and scientists to shed light on the causes of drought, melting polar ice caps and aquifer water depletion in California and India. Tapley, a principal investigator on the GRACE mission, and others from the Cockrell School’s Center for Space Research have helped to direct the mission since it was launched.

“GRACE has been the capstone of my career,” Tapley says. “The scientific community has embraced the measurements, and we are continuing to push it forward.”
PLUTO: NEW HORIZONS MISSION

After spending nearly a quarter of a century pushing NASA to fund a planetary mission to Pluto, Alan Stern shared a champagne-popping moment with the New Horizons team on July 14, 2015, when the mission reached the outskirts of the icy planet.

Soon after, Stern, the mission’s principal investigator, and his team presented the first-ever close-up views of Pluto’s icy mountain ranges and crater-free surface. He particularly noted that Pluto, which is sometimes called a “dwarf planet,” is actually larger than everyone anticipated.

“I have to tell you, I’m a little biased, but I think the solar system saved the best for last,” Stern said in a NASA-held news conference in July.

MARS: CURIOSITY ROVER

Michael Watkins returned to UT Austin this fall to become the director of the Cockrell School’s Center for Space Research and a professor in the Department of Aerospace Engineering and Engineering Mechanics. During his 22 years at NASA’s Jet Propulsion Laboratory (JPL), Watkins led teams on many of the lab’s highest profile missions, including overseeing mission operations for the Mars Curiosity Rover from its launch in 2012 through its landing and critical surface operations.

In the three years since landing, the rover has traversed nearly 11 kilometers across the Red Planet, discovering the best-ever evidence of past habitable environments.

In September, Watkins watched with interest as NASA scientists announced signs of liquid water on Mars, which they believe could help bolster the case for life on the planet. Although Watkins is no longer at NASA JPL, his fellow alumni are among those continuing this significant work.

“There are so many Cockrell School alumni working in the Mars program and all over JPL, making discoveries like these possible,” Watkins says.

In his new role at UT Austin, Watkins, who is active as an earth and planetary scientist, will also serve as the NASA Science Team Lead for the GRACE Follow-On mission.
Investigators of the Field

Just like the forensics experts you see on popular crime shows, forensic engineers are our industry’s behind-the-scenes problem solvers — the first ones on site after major engineering failures occur, working to find out what went wrong and prevent issues later on.

A handful of Texas Engineering alumni have been at the forefront of this field — taking their civil, architectural and structural engineering expertise and applying it to investigating and analyzing some of the biggest construction disasters in recent decades.

DAVID FOWLER
B.S. ARE 1960, M.S. ARE 1962

Boston’s notorious Big Dig highway construction project was nearly complete in 2006 when one of the essential ceiling panels collapsed onto a car, killing the passenger, in the city’s Fort Point Channel Tunnel. A world leader in concrete polymer materials and an authority on epoxy bolts, David Fowler served as an expert to reporters during the investigation, advising them on the likely causes of the failure, including failed epoxy and poor installation of the anchor bolts in the tunnel’s roof slab, and he was quoted extensively in coverage about the event, which resulted in multiple civil lawsuits in Boston. As a professor in the Cockrell School, Fowler has trained generations of forensic engineers, teaching courses to both undergraduate and graduate students since 1964.

ERIK NELSON
B.S. ARE 1981, M.S. ARE 1983, Ph.D. CE 1986

In the spring of 2013, a massive chemical explosion occurred in the town of West, Texas, killing 15 people, injuring hundreds and damaging more than 150 facilities, leading to over $100 million in associated reconstruction costs. Erik Nelson arrived within a week to evaluate blast distress and provide forensics assessments to many involved. He and his team found that the structural damage that occurred took on unique characteristics related to blast loading, including distress patterns unlike most other similar events. Unlike a wind event, the buildings were literally “squeezed” by the overburden pressure wave that radiated from ground zero. Throughout the town, Nelson documented violent damages, including building fractures, displaced brick facades, fractured roof frames, collapsed ceiling finishes and damaged windows to residential and commercial buildings. Property owners have benefitted from Nelson and his firm’s damage assessments and restoration recommendations to repair and rebuild West.

RANDALL POSTON

The seven-and-a-half-mile stretch of seawall that lines Marina del Rey in Los Angeles saw its first signs of major decay in the early 1990s when several sections of the wall collapsed and fell into harbor waters. Later that decade, Randall Poston, a renowned expert in reinforced concrete structures, was tapped to assess the situation. The seawall, built in the mid-20th century, consists of more than 700 concrete panels that are reinforced with steel. Some of that reinforcement, Poston would discover, had become corroded by seawater, resulting in the collapsed panels. By assessing the severity of corrosion using non-destructive testing methods and thus recommending tailored repairs (rather than reconstruction), Poston helped the Los Angeles County Department of Public Works save millions of dollars. Since then, he served as chair of the committee that has literally rewritten the structural concrete building code that engineers around the world reference every day.

JIM WIETHORN
B.S. ARE 1973, M.S. ARE 1975

When a major crane failure occurs — anywhere in the world — Jim Wiethorn is most likely performing the assessment. He is perhaps the foremost expert in this field. A licensed professional engineer in 35 states, Wiethorn is a top forensic engineer who has been involved in more than 850 crane failure cases nationally and internationally (he’s even written a book documenting them). Wiethorn has investigated some of the most publicized crane and construction site failures, including the 1999 crane collapse at the Miller Park baseball stadium in Milwaukee, which killed three construction workers; the 2006 collapse of a high-line cableway system for the Hoover Dam bypass; and the 2012 dangling crane boom and subsequent damage that occurred in Midtown Manhattan during Superstorm Sandy. His evaluations have been pivotal in many construction litigation cases and have helped lead to safer work environments.

— Adrienne Lee
THE ENGINEERING EDUCATION AND RESEARCH CENTER
INNOVATION INSIDE AND OUT

When it opens in 2017, the Engineering Education and Research Center (EERC) will transform the UT Austin campus forever — from the hands-on, cross-disciplinary learning that will happen inside to the creative, efficient design and construction elements you’ll see on the outside.

Let’s take a closer look and explore what truly sets the Cockrell School’s new building apart.
A CLOSER LOOK INSIDE
Since the early planning stages of the EERC, we’ve applied modern construction methods, cutting-edge components and an engineer’s eye. Tour a few of the most impressive features in this cross-section view through the center of the EERC looking north.

1. Perimeter walkways along the west side of the upper floors connect the two eight-story towers. These walkways are supported by a highly sophisticated **diagonal framing structure** that supports the connector bridges. The diagonal frame enables the bridges to be open to the outdoors yet safe and secure.

