TEXAS A&M UNIVERSITY

Department of Biomedical Engineering

FORMER STUDENT FEATURE

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SENIOR INNOVATION

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BIOMEDICAL ENGINEERING

2021


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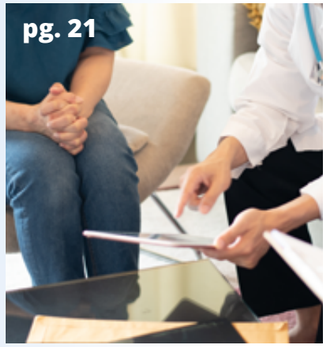
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Cover: This anatomical-sized ear is an example of how regenerative medicine research in the department is engineering functional human tissue that will drive biomedical innovations, enabling better understanding of diseases, drug discovery and therapeutics.

Letter from the
Department Head

Greetings from Aggieland! I hope this finds each of you and you loved ones well. It has been enlightening to prepare this annual update for the Department of Biomedical Engineering at Texas A&M University, as it has reinforced the fundamental commitment that our faculty, students and staff hav to making an impact. Therefore, it is extremely rewarding to highlight exciting research developments, celebrate the achievements of our faculty and students, and underscore the impact of their innovative and translational efforts

As we move into the future, we will maintain a technical emphasis on our four primary research areas of imaging technologies, medical devices, regenerative medicine, and sensing and monitoring systems. Our faculty is increasing connectivity to the Engineering Medicine program and the Center for Remote Health Technologies and Systems. This includes adding complementary expertise in application areas of great importance throughout the world: chronic diseases (cardiovascular disease, cancer, diabetes), trauma care and pediatric devices. These efforts are already strongly supported with federally funded research centers and continue to grow with new major projects, many detailed in this report. These programs support translational efforts to quickly move design concepts developed in our labs out into practice. It is a thrill to work with faculty and students so committed to solving real-world problems.

Students are benefiting from the transformation of coursework to leverage new technology, upgraded facilities and additional resources for hands-on learning. Changes are capitalizing on the unique backgrounds of faculty with extensive industry experience as well as integrating cutting-edge research into new elective courses. As a result, our graduates are being trained to become impact-minded leaders who will design engineering solutions to clinical problems and understand all aspects of the process necessary to turn those into approved products. It is through this comprehensive training that we produce strong biomedical engineers prepared to have a lasting influence

We are proud of the significant increases in research expenditures, publications, faculty awards, scholarships, fellowships and research space that all signal excellent forward progress. These achievements are enabling further growth in people and programs that will provide even greater opportunities for impact. Please visit our website or come visit us in person to see firsthand how our plans are coming together to make a difference in the world

Michael J. McShane, Ph.D.
Department Head and Professor
James J. Cain Professor II

BY THE NUMBERS

RESEARCH FUNDING **$11.2 MILLION** (FY 2020 TOTAL)

65 patents
Numbers from 2015-20

38 disclosures file
Numbers from 2015-20

ENROLLMENT (FALL 2020)

496 Undergraduates

159 Graduates

FACULTY

25 Tenure Track
5 Professors of Practice
1 Professor of Instruction
2 Lecturers
20 Affiliated Faculty

DEGREES AWARDED
(FALL 2019-SUMMER 2020)

28 M.S./M.Eng.

16 Ph.D.

149 B.S.

DIVERSITY

UNDERGRADUATE
45% Female
28% Minority

GRADUATE
40% Female
13% Minority

Student Scholarship & Award Winners

Artifink Capstone Team
Second place overall, 2020 Engineering Design Showcase, Texas A&M: Sarah Jones, Hunter Lyon, Brandon Worth, Gilberto Flores Reyes and Sarah Swift

Alcon Capstone Team
Second place in the Department of Biomedical Engineering, 2021 Engineering Design Showcase, Texas A&M: Emily Rayer, Beril Ulugun, Audrey Sheppard, J. Jesus Rodriguez Cruz, Annette Alanis and Esteban Ramirez

Biocoupler Capstone Team
Third place overall, first place in the Department of Biomedical Engineering, 2021 Engineering Design Showcase, Texas A&M: Rupal Gupta, Raaghav Bageshwar, Kamran Darvesh, Alexander Bogdan and Ariel Alanis Flores

Sara Abasi
Distinguished Dissertation Award, Texas A&M

Isabelle Agurcia
Buck Weirus Spirit Award, Texas A&M

Shreedevi Arun Kumar
Third place, Raymond's Idea Challenge, Texas A&M
U.S. Senator Phil Gramm Doctoral Fellowship, Texas A&M

Marco Bueso-Renteria
Roger J. McNichols '98 Memorial Scholarship, Department of Biomedical Engineering

Ana Chang-Gonzalez
Diversity Award, The Protein Society

Lydia Colvin
Equity, Diversity, and Inclusion Activity Grant, SPIE

Isabella Couture
Ayse Yalcinkaya '02 Memorial Scholarship, Department of Biomedical Engineering

Claudia Daboin
Ayse Yalcinkaya '02 Memorial Scholarship, Department of Biomedical Engineering

Kaivalya Deo
Third place, Raymond's Idea Challenge, Texas A&M

Heather Farris
Peter Chaplinsky Memorial Scholarship, Department of Biomedical Engineering

Jesse Fine
Student Initiative Award, Department of Biomedical Engineering

Kendall Gibson
Linda & Joe Fowler '68 Endowed Scholarship, Department of Biomedical Engineering
Morrow Foundation Engineer Scholarship, College of Engineering

Sanskruthi Guduri
Biomedical Engineering Havelka Award & Scholarship, Department of Biomedical Engineering

Michael Guillen
Ayse Yalcinkaya '02 Memorial Scholarship, Department of Biomedical Engineering

Wahibah Hannan
Roger J. McNichols '98 Memorial Scholarship, Department of Biomedical Engineering

BrieAnn Harris
Delano Women in Engineering Scholarship, College of Engineering

Christopher Hung
Linda & Joe Fowler '68 Endowed Scholarship, Department of Biomedical Engineering

Sarah Jones
Graduate Research Fellowships Program fellow, National Science Foundation

Anna Kersey
Second place, 3-Minute Thesis Competition, Texas A&M

Xiao Ling
Dr. William Hyman Scholarship Fund, Department of Biomedical Engineering

Brandon Look Fong
Roger J. McNichols '98 Memorial Scholarship, Department of Biomedical Engineering

Hamza Masood
Linda & Joe Fowler '68 Endowed Scholarship, Department of Biomedical Engineering

Sakina Mohammed Mota
Diversity Service Student Award, Accountability, Climate and Equity, Texas A&M
HEEP Graduate Fellowship, Hagler Institute for Advanced Study

Navaneeth K. R. Pandian
Distinguished Graduate Student Award, Association of Former Students

Kassidy Porche
Bill Blackwood Scholarship, College of Engineering

Daniel Prasca-Chamorro
Graduate Research Fellowships Program fellow, National Science Foundation

Amanda Rakoski
Graduate Research Fellowships Program fellow, National Science Foundation

Alexandra Ramos
Biomedical Engineering Havelka Award & Scholarship, Department of Biomedical Engineering
Class of '80 E. King Gill Selfless Service Award, Texas A&M LAUNCH program

Ruby Ross
Wanda and Jack E. McMahan '43 Scholarship, Department of Biomedical Engineering

Amelia Soltes
Wanda and Jack E. McMahan '43 Scholarship, Department of Biomedical Engineering

Hunter Syas
Freshman Dean's Excellence Award, Texas A&M

Daaniya Syeda
Dr. William Hyman Scholarship Fund, Department of Biomedical Engineering

Thomas Tigner
Graduate Research Fellowships Program fellow, National Science Foundation

Lauren Yamthe
Linda & Joe Fowler '68 Endowed Scholarship, Department of Biomedical Engineering
Morrow Foundation Engineer Scholarship, College of Engineering

Lois Wampler
Graduate Research Fellowships Program fellow, National Science Foundation

Departmental Scholarships

Our students and faculty benefit greatly through program enhancements and scholarships that our former students and friends make possible. We greatly appreciate your support.