2. In the center of the building’s two towers, visitors will gaze up through the ridged glass ceiling to see an extraordinary **sun-shading device**, a perforated stainless steel “shield” that is specifically designed to react to the angles of the sun and adjust with the seasons, ultimately reducing AC costs.

3. An especially distinctive feature of such a large space, the state-of-the-art **smoke evacuation system** automatically opens all windows in the three-story atrium when triggered. This forces smoke to efficiently flow outside of the building during a fire emergency.

4. Near the library on the facility’s first floor, students will learn advanced research techniques inside a **clean room training facility** — an area that will be equipped just like an actual clean room but customized to purely serve as a teaching resource for student researchers.
FUTURE-READY FROM THE GROUND UP

While it’s certainly decked out with the classrooms, labs and collaborative spaces necessary to educate the leaders of today, we’re actually building this facility to meet the needs of tomorrow. The EERC is made to last.

All of the EERC’s structural data will be represented in a building information model (BIM). This BIM will give university maintenance officials a digital blueprint of everything that makes the building functional — from the piping to the wiring — facilitating significantly faster decision-making and resolutions to challenging repairs.

Instead of putting the ductwork along the walls as is typically done, we’ve put it in the floor of the atrium — more quickly cooling the building from the bottom up.

The EERC’s windows, which cover much of the building, will be coated with high-performance glazing, a covering that allows for enhanced control over the temperature and lighting inside as the sunlight shines through and the weather changes.

Because our students’ and researchers’ high-powered microscopes will be sensitive to the steel reinforcing bars traditionally found in building construction — potentially impacting the outcome of research results — a portion of the EERC is being built with fiberglass reinforcement.

To support the needs of future generations of Texas Engineers, we took an innovative approach to the infrastructure of labs and research spaces: We stripped all of the systems out of the walls and put them in the ceiling. This creative shift gives us the opportunity to renovate and expand these spaces more economically and more efficiently.

EERC AT A GLANCE

• The building will have 430,000 square feet of space, including teaching and research labs, classrooms and flexible areas for interdisciplinary learning.

• A centerpiece of the EERC, the National Instruments Student Project Center will provide students with 23,000 square feet of space for creating, making and doing.

• With 299 seats, the James J. and Miriam B. Mulva Conference Center and Auditorium will become the Cockrell School’s largest teaching and event space.

• Students will study, collaborate and socialize inside a state-of-the-art engineering library and a café.

• The EERC will also serve as a new home for the Department of Electrical and Computer Engineering, the Cockrell School’s largest department.
Materials are mundane, extraordinary, ubiquitous and — perhaps most importantly for the engineering profession — pliable.

They are natural and man-made. Their stealth structural powers are often overlooked in our lives today, but certainly not in hindsight.

Human history is demarcated by the in-vogue material of the age: stone, bronze, iron, steel and so on. No revolutions of any sort without these. No nonstick pans, either. And forget the moon landing. Nix heart valves and hip implants, too.

What we now call “materials science” really is a continuum that connects us with our ancestors, our “smiths” and metallurgy tradespeople at least as far back as 25,000 BCE. Over time, we have undone material limitations and also conjured new materials altogether, our formulas spanning from crude application of heat to intricate nanostructuring, all in service of improving our overall quality of life.

Materials science is a profoundly transformative, pioneering research area in the Cockrell School of Engineering at The University of Texas at Austin. To walk in these halls is to walk among modern-day explorers — award-winning engineers — unlocking the highest material properties and bending the world to their will using no sorcery but the natural laws of physics and chemistry.

Let’s take a glimpse through the laboratory doors to discover a few of the world-changing materials and processing techniques our engineers are conquering.

Electronic Tattoos: A Skin-Tight Sensation of Meandering Ribbons

Nanshu Lu, an assistant professor in the Department of Aerospace Engineering and Engineering Mechanics, looked to silicon and metal as central elements for her materials science breakthrough: wearable electronic tattoos that gather and communicate data, simultaneously harvesting energy.

These wearable electronic devices have the ability to pick up and transmit the human body’s vital signals, tracking heart rate, hydration level, muscle movement, temperature and brain activity. Lu’s wearables are surely on the path to change the way we monitor our health. But she almost never got there.

As a graduate student, she realized she wanted to pivot from a theoretical focus, for which she needed only a pencil and paper to write about materials, to a more experimental approach. Once she started on that path, she faced new obstacles in asking for help.

“By creating serpentine shapes, or ‘meandering ribbons,’” she explains, “I can stretch brittle materials [such as silicon] quite long without actually changing the material, atoms or composition. So I’m basically playing the geometry game to change something from being as stiff as steel to being as soft as tofu without losing any functionality.”
Supergel: A Self-Powered, Self-Healing Marvel

Mechanical engineering assistant professor Guihua Yu is quick to credit nature as the inspiration for his latest discovery. “Very recently, I brought my daughter and son to an aquarium and we were looking at an octopus,” Yu explains. “It’s actually a very smart creature — how it can manipulate things and really adapt to its environment. Octopi can change their shape and become strong or weak depending on their environment, so they’re very responsive.”

Just like the octopus, Yu’s supergel is a responsive adapter. A hybrid of a conductive polymer gel and a self-assembling supramolecular gel, the gel is truly “super” in that it needs no external force — such as the application of light, temperature or acidity — to trigger its self-repairing properties. As a result, the supergel can be used to construct circuits in flexible and self-repairable electronics.

Furthermore, its porous structure makes it amenable to nanochemical modifications for many exciting applications in solar energy, energy storage, electronics and even bio-applications such as artificial skin and self-healing paste for surgical use.

Like his father, who worked in a Chinese government-owned sugar factory during his childhood, Yu took an interest in chemistry and chemical engineering as a young man. He was especially motivated by his high-school chemistry lecturer’s vivid classroom experiments. “It’s all like magic to me,” Yu says.

Yu’s research group is pursuing further mechanistic understanding and optimization of its supergel, as well as working on other organic nanomaterials and their hybrids for advanced applications in energy and environmental technologies.

“The materials scientist’s most important job is not to make materials for high-profile publication only,” Yu says, “but to make materials that are useful in daily life — and that is far more challenging.”

Silicene: The Swiss Army Knife of Materials

“There’s nothing in my childhood that says I should be in this area,” says electrical and computer engineering associate professor Deji Akinwande, “except that I was just generally consumed with questions.” He actually describes himself as an intellectual “late bloomer.”

But in fact, Akinwande’s revolutionary research would illustrate quite the opposite. The transistors he’s developed out of silicene — the world’s thinnest silicon material, at one atom-layer thick — hold the promise of transforming computers and other electronics. These silicene transistors could be crucial in building dramatically faster, smaller and more efficient computer chips. However, while silicene has shown outstanding electrical properties, it has, until now, proved difficult to work with because of its instability when exposed to air.

“The challenge is, silicene is like both a dragon and a ghost,” Akinwande says. “It’s just so difficult to chain it, to understand it, to bring it under control ... and it’s also incredibly difficult to measure it. You look at it and all of a sudden it’s gone.”

Until a few years ago, man-made silicene was a purely theoretical material. Looking at carbon-based graphene, another atom-thick material with promise for computer chip development, researchers began to speculate that silicon atoms could be structured in a broadly similar way.

Akinwande and his team developed a new method for fabricating silicene between two protective films — alumina
on top and silver below—that are peeled away later in the process, at which point the silicene sheet is transferred to an insulating substrate.

There wasn’t much precedent to build on, but Akinwande attests that such is the nature of pioneering research. “There’s not a lot there telling you ‘do this’ or ‘do that,’” he says. “It’s like an investigation in which you’re just searching for the truth, like a child playing with his toys.”

Akinwande and his team are currently working on a way to enable stable, long-term silicene production and operation. “Silicene and related atomic films are considered the Swiss army knife of all materials,” Akinwande says. “It can potentially do anything you want it to do; you just need to turn the right knob.”

“Smart Window Coating: The Case of Light and Heat, Unbound

“The idea of creating materials to meet certain targeted needs for an application really caught my attention, even in high school,” recalls chemical engineering associate professor Delia Milliron. And she’s certainly met a need — she and her team have designed energy-efficient smart-window composite materials capable of achieving something that seems impossible: separating visible light from near-infrared (or heat-causing) light.

“The first moment that we saw an optical effect that we were able to switch the transmittance, it was the happiest moment,” Milliron says. It was about a year-and-a-half into the project when they had their game-changing breakthrough. “We didn’t really know why our material worked and other materials hadn’t worked,” Milliron says. “There’s a lot you don’t know at that point, but we knew it was working and built on it from there.”

Milliron’s goal always had been to find a material that could control both heat and light, separately, and she had an idea for how to build a composite material to do that. “When I told my post-doc about it, I remember standing in my office and drawing on the whiteboard and said, ‘So here’s the idea—it won’t work. There are 10 reasons I can tell you, immediately, why this shouldn’t work, but we should try it anyway.’ She got it to work and we got these beautiful results, and we didn’t understand why. Then it stopped working, and in the process of trying to make it work again, we really figured out what was going on and how this was actually possible.”

Ultimately, Milliron’s team became the first to develop dual-band electrochromic materials by blending two materials with distinct optical properties for selective control of visible and heat-producing near-infrared light. Using a small jolt of electricity, a nanocrystal material could be switched back and forth, enabling independent control of light and energy.

By allowing indoor occupants to more precisely control the energy and sunlight passing through a window, Milliron’s new nanocrystal-based materials could significantly reduce costs for heating, cooling and lighting buildings. It all started with the identification of a need: “People said, ‘Hey, this is a problem, if you could solve it, that would be great,’” Milliron says. “So we did.”

— Ashley Lindstrom

“The materials scientist’s most important job is not to make materials for high-profile publication only, but to make materials that are useful in daily life — and that is far more challenging.”
Engineers and Physicians: Vital Partners in the Health Care Revolution

Painful procedures. Fatal surgeries. Late diagnoses and ineffective treatments. Our nation’s critical health care problems cannot be solved in a research lab alone. The relationship between the engineer and the physician is crucial.

With the rise of the Dell Medical School, opening fall 2016, The University of Texas at Austin will soon be a hotbed for cross-disciplinary health care collaborations. Today, faculty and students across the Cockrell School of Engineering are already leading the way, working with medical professionals to develop technically sound, patient-friendly devices that will streamline care, cut costs and save lives.

For more than eight years, biomedical engineering associate professor James Tunnell and Dr. Jason Reichenberg, Seton dermatologist and clinical director of dermatology for University of Texas Physicians Group, have worked together to develop a way to quickly and painlessly detect skin cancer.

About the size of a pen, their award-winning device shines light onto a patient’s skin and then gathers data that is analyzed on a computer. Through the data, doctors can detect three major types of skin cancer: basal cell carcinoma, squamous cell carcinoma and melanoma. Each reading takes about five seconds. The device will begin pre-clinical trials in early 2016.

Tunnell’s and Reichenberg’s success is just one example of the power of this kind of collaboration. The team estimates that today 25 negative biopsies are performed for every one case of skin cancer detected. These procedures cost patients time, pain and money, and translate to an estimated annual cost of $6 billion to the U.S. health care system. Once in the hands of physicians, this device will reduce the need for biopsies and help identify dangerous lesions earlier.

“Though our device isn’t on the market just yet, our work shows my patients that doctors are trying to make things better,” Reichenberg says. “It’s exciting to be able to give them hope that one day we can avoid painful procedures.”

Out of the Lab and Into the Clinic

Tunnell arrived at the Cockrell School as an assistant professor in 2005 and was interested in non-invasive diagnostic techniques. He began building a prototype of a device that could detect skin cancer, but he knew he needed a partner outside the world of engineering.

“To find meaningful biomedical solutions, you can’t just read books and conduct experiments in a void,” Tunnell says. “You have to put technologies in the hands of the people who will use them so they can tell you what is and isn’t working.”
Dr. Jason Reichenberg and associate professor James Tunnell partnered to develop a non-invasive skin-cancer-detection device.
Physicians are commonly involved in medical research, but most work on clinical trials for medicines. Device-related research operates on a much longer timeline — often lasting 10 years or more. It can be difficult for engineers to recruit collaborators from the medical field who are working with patients and have little time to supervise a long-term project.

After completing his dermatology residency at the Mayo Clinic in Rochester, Minn., Reichenberg relocated to Austin in 2006 to develop a dermatology training program. After years of performing biopsies, he was passionate about making skin cancer diagnoses more efficient and less painful.

He and Tunnell met at the perfect time. “We had common motivations and were at similar stages in our careers. We weren’t fully established with large labs, but we weren’t so new that we didn’t have any resources,” Reichenberg says.

Tunnell’s easygoing personality and understanding of the medical field quickly dispelled any stereotypes that engineers only communicate in technical terms.

“He understands clinical work and is able to speak the language. And he chooses students who are also socially and clinically aware,” Reichenberg says. “He acts as a translator between our worlds.”

The team’s collaboration has been a constant back and forth, yielding numerous iterations and prototypes. Inside Cockrell School research labs, Tunnell and his biomedical engineering graduate students designed and developed the device. Then they brought versions to Seton’s clinic, where Reichenberg and his medical residents provided insight into the needs and expectations of patients and physicians.