Marina and Don Canal '85 Scholarship*

This scholarship was established by Marina and Don Canal. It funds students who are both Texas residents and military veterans.

Peter Chaplinsky Memorial Scholarship

This scholarship was established to honor the memory of Peter Chaplinsky. It provides funding to the top biomedical engineering junior.

Linda & Joe Fowler '68 Endowed Scholarship

This scholarship was established by Linda and Joe Fowler. This needs-based fund supports students who are U.S. citizens and participate in leadership/ extracurriculars.

Biomedical Engineering Havelka Award & Scholarship^

This scholarship was formed by Jim '86 and Jacque Havelka '87. It is awarded to the top senior in biomedical engineering.

Dr. William Hyman Scholarship Fund

This scholarship was created in honor of Dr. William Hyman. It supports students who have industry internship/co-op experience.

Wanda and Jack E. McMahan '43 Scholarship

This fund was established to honor the memory of Jack and Wanda McMahan. It provides funding to members of the Corps of Cadets.

Roger J. McNichols '98 Memorial Scholarship

This fund honors the memory of former student Roger McNichols. It funds students with interest in entrepreneurship experience, translational work or taking additional classes to expand education.

Ayse Yalcinkaya '02 Memorial Scholarship

This fund honors the memory of former student Ayse Yalcinkaya. It provides funding to junior female students actively engaged in the Society of Women Engineers with a 3.0 GPA or higher.

** Future Scholarships*
^ Non-endowed

2021 Annual Research Symposium Winners

On behalf of the Department of Biomedical Engineering at Texas A&M University (BME@TAMU), the Biomedical Engineering Graduate Student Association is pleased to announce this year's research symposium winners:

1st Place Podium Presenter – Michaela Pfau

2nd Place Podium Presenter – Samuel Briggs

3rd Place Podium Presenter – Amirali Selahi & Ping Dong (Tie)

1st Place Rapid-Fire Presenter – Cyril Soliman

2nd Place Rapid-Fire Presenter – Thomas Tigner

3rd Place Rapid-Fire Presenter – Annie Hedman & Jace Willis (Tie)

Best First Year Graduate Presenter – Laura Rivera Tarazona

Best Undergraduate Presenter – Rithika Adavikolanu

Tian shifts biosensor research to focus on COVID-19 detection

Dr. Limei Tian and her team are developing a novel way to diagnose COVID-19 through a mask using adapted biosensor research designed for other disease diagnoses.

When the COVID-19 pandemic began to inundate the United States in early 2020, many researchers looked at how they could adapt their current work to help fight the pandemic. Dr. Limei Tian, assistant professor in the Department of Biomedical Engineering at Texas A&M University, and her team are developing a novel way to diagnose COVID-19 through a mask.

"We are developing a reliable, noninvasive, point-of-care biosensor that can directly capture and detect SARS-CoV-2 for rapid detection and surveillance of COVID-19," Tian said.

One of Tian's research focuses is in organic and inorganic hybrid materials for physical, chemical and biological sensors and multifunctional surfaces and interfaces. As opportunities to research ways to detect and fight COVID-19 started, Tian began to adapt biosensors designed for other disease diagnoses to instead detect COVID-19.

Tian said the goal is to develop a biosensor patch that can be placed into a mask/scarf. As a person exhales, their breath can be captured. The sensor then can be easily removed and placed in a hand-held reader for analysis.

"In addition to COVID-19, the platform technology being developed in our lab can be readily adapted for rapidly detecting and monitoring other infectious respiratory diseases," Tian said.

The team is in the sensor development process. Tian said one challenge has been improving the sensitivity of the biosensors to capture low concentration of biomarkers in the breath.

Tian was recently recognized for her work in biosensors by receiving the Trailblazer R21 Award from the National Institute of Biomedical Imaging and Bioengineering, part of the National Institutes of Health. The award is an opportunity for new and early-stage investigators to pursue research programs that integrate engineering and the physical sciences with the life and behavioral sciences.

Career Reflections, *Lessons Learned*

Scott Salys '96, is the divisional vice president of Heart Failure operations at Abbott, a medical device company. Heart Failure operations is a franchise within Abbott's medical device segment focused on implantable and nonimplantable heart pumps as well as heart failure monitoring systems. Salys has more than 20 years of industry experience and has expertise in research and development (R&D), operations, supply chain, program management, process development, marketing and customer engagement.

However, that was not the original plan.

In high school, Salys was set to pursue geophysics, although he wasn't set in which direction his career would go. However, in his senior year of high school, he was hospitalized on and off for about a ear.

"During that time, I was doing my own research online, trying to understand my illness and the physiology," Salys said. "It was during this time I started to learn how the body works."

"The human body is the most amazing machine and system you can work on," he said. "That's how I got into this field and I'm glad I did. It's been tremendously rewarding."

One major accomplishment toward his career path was a co-op he did with a pacemaker company out of Houston. In addition to firmly establishing his passion for R&D, he said it was instrumental in providing career options upon graduation. Having a resume with directly relevant work experience and tangible R&D achievements caught the interest of recruiting companies and provided topics to discuss in interviews.

After graduation, Salys went to work in R&D at Cyberonics, a company focused on neuromodulation for the treatment of epilepsy. Three years later, he was approached with the opportunity to move to California and join a larger company, St. Jude Medical, that focused on cardiac rhythm management and the design of pacemakers and defibrillators

While there, he made his way through different R&D positions, starting as an individual contributor in leads development to expanding his role to managing increasingly larger organizations.

At this point, Salys knew he wanted to expand his experience outside of R&D and have a broader overall business understanding, so he transferred within the company to St. Jude's Neuromodulation Division where he rotated through several vice president roles.

"Let them know what your interests are, and then see if there is a business need that matches up with your aspirations or where you want to go," Salys said. "Some of it's random timing and what the business needs at a given point in time. Your skill sets need to match the company needs."

Throughout his career, Salys said he has faced many challenges but was successful through persistence and staying focused on adding value.

"There were challenging times that I was working 18-hour days, working on weekends. But at the end, when it's all successful, it develops you and you feel good about it. It's rewarding at the end of it all. The challenging times are the most rewarding in my experience," Salys said.

Salys also encouraged students to explore many different career path options when they graduate, saying there are many entry points for engineers, including areas such as R&D, operations, regulatory and field roles with direct physician interaction.

"You're not going to be able to mastermind your career trajectory. Some of it just happens, so I never tried to over plan it," Salys said. "As you go through your career, you should have a general trajectory in mind and take on opportunities that lead in that direction."

Summer enrichment experiences give students face time with industry

The Summer Enrichment Experience (SEE), hosted annually by the department, celebrated its sixth anniversary in 2021.

The SEE program launched in 2015 as a way to provide students additional opportunities for interactions with industry to assist with career exploration and networking. Jacqueline Havelka '87, a member of the Biomedical Engineering Advisory Board, started the program. Maria Lyons, program manager for corporate relations and former student outreach in the department, manages the program.