When Tunnell and his graduate students brought an early version of their device to the clinic, Reichenberg immediately noticed a problem.

“It had aggressive-looking clamps that grabbed the patient to hold them steady,” he says. “I knew that was not going to go over well in a clinical setting.”

Tunnell’s team responded quickly — engineers are swift problem-solvers after all — and replaced the clamps with a flat glass plate that is placed against the skin to hold it steady as the device shines light onto a lesion.

The team is currently refining the device to ensure that physicians can use it independently. Today, an engineer must be present when the physician is using the device to help interpret the data. Tunnell’s group is working to generate a graded scale or a black and white reading that physicians can quickly process and relay to the patient.

Work on the skin-cancer-detection device is funded in part by a three-year, $1.3 million grant from the Cancer Prevention Research Institute of Texas. The size and length of the funding allowed Tunnell and Reichenberg to secure teams of engineering researchers and medical fellows and perfect their collaboration process, creating opportunities for additional academic work and other breakthrough health care solutions.

Each time Tunnell’s students visit the clinic with a new prototype, they are exposed to other clinical procedures that could be improved with new technology. “As a biomedical engineer, spending time with patients and physicians is incredibly important,” Tunnell says. “If we hadn’t been in the clinic working on the skin cancer device, we wouldn’t have seen issues and gone back to the lab to see how we might address them.”

A New Era of Collaboration on the Forty Acres

Many physicians like Reichenberg are eager to work with engineers to create devices that will improve health care, but certain obstacles have sometimes hindered collaboration between the engineering and medical worlds.

Since Tunnell and Reichenberg work for separate institutions, they must register multiple Institutional Review Boards, which are required for biomedical research involving humans. Additionally, students must obtain special credentials in order to work in both UT Austin’s labs and Seton’s clinics.

Tunnell and Reichenberg rapidly exchanged emails and develop new ideas, and throughout their creative process, they must frequently consult with their institutions’ legal counsel.

“When you generate technology, you generate intellectual property,” Tunnell says. “The question of ownership always comes up when you’re working for two groups.”

Soon, however, the Dell Medical School will dramatically expand opportunities for collaboration. Cross-disciplinary education is already built into the school’s innovative curriculum. Third-year medical students will have the option to pursue dual master’s degrees or traditional research. The Cockrell School will offer a third-year master’s degree in biomedical engineering.

“It is an exciting opportunity to cross-train students who will be able to go out in the world and do both — practice medicine and develop technically sound devices,” Tunnell says.

In addition to their time spent on the Forty Acres, medical students and faculty will work, train and learn at Seton facilities, including the new Dell Seton Medical Center currently under construction at UT Austin.

Reichenberg looks forward to the opportunities to bring more physicians and engineers together.

“Medical students are eager to learn by doing projects together and they will push passed obstacles to make it work,” he says. “If even one of these 50 new medical students decides to spend some time developing devices, we have plenty of projects for them.”

Reichenberg has already joined the medical school faculty as an associate professor. He and Tunnell are excited that they will finally work for the same institution.

“The Dell Medical School allows engineers and physicians to become university colleagues,” Reichenberg says. “We will have a mutual interest in collaboration and sharing knowledge and resources, which will ultimately facilitate the development of more solutions like our device that can improve patient quality of life.”

— Kristin Tommey
The device, which can detect three types of skin cancer, gathers data by shining a light onto a patient’s skin.

After winning the 2015 SXSW Interactive Innovation Award, emails flooded in from prospective patients hoping to receive a diagnosis from the device. However, as the team begins the clinical trial phase early next year, the physician must still surgically remove the lesion in order to test the accuracy of the device. So, Tunnell and Reichenberg are faced with the challenge of finding patients who are interested in participating for the sake of making skin cancer diagnoses more efficient and less painful for future patients.

For the first time, the device will be used in a high-yield clinic. Tunnell and Reichenberg believe this will be the true test of the device’s technical accuracy and clinical applicability.

Throughout the trial, engineering and medical fellows will continue to work together as they supervise each test and further refine the device until it is ready to submit for FDA approval. Tunnell and Reichenberg give a hopeful estimate of three to five years before the device is in the hands of physicians and able to permanently transform health care’s approach to skin cancer diagnoses.
Keeping it Simple
Undergraduate Students Invent Device to Improve Physical Therapy

In 2014, the Seton Brain and Spine Recovery Center came to mechanical engineering assistant professor James Sulzer with a problem. Their patients were performing shoulder exercises incorrectly and subjecting themselves to further injury, a particular issue for patients with spinal cord injuries.

“We were looking for a device to help cue the patient when they are overusing the upper trapezius and hiking the shoulder,” says Eric Lantz, an occupational therapist at Seton.

Sulzer and his students went straight to work, testing lots of ways to address the problem in his lab, known as Rewire.

“We came up with a number of ideas with some complex engineering,” Sulzer says. ”In the end, simplicity won out.”

Sulzer, along with mechanical engineering students Jose Juan Mendez Jr. and Nicholas Daniel Philips, invented a device already being tested today by Seton Hospitals and UT Athletics to improve shoulder exercises. The device lets people know if they are performing shoulder exercises safely by clicking if the shoulder is too high.

Duannah Ashmore is in physical therapy with Lantz to help with her spinal cord trauma. She used the Rewire device for six weeks last spring.

“I would wear it around the house all day,” Ashmore says. “What a revelation. It’s that little bit of therapy I can take with me.”

Now the team is working with UT Austin’s Office of Technology Commercialization (OTC) to patent the device. The OTC is working with a company to commercialize it in hopes that it will be distributed nationally to hospitals, therapy centers and for at-home physical therapy.

How would you describe your invention?
Sulzer: The device is a piece of measuring tape between two stickers. It’s almost absurdly simple. When it is attached to the neck and shoulder, it clicks when scapular elevation occurs, providing a sound to the patient without the need for observation of a therapist. We think that with this device people will be more independent in their shoulder therapy, allowing home use.

How many other prototypes did you try? Why did you choose this simple version as the best choice?
Jose Juan Mendez Jr: We went through four to five different prototypes. We began with an infrared red sensor system, but it was difficult to tune and rigging it on the shoulder would have been burdensome. After a meeting we then went back down to a mechanical solution. From there we went from a beam with relief cuts to supports with the measuring tape, and then with varying cantilever (overhang) length supports.

We visited the Rewire lab to talk about how they came to their simple invention with real clinical application:

What is Rewire?
James Sulzer: Rewire stands for Rehabilitation with Insight from Robotics and Engineering. We’re part of a larger consortium of researchers and clinicians around UT Austin called CARE (Clinically Applied Rehabilitation Engineering).
clinician’s needs of a simple-to-use, small and audio-feedback device. The solution that we came up with showed that simple is the best solution. It can’t get any simpler than tape and stickers on the sides.

What is your favorite thing about working in the Rewire lab?

Sulzer: When the students begin to see the big picture — how their engineering skills can dovetail with clinicians’ knowledge and create something useful. It’s not as easy as it sounds.

Nicholas Daniel Phillips: I want to be a lifelong problem-solver. Working at Rewire has allowed me to see that I might actually get to do this for the rest of my life and enjoy it.

Mendez: My favorite part is hearing back from the clinicians that a patient is happily using the device. It lets me know that there’s a purpose to the work we’re doing.

How has working in this lab shaped your time at UT Austin?

Sulzer: I think my biggest realization was that I’m not the guy leading things anymore, but rather guiding. The students here are phenomenal; my job is just to focus their energies toward a productive goal.

Phillips: Working at Rewire has taught me to appreciate my education more. Before I felt like I was learning things just to learn them. Now I realize that I have been developing a certain ‘engineering mindset,’ and classes, while still tough, are much more enjoyable. Also, Dr. Sulzer is a great mentor and has helped me realize, maybe not intentionally, certain career paths I would like to take further down the road.

Mendez: Working at Rewire has allowed me to see that I might actually get to do this for the rest of my life and enjoy it.

What do you want your lab to be known for?

Sulzer: Improving stroke patients’ lives by understanding their problems and then developing the appropriate technology to address them.

What’s next?

Sulzer: We’re conducting studies on the device now to examine how it can adjust to people of different sizes and then translating this to patient studies. We hope to learn how effective it is at assisting therapy. We have three areas we’d like to go into: home physiotherapy (a company is interested in licensing the device in that regard); neurological therapy after spinal cord injury, stroke or other injuries and diseases (its initial intended purpose); and finally, athletics and biomechanics.

— Sara Lentz
Texas Still Needs to Support Innovation

BY ROBERT HEBNER

“We have the opportunity and responsibility to make Texas more successful in the 21st century than it was in the 20th.”

Early this year, Texas Gov. Greg Abbott called for the elimination of the Emerging Technology Fund, a program that gave $200 million in taxpayer dollars to Texas startups but was hindered by bankruptcies and other issues.

This may be a reasonable decision. After all, when programs are not cost effective, they need to be changed or eliminated.

But this should not be the last decision. We have the opportunity and a responsibility to make Texas more successful in the 21st century than it was in the 20th.

One part of the Emerging Technology Fund was dedicated to getting a larger piece of the economic pie for Texas at the expense of other states. The other was focused on growing the economic pie in Texas.

It is self-evident that attracting established companies is an effort to grow at the expense of other states. Attracting researchers is similar in that there is a finite national investment in research by the federal government and industry.

More researchers attract a larger share of those funds to Texas. This has a demonstrated benefit as each dollar of research funding grows the economy by about two and a half dollars.

Growing the economic pie is even more important. As a colleague of mine is fond of saying, “Research turns knowledge into money.” Between the research and the innovation, however, is something called “the technology valley of death.”

Governments typically move technology across the valley of death. Technologies as diverse as railroads, the Internet, nanotechnology and pharmaceuticals received critical government support, as did the core technologies of the iPhone. Once the technology gets across the valley of death, amazing things can happen.

If Texas dropped out of the activity, the state would depend on federal government investments to develop these technologies in Texas. Unfortunately, the federal government increasingly invests where the host state is willing to invest.

If Texas opts out, innovation will occur elsewhere. We will have the research. Others will have the climate of innovation that turns knowledge into economic growth.

But there are characteristics that a state program should have. First, it should be run by professionals who are employees of Texas. The state’s retirement system is a good model. Texas hires portfolio managers to make investment choices.

Elected officials review the long-term results. They do not approve every purchase and sale. The same should be true in developing longer-term technologies. Hire professionals and hold them responsible for the success of the portfolio.

Second, there are critical aspects to successful projects, and they should each be assessed by experts. One is the quality and potential growth of the technology. These should be evaluated by technology experts. They could be drawn from researchers at Texas universities as many of these are among the best in the world in their fields.

They should sort proposals so that only those that transfer research results into interesting technology should go forward. To do otherwise is to compete in the marketplace not to get technologies across the valley of death.

Those passing technical scrutiny should then be reviewed by a business group. The group would determine that, if successful, the proposed project can be a marketable product. The program managers then select the final portfolio from among projects that easily pass both hurdles.

Finally, the impact of the portfolio needs to be measured. Independent economists should routinely and independently assess the success of the portfolio. Based on other programs, the portfolio should deliver $4 to $5 for every dollar invested within the first few years, and the return should continue to grow.

This program is an investment in our future, and it must pay off. Gov. Abbott is providing a golden opportunity to try again to develop a technology-based economic development program that works for Texas. It is an opportunity we cannot afford to waste.

Robert Hebner is a research professor in the Cockrell School, the director of the Center for Electromechanics at The University of Texas at Austin and formerly served as acting director of the National Institute of Standards and Technology, an agency of the U.S. Department of Commerce. This op-ed appeared in the Houston Chronicle, San Antonio Express-News, Fort Worth Star-Telegram, Austin American-Statesman, Corpus Christi Caller-Times, The Beaumont Enterprise and The McAllen Monitor in February 2015.
“Making dynamic teaching materials available to a new audience hungry for content is a powerful way to expand STEM education and enhance energy literacy.”

Just about every sector of society and the economy is affected by energy-related policies. But because scientific fundamentals as well as economics, politics, law and culture underlie what energy can—or can't—do, the general public has a hard time engaging in the policy debates in a meaningful way. Too often, the public debate gets reduced to bumper sticker slogans such as “Drill, baby, drill,” or “Don’t frack the planet.”

Improving energy literacy and overall STEM education should be one of the most critical priorities for the United States. As an energy educator, I believe we can use innovation to bridge the gap by supplementing traditional classroom instruction with engaging and dynamic outreach initiatives.

Last year, I had the opportunity to practice what I preach by experimenting with new teaching technologies and methods across a variety of different media.

One way of doing this was via television. I hosted “Energy at the Movies,” a nationally syndicated PBS television special that featured clips from different movies to teach the history and science of energy. Movies such as “Silkwood,” “Syriana” and “Promised Land” contain useful imagery and scenes related to energy topics, and my role as the educator is to point out where Hollywood got the science right—or wrong. Early feedback on the special has been so positive, with telecast carriage exceeding 45 million homes, that an “Energy at the Movies” series is being developed.