"It has been very rewarding to see hundreds of students participate over these last years," Havelka said. "I hope that we have provided some sparks of interest to help them pursue a particular career path. All it takes is a spark to get that fire going!

The undergraduate population in biomedical engineering nearly doubled in size between 2014 and 2020. As a result, the program saw changes as well.

"The program has grown tremendously from the student perspective. In its first year, approximately 20 students participated," Lyons said. "Our fully virtual series in 2020 resulted in 94 active participants, 25 of which received credit for the ENGRx curriculum requirement."

The SEE program lined up with a College of Engineering initiative called ENGRx, which requires all students to have external experiences such as research, leadership or industry experience.

When it first started, opportunities focused on contacts in the Houston and College Station areas. However, that soon expanded throughout Texas in person and the entire nation virtually. Some examples of partnering companies include Quest Medical, Abbott, the Mann Eye Institute, NASA, Medtronic, BD and Cook Medical.

In-person opportunities prior to the pandemic included industry and hospital tours, physician shadowing and networking opportunities. The transition online allowed the series to expand to include panel presentations from former students, information sessions focused on career paths at medical device companies, virtual product demonstrations and more.

"Companies, their employees and our former students have all been extremely gracious in sharing their time and expertise with our current students," Lyons said. "Summer 2021 will utilize a hybrid model incorporating both in-person and virtual experiences."

Researcher Receives $5M Cancer Grant

Dr. Tanmay Lele, Unocal Professor in the department, received a multi-million dollar grant to support groundbreaking cancer research.

Lele received a $5 million Recruitment of Established Investigators grant from the Cancer Prevention and Research Institute of Texas (CPRIT) to further knowledge about cancer and how it progresses.

Lele's research focuses on mechanobiology — the mechanical aspects of biology — where he works to understand how cells sense external mechanical forces as well as how they generate mechanical forces, and how these mechanical forces impact cell function.

In cancer, both cellular mechanical forces and the mechanical properties of resisting cellular structures go awry. This in turn causes abnormalities in cell structure. A particularly striking feature of cancer cells is the highly irregular and/or distended shape of the nucleus.

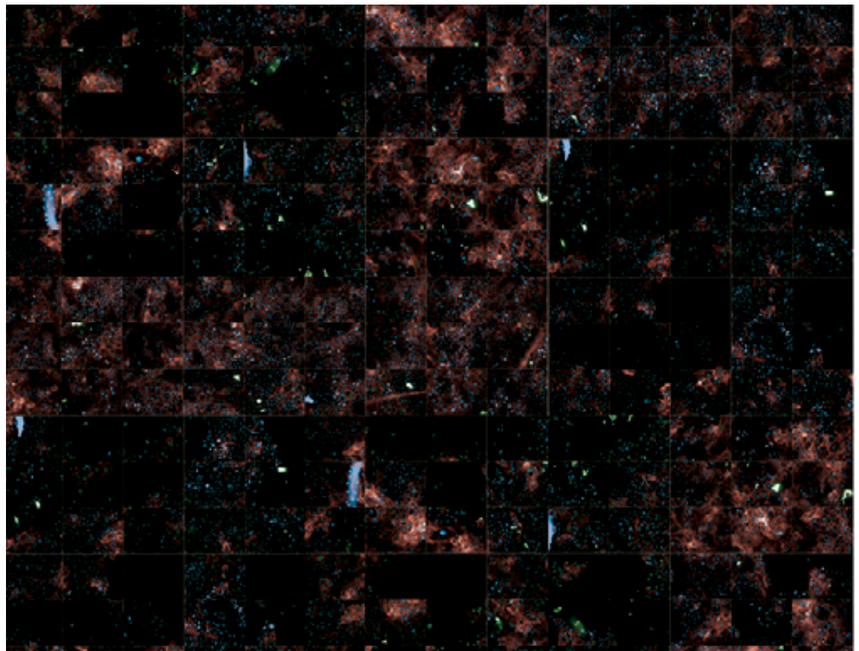
"The nuclei in normal tissue have smooth surfaces, but over time the surfaces of cancer nuclei become irregular in shape," Lele said. "Now, why? Nobody really knows. We're still at the tip of the iceberg at trying to figure this problem out. But nuclear abnormalities are ubiquitous and occur in all kinds of cancers — breast, prostate and lung cancers."

Pathologists study biopsies and note abnormalities in the shape of the cell and its nucleus to grade the severity of cancer. To research the cause of abnormal cancer nuclear structures, Lele and his team are working to computerize the analysis of nuclear shapes.

Lele's research aims to help the medical community develop new knowledge of human cancers and how they progress to better diagnose and manage cancers. Understanding the mechanisms behind the abnormalities can help develop therapies to better treat cancers by targeting the nucleus.

"Like any other basic field, we are trying to make discoveries with the hope that they will have long-term impacts on human health," Lele said.

Lele has two laboratories, one in College Station and one in the Texas A&M Health Science Center's Institute of Biosciences and Technology in Houston. The cancer grant from CPRIT is a collaborative effort with Dr. Michael Mancini and Dr. Fabio Stossi from the Baylor College of Medicine. Lele said he is looking forward to collaborating with researchers in both College Station and Houston.



Lele received his doctoral degree in chemical engineering from Purdue University. Before coming to Texas A&M, he served as the Charles A. Stokes Professor of Chemical Engineering at the University of Florida. At Texas A&M, in addition to being in biomedical engineering, he is a joint faculty member in the Artie McFerrin Department of Chemical Engineering.

FROM ***RESEARCH*** TO ***ACADEMIA***

Del Bosque embraces teaching opportunity

Romina Del Bosque initially pursued biomedical engineering as an undergraduate student because it combined medicine and engineering. At the time, she planned to pursue a medical degree but found she liked the problem-solving aspects of biomedical engineering more.

That interest continued on to her doctoral program. There, she continued her research in radiofrequency coil design for magnetic resonance imaging and spectroscopy in Dr. Mary McDougall's lab. Financial support came from two Texas A&M University fellowships — the Louis Stokes Alliance for Minority Participation and the Graduate Diversity Fellowship.

"Throughout both undergrad and graduate school, I had phenomenal professors and mentors," Del Bosque said. "The combination of that support and my interest in mentoring and teaching undergraduate researchers in my lab is what led me to pursue a career in academia."

Del Bosque defended her dissertation in late 2019, started teaching in January 2020 and graduated from Texas A&M in May. She is now on the academic professional track at Vanderbilt University. Along with teaching two courses a semester, she has two service components: developing a mentorship program for underrepresented minorities within the department and designing a program that helps students get internships.

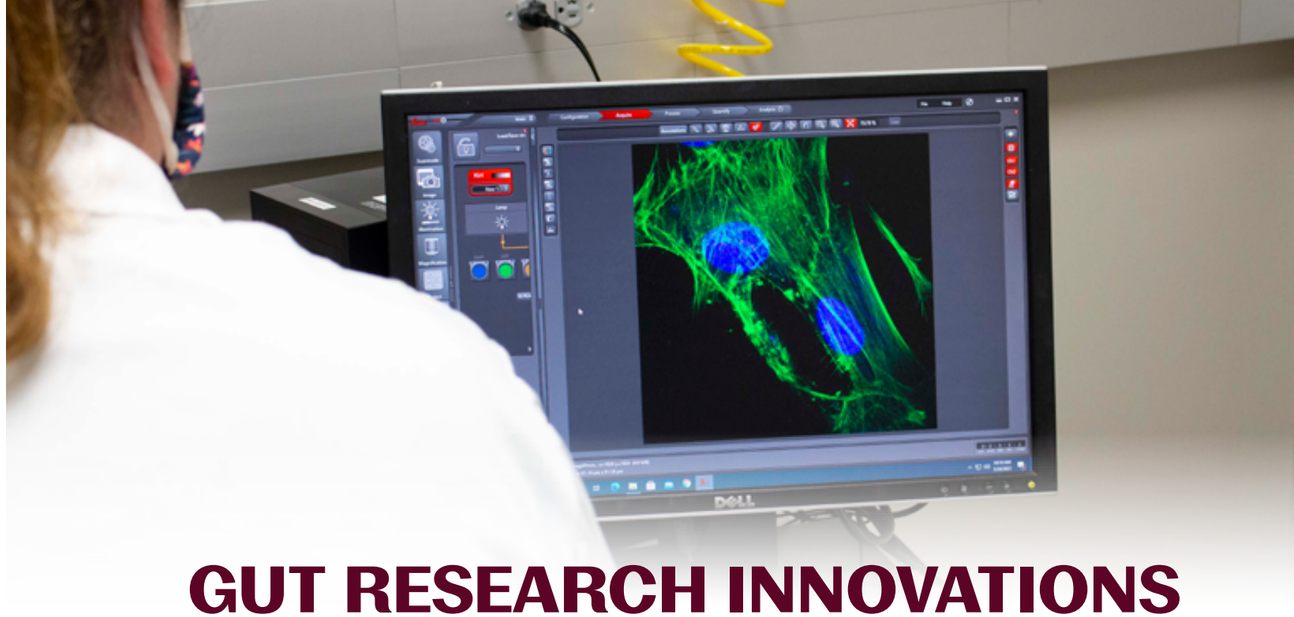
While in Bryan-College Station, Del Bosque was a member of the Texas A&M System Research Model (TxARM), part of The Texas A&M University System Texas Alliance for Graduate Education and the Professoriate. This alliance was created to advance knowledge about models to improve pathways to the professoriate and success of historically underrepresented minority graduate students, postdoctoral fellows and faculty in specific science, technology, engineering and math disciplines.

Del Bosque said TxARM provided a community with a common goal — to pursue a career in academia.

"These professional development activities are extremely helpful when transitioning from doctoral student to junior faculty," she said.

One of her main professional and personal mentors in graduate school was her advisor. One piece of advice that Del Bosque has carried with her is to not doubt herself.

"As a first-generation college student, I often doubted myself and my abilities," she said. "I plan to mentor undergraduate students, especially those who are in similar situations I was in, to help them understand that they do belong within the department and that hard work can help them accomplish anything they set their mind to regardless of their 'starting point.'"



GUT RESEARCH INNOVATIONS

could help veterans through regenerative medicine

Gulf War Illness (GWI) is a multi-symptom illness that impacts an estimated 25% to 35% of veterans of the Gulf War. Since the war, functional gastrointestinal disorders related to GWI have gone largely unexplained and there are no clear therapies that directly address gastrointestinal dysfunction in GWI.

Dr. Shreya Raghavan, assistant professor, and her lab aim to develop new ways to research GWI occurrence and treatment options using bioengineering.

"We believe that by investigating the pathobiology of GWI-related gastrointestinal dysfunction, we will be able to therapeutically target it and improve the quality of life of aging Gulf War veterans," Raghavan said.

Her lab works on engineering tissue microenvironments for both intestinal inflammation research and cancer. By isolating all the individual cellular components and reengineering them in controlled ratios, the lab is able to better understand the different variables that cause the biological problems. These bioengineered constructs, if made from patient-derived cells, can then be used for personalized, patient-specific treatments

"The readouts from bioengineered guts/intestines are phenomenally similar to comparable tissues from rodents, rabbits and even humans," Raghavan said. "Our previous work has shown that by creating these gut structures, we're able to compare physiological function and show remarkable equivalency."

One challenge her overall research faces is sourcing cell material from the patient to form the engineered portion. Many of the issues she's trying to address impact only parts of the gut.

"For a regenerative medicine approach to work, you have to show that other portions of the gut are still functioning normally," Raghavan said. "That's our first challenge — to show that engineered pieces from the uninvolved gut still function physiologically as expected and sourcing enough amounts of autologous tissue to create this solution."

Raghavan said personal connections have also led to her interest in studying the gut, including family members afflicted with chronic gut disorder

"Even outside of GWI, this work has implications in other inflammatory disorders of the gut like Crohn's and colitis, even cancer initiation," Raghavan said. "These sorts of personalized medicine approaches are currently not very popular in the gut realm. It will be exciting to generate bioengineered guts. To ask so many different questions like, 'Why are some patients susceptible to colorectal cancer? Or why do some individuals with inflammatory bowel disorders have disruptions in gut motility, and how can we treat them?'"

CAPSTONE *Design Projects*

The senior design experience is an extremely important part of the biomedical engineering curriculum at Texas A&M University. The department's undergraduate students work with sponsors as part of a project aimed at designing and fabricating a medical device or system. The projects, which can result in new designs, improvements to existing designs or new process designs, are sponsored by clients such as medical device companies and clinicians.

These are just a few examples of projects our students have recently participated in. *Please note that all photos were taken before COVID-19 restrictions were in place.*

Taking steps to improve youth foot and ankle orthotics

One senior design team developed an orthotic to help children move easier. Working with Texas Children's Hospital, the team designed an orthotic device to help children with foot-ankle malalignments. Current orthotics are either generalized pieces designed for adults or customized devices that take lots of time and money to make. The team developed a plan and prototype that landed at the perfect intersection of timely and customizable. Another aspect of their project is a business plan that explains costs, associated risks and anticipated profit margins

"Our sponsor is very ambitious. I think that pushes us and challenges us more and gives us that drive to be successful," Emily Burrows said. "They've been helpful and clear on what they want."

Students offer pediatric surgeons a helping hand

In a surgery suite, it's all hands on deck to give the patient the best care possible. However, using an endoscope, a tube with a light and camera attached to it, can sometimes take away some of that mobility. This capstone team of five developed a holder that can keep the endoscope absolutely still during surgery for a pediatric ear, nose and throat surgeon with Texas Children's Hospital.

"This project is on the smaller scale since we are just catering to our surgeon, but the bigger impact of this is it's going to cut down on procedures and it's going to allow him to work on more patients at the end of the day and help those kids that need it," Camille Felgenhauer said. "It's those small details that make the bigger picture worth it."

Students develop device to support infant kidneys

When babies are born with cardiovascular issues that require surgery, their other systems, especially the kidneys, need support. Babies in the neonatal intensive care unit receive this support through peritoneal dialysis, which helps soak up and remove waste. This process is currently done by hand. One team worked with Texas Children's Hospital to develop an automated system to save time and labor and allow the nurses to act as a second pair of eyes.