One of the benefits of working with public television is the ability to reach a large audience of prospective minority STEM students. Given the U.S. Department of Energy’s Minorities in Energy Initiative, expanding this approach could help address the needs of underrepresented groups.

I also taught a successful massive open online course, or MOOC, in the fall of 2013 titled Energy 101. Over 44,000 students from 173 countries enrolled. Nearly 5,000 students completed the course, resulting in a 13 percent completion rate, which is more than twice the rate for a typical MOOC.

During my first virtual “office hours,” I received questions from students on every continent (except Antarctica). In all, this MOOC expanded global reach for energy literacy and STEM education. The platform brought a college course to people who would not easily have access otherwise. In fact, a few high schools are using it.

These two experiments—the national television show and the global MOOC—offer a few lessons learned.

First, support and financial backing from the school—from the department chairs up to the university president—is needed before educators can experiment with multimedia teaching tools. Fortunately for me, The University of Texas at Austin and the Cockrell School of Engineering are both very supportive.

Creating educational content for the general population or for a global audience makes for better educators. Energy 101 is based on a graduate course retooled every few semesters at UT Austin. However, video is forever, so close content scrutiny and a highly coherent lesson plan were vital for the MOOC’s success. Also, because many MOOC students are outside the United States, teaching a MOOC requires an international lens. All this focused my teaching, and forced me to reframe some of the arcane details of American energy policy in a way that could be accessible to everyone.

Overall, the MOOC was an effective experiment with energy literacy curriculum. However, until online assessment capabilities improve, the traditional classroom will continue to serve a critical function for not only distributing critical information but for assessing students’ learning objectives.

Indeed, MOOCs are probably misnamed. They function less as courses and more as open textbooks—a massive open online textbook, if you will. Turning these online materials into high-quality, interactive textbooks is the right direction for the future. Making these dynamic teaching materials available to a new, global audience hungry for content is a powerful way to expand STEM education, and it can enhance energy literacy. Both of those outcomes would benefit society.

Michael Webber is an associate professor in the Cockrell School and also serves as deputy director of The University of Texas at Austin’s Energy Institute. This op-ed appeared in Mechanical Engineering Magazine in April 2014.
Alumna Follows American Dream to the Top of American Airlines
Over her 27-year career with American Airlines and AMR Corporation, Texas Engineering alumna Bella Goren rose to the top of one of the most complex global industries. A dynamic leader and talented problem solver, she led teams that enhanced the airline’s AAdvantage loyalty program, transformed call center operations and made the company’s website its main source of revenue before becoming chief financial officer in 2010.

Goren’s drive and courageous spirit helped her persevere through adversity to become the success she is today. She immigrated with her family to the United States from the former Soviet Union at age 14, without knowing a word of English. Resettlement agencies ultimately placed Goren and her family in Dallas, where she excelled in high school despite the language barrier. She went on to earn her bachelor’s degree in chemical engineering with highest honors from UT Austin in 1983 and later received her MBA from Southern Methodist University, graduating first in her class.

In 2013, Goren embarked on a new phase of her career and now serves on the boards of directors of Gap Inc., LyondellBasell Industries N.V. and MassMutual Financial Group. We caught up with Goren this fall to learn more about her incredible path.

Your story is a true realization of the American dream. How did your family’s experience shape your path?
The opportunities I have had in this amazing country are beyond what I could have imagined as a child. I owe being here to the love and courage of my parents. When we arrived, we had nothing but $360 and a few personal belongings. Although my parents were highly educated—my mother had a degree in retail management and my father was a civil engineer—they did not speak English and initially had to work minimum wage jobs, as did my brother and I. It was clear to me from a young age that, in order to achieve the American dream, I needed to work as hard as I could to get a good education.

What did you find most exciting about life in America?
There were so many new and exciting things—it’s hard to pick just one. One aspect of American life that I believe is truly exceptional is the opportunity to make choices and shape your own future. For example, in American schools, I was encouraged to focus on subjects that interested me and try innovative approaches. I found both the flexibility and the responsibility that came with it very exciting. In high school, I fell in love with science and math, and I was very fortunate that I could go to the university of my choice and pursue a career that reflected my passions.

How did you come to study chemical engineering?
My father and my brother were both engineers, and when I was selecting a subject to major in at UT Austin, I saw that chemical engineering combined my interest in chemistry with something very practical and tangible. I love that engineering teaches us to develop solutions that can improve people’s lives, communities and businesses.

How did your engineering background influence your career success?
My degree from the Cockrell School has been the foundation of my career. In addition to working as an engineer for DuPont after graduation, I am fortunate to have worked in different functional areas throughout my career with American Airlines, including finance, human resources, marketing and operations. Irrespective of the roles I’ve had, I’ve leveraged my disciplined, analytical thinking to be a better leader and to make complex challenges more manageable. I attribute that problem-solving approach to the education I received at UT Austin.

As CFO, you managed the financial structure of a large, publicly traded, global company. What was your biggest challenge? Your biggest success?
I was part of the executive team that led American Airlines through a financial restructuring between 2011 and 2013, which ended up being both my biggest challenge and my biggest success. In the decade following 9/11, the company was in a very difficult financial situation. When it became necessary to formally restructure the business, the entire American team rose to the challenge. In 15 months, we reduced the company’s debt, renegotiated agreements and made our operations far more efficient, while also reinvesting in the business and improving customer service. It has been widely characterized as one of the most effective restructuring processes in airline history, and it re-established American Airlines’ leading position in the industry.

Today, you’re lending your expertise to three very different companies. What do you enjoy most about serving on the boards of directors?
It’s very interesting and rewarding work. I’m able to apply my knowledge and expertise to serve stakeholders in a variety of industries, while broadening my experience by working with board members and management teams with different professional backgrounds. It’s a great opportunity to contribute to the success of multiple companies and to continue to expand my thinking and knowledge.

Bella Goren resides in Dallas with her husband Garry. The couple has two daughters, Ilana and Jessica. Goren is dedicated to giving back to the community and serves on the boards of the Lyle School of Engineering at Southern Methodist University and the National Association of Corporate Directors of North Texas. She is also a member of the International Women’s Forum. In 2013, she received the Dallas Business Journal’s Women in Business Award. An active member of the Cockrell School community, Goren serves on the Engineering Advisory Board and in 2015 received the Cockrell School’s Distinguished Engineering Graduate award.

— Kristin Tommey
It was autumn on Lake Austin when inspiration struck Daniel Horne, now a second-generation alumnus of the McKetta Department of Chemical Engineering. On that day in 2011, Daniel and his father Ron (B.S. ChE 1973) were attending the 95th birthday party of Dean Emeritus John McKetta Jr.