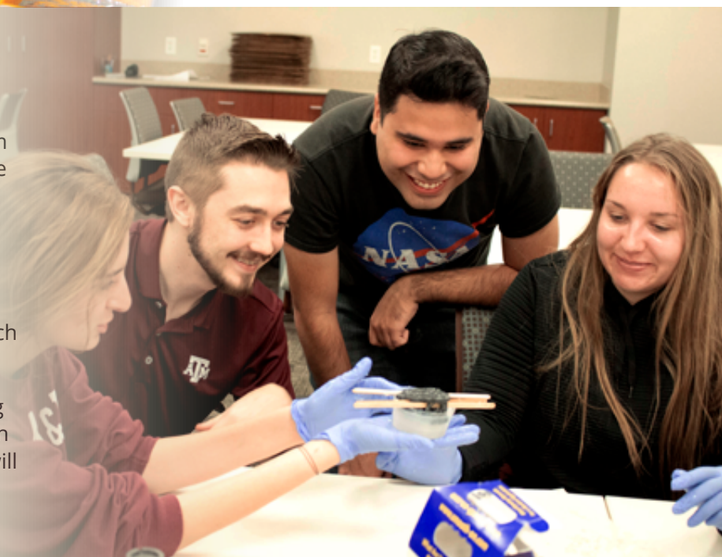
"This is the first class where we have full discretion over everything," Ashwin Mukund said. "A lot of classes have guidelines and, 'OK, if this goes wrong, you can go to a teacher,' but this class it's really all on us."

Team designs phone app for low-contrast visual acuity tests

Technology is always evolving, including using telehealth to reach patients who cannot easily travel to a physical clinic or hospital. One capstone design team of four developed a new phone app to test low-contrast visual acuity. Working with The University of Texas Southwestern Medical Center, this app could help clinicians diagnose neurological conditions, including multiple sclerosis, without the patient traveling to the clinic.

"Our application is sort of a first test to see how your vision is doing, and see if that's manifesting as a symptom of a larger issue," Matthew Armstrong said. "Our assignment is to design something that can be deployed remotely."

Capstone team works to help the littlest ears



This capstone team worked with two sponsors from Texas Children's Hospital to find new and adaptable solutions to infant ear deformations — where all the material is there, just not in the right place. The students worked to solve a real-world problem in an effective way. The team developed a 3D print personalized treatment plan to create alternative devices to the generic products on the market, which aren't exactly fit for infants

"This is the application of our education, and seeing it and being successful with it helps me know that in the future, wherever, whatever I do with my life, I will be able to achieve something like this because I've already seen results," Meagan Makarczyk said.

Faculty & Staff Awards

IMPEDE® Embolization Plug Team

R&D 100 Award, R&D World Magazine

2020 Excellence in Technology Transfer Award, Federal Laboratory Consortium for Technology Transfer

Isaac Adjei

"1,000 Inspiring Black Scientists" Distinction, Cell Press

Daniel Alge

Dean of Engineering Excellence Award, Texas A&M – Assistant Professor Level

Saurabh Biswas

Senior Member, National Academy of Inventors

Gerard Coté

Walston Chubb Award for Innovation, Sigma Xi

Distinguished Achievement Award for Graduate Mentoring, Association of Former Students

Akhilesh Gaharwar

Dean of Engineering Excellence Award, Texas A&M – Associate Professor Level

Outstanding Contributions, College of Engineering

Melissa Grunlan

Chancellor's Enhancing Development and Generating Excellence in Scholarship Fellow, The Texas A&M University System

Eileen Hoy

Commitment to Students Award for Staff, Texas A&M chapter of the Biomedical Engineering Society

President's Award for Academic Advising, Texas A&M

Abhishek Jain

CAREER Award, National Science Foundation

Dean of Engineering Excellence Award, Texas A&M – Assistant Professor Level

Roozbeh Jafari

Dean of Engineering Excellence Award, Texas A&M – Professor Level

Research Impact Award, Texas A&M Engineering Experiment Station

Senior Member, National Academy of Inventors

Tanmay Lele

Recruitment of Established Investigator's Award, Cancer Prevention and Research Institute of Texas

Unocal Professorship, College of Engineering

Charles Patrick

Commitment to Students Award for Faculty, Texas A&M chapter of the Biomedical Engineering Society

Charles Peak

Presidential Transformative Teaching Grant

Roderic I. Pettigrew

Fellow, American Academy of Arts and Sciences

Shreya Raghavan

ADVANCE Fellowship, National Center for Faculty Diversity and Development

Limei Tian

Trailblazer Award, National Institutes of Health

Alexandra Walsh

Finalist, Early Career Professor Award, Agilent Technologies

Young Investigator Research Program Grant, Air Force Office of Scientific Research

Fellows for the Advancing BioImaging Initiative, Scialog

Vladislav Yakovlev

Harold E. Edgerton Award in High-Speed Optics, International Society for Optics and Photonics (SPIE)

Faculty Fellow, Texas A&M Engineering Experiment Station

Faculty Professional Society Fellows

Gerard Coté, Regents Professor

American Institute for Medical and Biological Engineering

Biomedical Engineering Society

Institute of Electrical and Electronics Engineers

International Society for Optics and Photonics (SPIE)

Melissa Grunlan, Professor

American Institute for Medical and Biological Engineering

American Chemical Society

Balakrishna Haridas, Professor of Practice

American Institute for Medical and Biological Engineering

Roozbeh Jafari, Professor

American Institute for Medical and Biological Engineering

Duncan Maitland, Professor

American Institute for Medical and Biological Engineering

National Academy of Inventors

Kristen Maitland, Associate Professor

American Institute for Medical and Biological Engineering

International Society for Optics and Photonics (SPIE)

Mike McShane, Professor

American Institute for Medical and Biological Engineering

Roderic Pettigrew, Professor

American Academy of Arts and Sciences

American College of Cardiology

American Heart Association

American Institute for Medical and Biological Engineering

International Society of Magnetic Resonance in Medicine

National Academy of Engineering

National Academy of Medicine

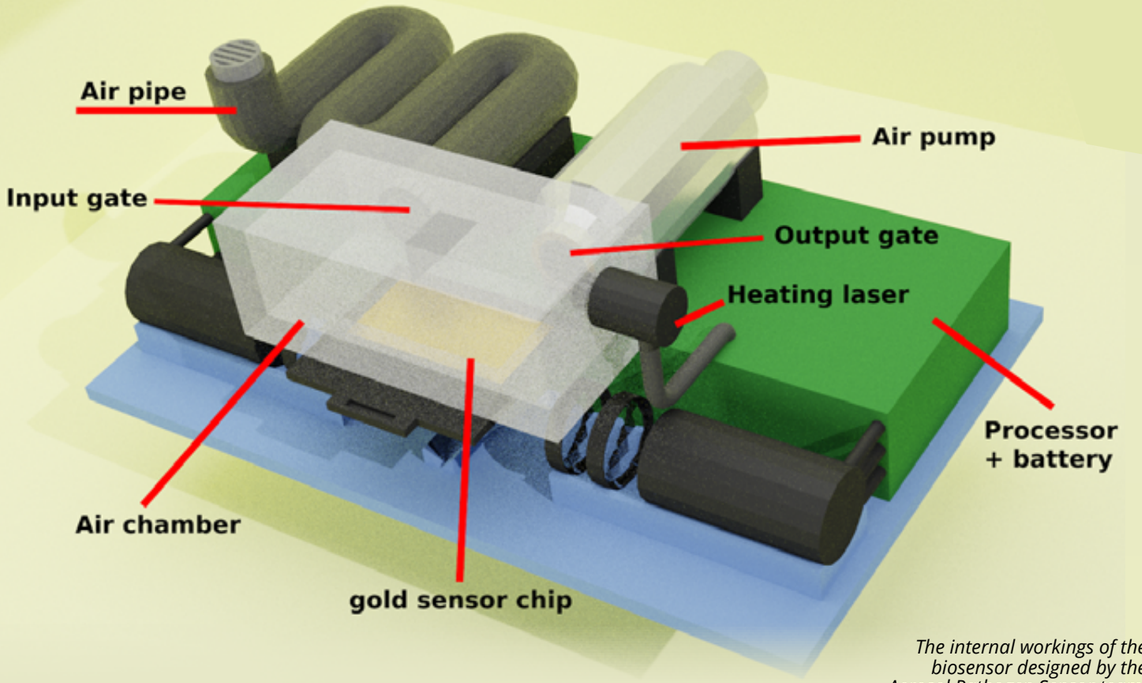
Vladislav Yakovlev, Professor

American Institute for Medical and Biological Engineering

American Physical Society

International Society for Optics and Photonics (SPIE)

The Optical Society of America



The internal workings of the biosensor designed by the Aerosol Pathogen Sensor team.

Rapid **COVID-19** Detection

One challenge of the COVID-19 pandemic has been monitoring cases in places with high amounts of foot traffic. A team of students from the departmen worked on a biosensor that could quickly diagnose cases and help prevent the spread of coronavirus.

The Aerosol Pathogen Sensor team was selected for the 2020 National Science Foundation's I-Corps Site Program at Texas A&M to gain resources and assistance with moving their design past the concept phase.

Their biosensor is designed to detect airborne pathogenic particles relating to COVID-19 to help diagnose a case within 20 minutes. This device is focused on use in hospitals, private practices and retirement homes.

The team first came together to participate in the Aggies Against COVID challenge in April 2020. They also participated in the "Tracking COVID-19" challenge from the New York Academy of Science, where they competed in a global challenge assisting in the tracking of COVID-19. There, they placed in the top 10 teams worldwide out of about 100 teams that competed.

"There's a lot of people suffering from the COVID crisis, a lot of people dying, and I wanted to help however I could," said junior Ryan Bean.

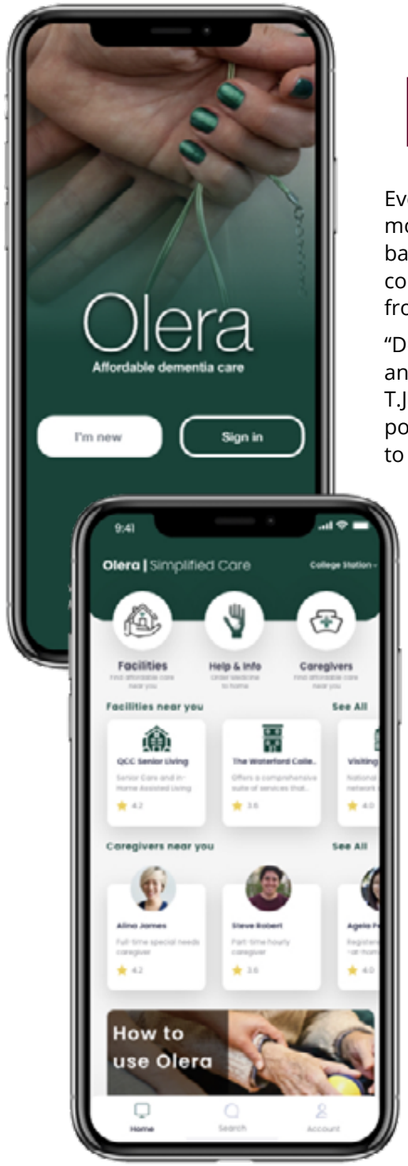
As fellows in the I-Corps program, the team conducted 35 industry interviews and 400 consumer interviews to gauge reaction, interest and feedback on their proposed biosensor. The team said they received lots of positive feedback, especially since their device is noninvasive, more accurate and reusable.

"It was extremely useful for us because it gave us that entrepreneurship mindset and the business side versus just strictly engineering," said junior Haley Clark.

Junior Hannah Chamberlain said her biggest takeaway from the I-Corps program was the entrepreneurial skills she gained.

"(The program) really teaches you how to gauge needs from an industry and then create your device based off those needs," Chamberlain said

"The applications for it truly are pretty numerous once we get it going," said junior Zach Mendoza. "What we're working on can be applied across all infectious diseases. Of course, that's very broad and far in the future, but the fact that we've gotten this far and been this successful gives me a lot of hope."



There is a demand for elderly care in the United States, but there is not an easy resource available to find the right facility while balancing budget, health concerns and time. The Olera app, designed by students at Texas A&M University, aims to change that.

Mobile solution for
ELDERLY CARE

Even before the coronavirus pandemic hit, finding elderly care was becoming more difficult in the United States. Trying to find the right facility whi balancing budget, health concerns and time were challenges that COVID-19 compounded. However, an interdisciplinary team of student researchers from Texas A&M University are working toward a mobile solution.

"Dealing with the mental trauma of watching a loved one's memories and mental faculties deteriorate is difficult enough," said team membe T.J. Falohun, biomedical engineering doctoral student. "Individuals in this position should not have to struggle to find the information that they need to make the best decision on finding care for their loved one.

With their application, Olera, the team aims to provide a resource for children or spouses of elderly individuals in need of professional care and connects them to local care options. While the name Olera doesn't stand for anything, Falohun said it evokes a feeling of balance, lightness and tranquility that represents the vision of their venture.

"This not only lowers the stress involved with finding care, but it drastically reduces the time that this process would otherwise take," said member Carter Radocha, computer engineering junior. "Upon logging in, users will have the ability to filter local facilities by price, location and offered medical services, information that would otherwise be time consuming to obtain."

The team, which also includes business administration graduate student Logan DuBose, biomedical engineering senior Jesse Phipps and biomedical engineering graduate student Chidinma Nzedibe, began through participation in Sling Health, a student organization where teams tackle unmet clinical needs in interdisciplinary teams. The members wanted to address Alzheimer's and dementia.

Team members participated in the National Science Foundation's I-Corps Site Fellows Program at Texas A&M in 2020, where they interviewed 40 people familiar with the process of searching for elderly care. This helped them learn about one of the greatest challenges they would have to address — a lack of knowledge on what to do when a loved one needs to be moved to a long-term care facility.

Moving forward, the team plans to launch a limited beta test to test and refine the product. They also are focusing on entrepreneurial efforts.

"Less than a year ago, Olera was nothing but an idea," Falohun said. "Currently, we have a hardworking team of eight students, a prototype and several early adopters who are eager for our product launch. By keeping the needs of our users first, we believe we can overcome any obstacles that may arise and create a digital platform that will revolutionize elderly and dementia care."

INSPIRED BY

COLLABORATIVE RESEARCH

Michael Frassica chose to pursue his doctoral degree in biomedical engineering at Texas A&M University. He said he was drawn to the research area because he's interested in the crossover of medicine with chemistry and biology.

"I wanted to find a way to utilize those fields to solv macro-level problems in the field of medicine," Frassica said.

His research focuses on treating osteochondral defects, such as loss of tissue in the knee, with templated hydrogel scaffolds to aid in regeneration

"We aim to provide an off-the-shelf synthetic device that can repair damaged osteochondral tissue without the limitations of current surgical approaches," Frassica said. "In doing so, we can stop these defects from progressing to osteoarthritis and eventual total knee replacement."

Frassica said since he started school at Texas A&M, he gained more skills in time management, communication and collaboration.

"I've enjoyed the access to equipment, facilities and high-level personnel in the department and across the entire university," Frassica said. "The department provides a lot of collaborative opportunities between labs and research, and also through coursework and seminars. The department really tries to get you and faculty together as much as possible to foster that collaboration."