Moved both by McKetta’s convivial conversations with former students and by the Challenge for McKetta—a $25 million fundraising campaign that would name the department after McKetta—something clicked for Horne. He knew he eventually wanted to contribute in a special way.

In his senior year, after receiving tutoring from a fellow student to get through his Transport Processes course, Horne decided he would give $1,000 of his own money to the department when he graduated—his way of giving back for all the help he received from the chemical engineering community that semester.

But just when he had set his mind on giving $1,000, he learned that it only required $24,000 more to set up a permanent fund that would provide annual support in perpetuity and make a significant impact on the future of the department.

Horne’s idea struck a chord with fellow students Dan Dietz, Colin Gentry, Camila Bastidas, Matt Ferris and John Wilbur, who pledged to donate $1,000 each, every year, for five years toward a focused, sustainable giving program. And thus, the new Senior Class Gift Endowment was born.

McKetta, the department’s namesake, was so encouraged by these students that he made his own $5,000 gift to their cause.

Today, alumni and senior class students can contribute any amount to the fund, which is used to provide research scholarships to undergraduate chemical engineering students.

When the endowment reaches a total of $500,000, 50 percent of the funds will continue to be used to provide undergraduate research scholarships. The remaining 50 percent will be awarded to undergraduate and graduate student teaching assistant positions. The financial support of teaching assistants was significant to co-founder Dan Dietz and his decision to back the endowment because tutoring from other students was integral to his own engineering education. He and the other founders were especially encouraged by the assurance that their contributions would be going straight back to students.

“We all had a few of those classes,” he recalls, “where the help of one brilliant student, who was generous with his or her time, really made the difference in our success in the class.”

Dietz says he has also been inspired by the enthusiasm of older alumni who continue to participate, while co-founder Camila Bastidas has noted the generosity of giving among recent graduates. Their support shows the high level of confidence in the quality of their education.

“The six of us really want to stay involved,” Horne says of the founders. “We really love the department and want to be involved for the rest of our lives. This is the best way for us to do that.”

— Ashley Lindstrom
Alumni Notes

Texas Engineering alumni lead industries, launch companies and help develop solutions that improve lives around the world. We’re proud to share just a few of their accomplishments from the last year.

1960s

Louis Pirkey (B.S. ChE 1960) received the 2015 Austin Bar Foundation’s Distinguished Lawyer Award in recognition of his significant contributions to the law profession. Pirkey pioneered the private practice of intellectual property law in Austin. He is a founding member of Pirkey Barber PLLC, an Austin-based trademark specialty firm where he continues to practice.

1970s

Jim Wiethorn (B.S. ARE 1973, M.S. ARE 1975), chairman and principal engineer at Haag Engineering Co. in Houston, was named one of the Top 25 Newsmakers of 2015 by Engineering News-Record. Over the past three decades, Wiethorn has investigated hundreds of crane accidents and helped make jobsites safer by investigating what causes lifting machines to fail.

Bob Brown (B.S. ChE 1973, M.S. ChE 1975) was awarded the 2014 National Academy of Engineering’s Simon Ramo Founders Award for his leadership in chemical engineering research and engineering education. Brown is the current president of Boston University and has conducted groundbreaking research in the areas of semiconductor crystals, microstructure formation and viscoelastic fluids.

Thomas Eller (Ph.D. ASE 1974) received the 2014 Air Force Academy Distinguished Graduate Award. Eller served as a pilot during the Vietnam War and received numerous medals for his heroism. After earning his Ph.D. from UT Austin, Eller returned to the Air Force Academy, where he served as assistant dean of faculty and head of the Astronautics and Computer Science Department. He is also the co-inventor of the GPS Magnetic Momentum Dumping System, which significantly prolongs the lifetime of satellites.

1980s

Randy Poston (B.S. CE 1978, M.S. CE 1980, Ph.D CE 1984) was named one of the Top 25 Newsmakers of 2014 by Engineering News-Record. He recently founded Pivot Engineers, based in Austin, to focus on the investigation and repair of existing structures.

Karen Hagedorn (B.S. PE 1986) has been promoted to ExxonMobil’s UK/Netherlands Asset Manager and is relocating to London. She previously served as Alaska Production Manager in Anchorage.

Jeffrey Schultz (B.S. EE 1987) became chief marketing officer at OpenGov, a government tech company in Silicon Valley that is building a platform to help organizations using public money to better allocate funds and achieve greater transparency.

Chris Chuter (B.S. ECE 1993, M.S. ECE 1997) and Craig Sullender (B.S. ECE 1989) developed Peeple, an app-enabled smart camera for your front door, and they completed a successful Kickstarter campaign that raised $90,000 to launch the product.

Cheryl Blanchard (M.S. Materials Science and Engineering 1989, Ph.D. Materials Science and Engineer-

1990s

NASA

Stephanie Wilson (M.S. ASE 1992) received the 2015 Texas Exes Distinguished Alumna Award. Wilson is a veteran of three space flights on the space shuttle Discovery and has logged more than 42 days in space. During her spaceflights, she managed successful spacewalks and operated the robotic arm that transferred supplies and equipment to the International Space Station.

Michael Pishko (Ph.D. ChE 1992) became dean of the University of Wyoming’s College of Engineering and Applied Science. Previously, he was director of the National Center for Therapeutics Manufacturing at Texas A&M University.
Rachel Segalman (B.S. ChE 1998) was named chair of the Department of Chemical Engineering at the University of California, Santa Barbara. She also received the 2015 Journal of Polymer Science Innovation Award, which recognizes an outstanding polymer scientist under the age of 40.

2000s

Russell Parker (B.S. PE 2000) was named president of Chief Oil & Gas in Dallas. He joined the company in 2012 and previously served as vice president of engineering and acquisitions and senior vice president of engineering and operations. Parker delivered the commencement address at the Cockrell School’s fall 2015 ceremony.

Raiyan Zaman (B.S. ECE 2000, M.S. ECE 2006, Ph.D. BME 2011) was selected as one of eight associates for the inaugural American Association of Physicists in Medicine’s Science Council Associates Mentorship Program. Zaman is an American Heart Association postdoctoral fellow at Stanford University’s School of Medicine, where she developed a catheter-based imaging system to detect vulnerable plaques in the heart.

Ben Matthews (M.S. CE 2003) was named one of Texas’ and Louisiana’s Top 20 Under 40 by Engineering News-Record. Matthews manages Air Force programs nationwide as a division manager in the Dallas office of Atkins North America, a global engineering and project management consulting firm.

Evan Grim (B.S. ECE 2003, M.S. ECE 2012), co-founder of the Austin-based enterprise security startup Toopher, sold his company to Salesforce in April. Toopher’s app allows users to log in to secure websites using two-factor password authentication.