As an out-of-state student, Frassica said he was pleasantly surprised at how smoothly the transition to Texas A&M went.

"Texas A&M itself is built to take in anybody from anywhere. It's home in and of itself. The transition is a lot easier than I think anybody could ever imagine it would be," Frassica said.

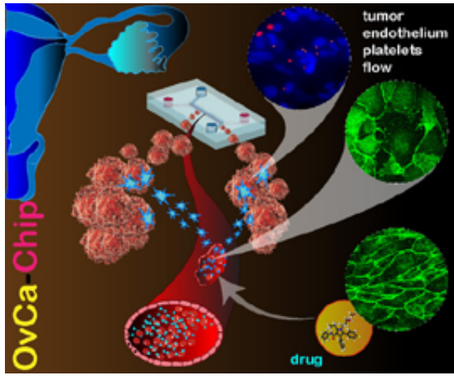
One of his biggest takeaways was to stress the importance of time management — most graduate students run their own schedules — and his advice is for students to come in ready to accomplish a diversity of tasks.

"Be prepared to solve a wide variety of problems across several different topics and fields. If you'r excited about doing something like that, then it's definitely the right place," Frassica said

Frassica graduated with his Ph.D. and is now employed as a senior clinical research scientist at Abbott.

OvCa-Chip

Fighting Ovarian Cancer



Recent discoveries made by researchers at Texas A&M University could change the way ovarian cancer is understood and treated.

Dr. Abhishek Jain, assistant professor in the Department of Biomedical Engineering, collaborated with researchers from the Departments of Gynecologic Oncology and Cancer Biology at MD Anderson Cancer Center to gain a better understanding of the interaction among ovarian cancer tumors, blood vessels and platelets. They found that tumors break the blood vessel barriers so that they can communicate with the blood cells, such as platelets. When these tumors come into contact with platelets, they can then metastasize, or begin to spread to other sites in the body.

Currently, researchers understand that platelets are one of the initiators of ovarian cancer metastasis but did not know what led to the introduction of the platelets to the tumor cells. Instead of struggling to view this relationship in animal models, Jain's team brought a new solution to the table: organ-on-a-chip research.

Organs-on-a-chip are microfluidic medical devices th size of a USB drive. The team designed the OvCa-Chip to give researchers an easier window to view the biological processes between tumors and platelets.

In an interview with the International Society on Thrombosis and Hemostasis, Jain explained that "it basically is a microenvironment where ovarian tumor cells can be co-cultured along with their blood vessels, and then they can interact with blood cells. Once we learn about these interactions, we can then move forward to look into how drugs will impact these kinds of interactions."

Viewing the interaction between tumors and blood vessels on the OvCa-Chip led the researchers to an extraordinary result — the tumor cells systematically broke down the endothelial cells, which are the barrier that lines the interior surface of blood vessels and prevents exterior interaction with blood cells. Once this barrier was gone, blood cells and platelets entered the tumor microenvironment and could be recruited for metastasis.

Harnessing this knowledge could change how clinicians approach ovarian cancer treatment, Jain said, suggesting that anti-vascular drugs could be considered along with anticancer treatments. A benefit of the organ-on-a-chip is that it can also tes these novel drug treatments and drug combinations.

"You have to understand that these are chips that are living. They contain living cells. The advantage is that these are all actually human samples," Jain stated in the interview. "So what we think the future for this technology is, is perhaps we can advance it in the direction of personalized medicine."

STAFF SPOTLIGHT

HOY BRINGS LOVE FOR TEACHING TO ACADEMIC ADVISING POSITION

Eileen Hoy, undergraduate academic advisor, loves helping students navigate the many resources biomedical engineering and Texas A&M University have to offer.

Eileen Hoy began her pursuit of helping students while working toward her master's degree in the early '80s when she decided to earn a certification to teach high school.

"While teaching, I spent a lot of time working with and talking to students individually on topics other than science and their coursework. We discussed personal issues, decisions they were making about coursework, going to college, working after high school, what careers they wanted," Hoy said.

Hoy and her family moved to the Bryan/College Station area in 1994. After serving in various roles, she started working for the Department of Biochemistry and Biophysics at Texas A&M University as the stockroom manager. After a couple of years, the department's advisor position opened up. Hoy applied and was hired, and she continued to grow her love of working with students and helping them navigate new knowledge.

"There is so much, especially at the university level, that can remain uncovered unless they really research or have someone help them find thos hidden opportunities that can make a real differenc in a student's career path/life," Hoy said. "I love seeing the changes they make and the process of maturing as they progress through the years to graduation."

Hoy joined the Department of Biomedical Engineering as an undergraduate academic advisor in December 2018. She said she likes that the department has a family feel despite being part of a large university.

Hoy's exceptional academic advising has been recognized many times. She was a recipient of the 2020 President's Award for Academic Advising and the 2019 Commitment to Students Award from the student chapter of the Biomedical Engineering Society.

"Anything I do, big or small, has an effect on the student," Hoy said. "I make every effort to make certain that what I do makes that effect a positive one. I do make mistakes, but I try my best to make them right. Being selected for these awards is awesome, but I don't do what I do for any award. I do it for the students."

OUTSTANDING ALUMNI

Cindy Haven '79

Haven, now retired, spent the majority of her career leading innovative, biologically based programs at NASA, including the Human Research Facility.

The Department of Biomedical Engineering at Texas A&M University presented its 2020 Outstanding Alumni Award to Cindy Haven '79, who spent most of her career launching — literally — innovative, biologically based programs at NASA.

"Cindy always took that one more chance to make an impact at NASA, and now we're thrilled to recognize her many accomplishments here today," said Dr. Mike McShane, department head.

After graduating from Texas A&M with her bachelor's degree in bioengineering, Haven took a job at NASA, where she worked for 31 years. She started in the life sciences project division in 1988 and was involved in various roles in Spacelab missions dedicated to life sciences research.

"I did continue to use my biomedical engineering education and relationships," Haven said. "I wasn't one of those people who got a degree and changed fields. It served me well my entire career.

Haven was a key member of the initial team that laid the groundwork for the biomedical and biological research on the International Space Station (ISS), an effort known today as the Human Research Facility (HRF). In 2001, Haven served as HRF increment lead to watch the launch and installation of the first rack of payload equipment that started human research aboard the station, an effort that continues today

She also managed the ISS Medical Project, worked with the Human Research Program's International Science Office to establish processes, ris management and data sharing principles across all ISS international partners, and helped NASA transition to the Exploration phase.

Throughout her career, Haven made sure to maintain connections to the department and Texas A&M. She connected with fellow graduates, used social networking to stay in touch and attended events in the College Station and Houston areas. She gives financially and plans to leave a living legacy in the department.

"I do believe in what the department is doing, and that they're doing some amazing things," Haven said. "I've seen some of the amazing students already come past here, and it makes me feel like things are in good hands."

Over the years, Haven has also mentored students and provided advice.

"I want to help students with the challenges of getting into the business, understanding what I call lessons learned, what went wrong, what went right," Haven said.

"A lifetime of learning is something that's very important," Haven said. "I've tried to make sure that I didn't stagnate. Make sure you get smarter, change your mind along the way, but never, never stop learning, and share with other people what you know."

The department's Outstanding Alumni Award is given annually to former biomedical engineering students who shoot for the stars. The award is based on peer nomination.