Thaimar Ramirez (M.S. PE 2004), a petrophysical engineer in Apache Corporation’s exploration and production technology department in Houston, was named the 57th president of the Society of Petrophysicists and Well Log Analysts, an international technical society. She is the youngest president, second Hispanic and the first female to hold this position in more than 20 years.

Matt Riley (B.S. ECE 2006, M.S. ECE 2008), co-founder of the online search startup Swiftype, raised $13 million in additional funding. Headquartered in San Francisco, Swiftype provides companies with search engines for websites and apps, and this series B funding will be used to further strengthen its search functions.

Andreas Mogensen (Ph.D. ASE 2007) launched to the International Space Station and is co-piloting the Soyuz spacecraft. This is Mogensen’s first spaceflight and the first ever by a Danish national.

Isis Trenchard (B.S. BME 2008) is a postdoctoral researcher working with lead researcher Christina Smolke at Stanford University. Their team created strains of yeast that can produce narcotics, which could make painkillers and cough suppressants less expensive and more predictable than those created from poppies. Their work was published in Science and featured in The New York Times, Reuters and The Washington Post.

2010s

Justin Drake (B.S. BME 2011) was appointed as student regent to UT System Board of Regents. He is currently pursuing a doctorate of biochemistry and molecular biology from The University of Texas Medical Branch at Galveston.

Kartik Jain (B.S. ME 2011) launched new restaurant app Nomly, which allows users to discover new places to eat and drink through recommendations from the app’s network of local foodies.

Karl Nieman (M.S. ECE 2011, Ph.D. ECE 2014) created the first 100-antenna massive MIMO (multiple input multiple output) base station, in collaboration with National Instruments and Sweden’s Lund University, which could help enable 5G wireless and meet the demands of next-generation mobile devices.

Oscar Ayala (B.S. BME 2012) received a National Defense Science and Engineering Graduate Fellowship awarded through the Air Force Office of Scientific Research. A third-year graduate student at Vanderbilt University, Ayala is working to identify bacterial strains that cause ear infections. This highly competitive, three-year award fully covers his tuition and provides a monthly stipend.

Rebekah Scheuerle (B.S. ChE 2013), a Ph.D. student at the University of Cambridge’s Department of Chemical Engineering and Biotechnology, received the Benefactor’s Scholarship from the university’s St. John’s College in recognition of her research and academic success. She is currently leading the development of a nipple shield drug delivery device that supplements breast milk with medications or nutrients during breastfeeding.

Share your news in the next edition of Texas Engineer by submitting your update via email to comm@engr.utexas.edu.
BY THE NUMBERS

The Cockrell School is leading a revolution in innovation that is improving lives and generating economic growth. We educate engineering game changers who launch and lead companies, create new industries and bring global investment and prestige to our state. We tackle real-world challenges that touch virtually every part of society — from transforming drinking water systems in rural Texas towns to finding ways to detect cancer earlier. Here are a few statistics that show the Cockrell School’s impact in Texas and beyond.

SNAPSHOT OF A GRADUATING CLASS

1 in 3 students will join the energy sector
1 in 5 will go into a high-tech field
1 in 5 will further their studies through graduate school
1 in 6 will join infrastructure/construction initiatives

B.S. graduates over a three-year period.

$71K AVERAGE STARTING SALARY OF A COCKRELL SCHOOL GRADUATE WITH A B.S. DEGREE

Who hires our students?
Chevron, Dell, ExxonMobil, Halliburton, IBM, Lockheed Martin, Motorola, NASA, National Instruments and the Texas Department of Transportation — to name a few.

THE BEST ENGINEERING EDUCATION AT THE MOST AFFORDABLE COST FOR TEXAS STUDENTS

<table>
<thead>
<tr>
<th>University</th>
<th>Cost (2015-2016 tuition and fees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UT Austin</td>
<td>$10K</td>
</tr>
<tr>
<td>Berkeley</td>
<td>$25K</td>
</tr>
<tr>
<td>Illinois</td>
<td>$30K</td>
</tr>
<tr>
<td>Michigan</td>
<td>$41K</td>
</tr>
<tr>
<td>Stanford</td>
<td>$44K</td>
</tr>
<tr>
<td>MIT</td>
<td>$45K</td>
</tr>
</tbody>
</table>

Amounts represent annual tuition and fees.

556 PATENTS ISSUED IN THE LAST 10 YEARS TO TEXAS ENGINEERING RESEARCHERS

These patents provide royalties that support the university and helping thousands of people with solutions in areas such as health care, manufacturing and energy.

THE COCKRELL SCHOOL IS HOME OF...

John Goodenough, inventor of the lithium-ion battery that powers today’s consumer electronics.

Joe Beaman and Carl Deckard, creators of the 3-D printing technology that has driven advanced manufacturing.

Jeannie Leavitt, alumna who became the first woman fighter pilot in the history of the U.S. Air Force.

Bob Mansfield, alumnus who helped develop the iPhone as Senior VP for Technology at Apple.

A GLOBAL LEADER

#1 Producer of Minority Engineering Graduates in Texas and #4 in the Nation

Diverse Issues in Higher Education

#5 Best Engineering School in the World

Academic Ranking of World Universities

#10 Graduate Engineering Program in the U.S.

U.S. News and World Report

#11 Undergraduate Engineering Program in the U.S.

U.S. News and World Report

A WISE INVESTMENT

15:1

The return UT Austin gives Texas for every tax dollar spent on the university

$8.8B

Is created in Texas business activity from UT Austin initiatives

$488M

In added state income from UT Austin research

EMSI (Economic Modeling Specialists Intl.), February 2015
The timing of Dean Emeritus John McKetta Jr.’s 100th birthday couldn’t have been more serendipitous. In 2015, the beloved professor shared his centennial milestone with the department that bears his name. Over the past 100 years, the McKetta Department of Chemical Engineering has educated thousands of students who have become renowned engineers, industry leaders, inventors and professors.

And for nearly 70 years of that century, McKetta has been here. He started teaching at The University of Texas at Austin in 1946, and served as dean of the Cockrell School of Engineering and vice chancellor of the UT System. He is recognized as a global authority on the thermodynamic properties of hydrocarbons and served as an energy advisor to five U.S. presidents.
Endowments permanently strengthen the Cockrell School of Engineering by providing recurring funds that support our outstanding students, faculty, and renowned academic programs. By creating an endowment, you can leave your mark on the UT Austin community and support generations of Texas Engineering leaders who will go on to change the world.

To learn more about establishing an endowment, contact the Cockrell School’s Office of Alumni Relations and Development at alumni@engr.utexas.edu or 512-471-2409.