Birthing Medical Innovation

Students in Texas A&M University's Department of Biomedical Engineering are learning to create innovative solutions for some of the most pressing medical issues facing individuals around the globe. They also are working with companies and clinicians nationwide to address these needs. Ideally, these students would have access to a collaborative space that offers access to medical specific models, tools and supplies as well a audiovisual capabilities to communicate with remote partners anywhere in the world — from the operating room to the African desert.

A space tailored to the specific needs for teachin biomedical engineering has been created thanks to recent room renovations. Now, the department's leaders are working with the Texas A&M Foundation to identify funding to outfit a state of-the-art Biomedical Engineering Design Studio. "We need to create a space where our students can immerse themselves in the design process and have tools and equipment that are not readily available other places on campus," said Professor of Practice James Machek.

The BME Design Studio, located in the Emerging Technologies Building, will foster an entrepreneurial mindset based on teamwork and design. Students will have access to a variety of specific medical resources such as anatomica models and virtual reality tools, as well as electronics and chemical and biological test equipment. The space will also include specialized hand tools, 3D printers, laser machining tools and other prototyping equipment. Critical infrastructure such as large-screen televisions, HD cameras and high-fidelity audi for effective communication will further allo students to virtually meet with clients, researchers and medical professionals.

Students will also have access to the Fischer Engineering Design Center, a makerspace that serves all engineering students but doesn't offe specific biomedical engineering equipment. "We'r not looking to recreate what the college already has," Machek said. "We're looking to add resources and capabilities that don't exist and also have a 'home base' where these students can coalesce to work on their projects or work in teams when classes aren't meeting."

Once outfitted, the BME Design Studio will mor adequately support students' progress as they go through the design course sequence and help them create innovative prototypes for project sponsors. For more information on the senior capstone experience and project examples, visit tx.ag/bmencapstone.

Designing Health Innovation

The department is always looking for improvements while maintaining quality and currency to prepare students for entering the biomedical field. "Preparing students to succeed in this rapidly changing industry, which now includes things like artificial intelligence and robotics, is a major priority of ours," said Dr. Mike McShane '94, biomedical engineering department head and holder of the James J. Cain Professorship II.

Based on internal observations and feedback from external stakeholders — including an advisory board comprising representatives from the medical device industry, clinicians and academic leaders — the department launched a revised curriculum with significant enhancements to the design experience. While design work has been part of the department's curriculum in some way since 1972, there is now an expanded focus on medical device design innovation starting in sophomore courses that culminates in a senior year capstone project.

In 2013 the department was the first in the college to implement a vertical integrated curriculum, where design content was taught during each year of the biomedical engineering degree rather than just the senior year. The curriculum was further revised in 2019 to impact student knowledge base concerning industry preparedness. Students now start with a deep dive into the many career paths available, followed by training in Solidworks.

During the course of their last two semesters, undergraduates work with sponsors on a project aimed at designing and fabricating a medical device or system. This expanded curriculum ultimately prepares students for a realistic industry experience.

This expanded curriculum, detailed below, ultimately prepares students for a realistic industry experience.

Year One: General engineering students study diseases as well as types of devices used for treatment, such as pacemakers.

Year Two: After joining biomedical engineering, students learn about federal agencies, risk management and disease control. Teams begin creating small-scale design projects.

Year Three: Students explore the demographic and ethnographic needs for design solutions, the development of design proposals and the patent landscape.

Year Four: Students develop a prototype based on the needs of industry and clinician sponsors such as Texas Children's Hospital, Becton Dickinson, Abbott and many others.

Taking inspiration from **nature** for **late-stage cancer care**

Dr. Isaac Adjei is using his background in drug delivery to engineer new ways to treat late-stage cancer patients.

Adjei, assistant professor in the Department of Biomedical Engineering at Texas A&M University, develops treatments for patients with late-stage cancers to improve their quality of life and help them live longer. Typically, these patients have cancer that has spread to other parts of the body or tumors that do not respond to treatment.

One of the current treatments for most cancer patients is immunotherapy, where antibodies are used against specific receptors on cancer cells t activate the immune system or immune cells are isolated, activated and then re-injected into the body to attack the cancer. However, immunotherapy is less likely to work on patients with late-stage cancer. In breast cancer patients, only about 5% in the advanced stage will respond to treatment.

Adjei's group looks to see if they can develop ways to change the environment inside a patient's tumor to give the treatment a better chance of working.

"We're trying to change the environment within the tumor using nanoparticles that we developed in our lab so that when the new immune cells get there, the cells are happy, and they can find the cancer cells and kill them," Adjei said. "We're giving them a fighting chance to be able to do the job you send them there to do."

One way Adjei's team is hoping to accomplish this is by changing the oxygen levels within the tumor. As cancer grows, it uses a lot of nutrients, lowering the amount of oxygen within the tumor. Once the environment is depleted of nutrients, the tumor is prompted to leave, which leads to the cancer spreading throughout the body through metastasis.

If nanoparticles — tiny devices 1,000 times smaller than a strand of human hair — can be injected into the tumor and produce oxygen, the immune system will have a better chance at destroying the tumor.

Adjei says one goal is to find ways to mimic nature

"One of my philosophies is if you take something that nature is already using, it makes it easy to translate," Adjei said. "Before you develop or design anything, you have to think about how you're going to ultimately get it into a patient."

Adjei said one of his goals is to train students with the right skills and mentality to help patients, which can have a broader impact on the health of the community.

"That is my ultimate goal: help patients and train excellent, translation-minded students who, when they go out, even if they are in industry, are going to make impacts," Adjei said.

Dr. Kathy Banks

becomes 26th president of Texas A&M University

M. Katherine Banks officially became Texas A& University's 26th president June 1 after serving for nine years as vice chancellor of engineering and national laboratories, dean of the College of Engineering and director of the Texas A&M Engineering Experiment Station.

Banks will continue serving as vice chancellor of national laboratories and national security strategic initiatives for The Texas A&M University System. Her efforts helped lead the system to secure the management contract for Los Alamos National Laboratory, as well as the creation of the George H.W. Bush Combat Development Complex at the RELLIS campus.

Described by colleagues as visionary, Banks was named in March as the sole finalist in the nationwide search for the next Texas A&M president — a move unanimously confirmed three weeks later by the Board of Regents.

A&M System Chancellor John Sharp recruited Banks to the top leadership post, citing her remarkable success with each initiative with which she's been involved, including transforming the engineering college, which in March was ranked by U.S. News & World Report as being the best graduate engineering program in Texas.

Banks — who joined a group of students for lunch on her first day, which also marked the opening day of summer classes — said she's embarking on several rounds of "crucial listening sessions" with students, faculty, staff, former students and other key stakeholders across the campus and beyond to learn different perspectives about the challenges and opportunities facing Texas A&M.

"As a result of these conversations, together, we will develop a framework for the future," Banks wrote in a message emailed today to students, faculty and staff. "I am eager to hear about your experiences, thoughts, concerns and aspirations for Aggieland as we identify key priorities for our university."

John L. Junkins, a university distinguished professor of aerospace engineering who served as interim president from Jan. 1 to May 31, said he believes Dr. Banks brings with her a "new era of optimism and advancement for Texas A&M."

The longtime national leader in higher education also established Texas A&M's Engineering Medicine (EnMed) program, which is a first-of-its-kind engineering medical school program designed to educate physician-engineers who will create transformational technology for health care.

In her recent role as vice chancellor, Banks coordinated and collaborated with the engineering, academic and research programs at seven universities throughout the Texas A&M System, as well as oversaw three state agencies, including the Texas A&M Engineering Experiment Station (TEES), Texas A&M Engineering Extension Service and Texas A&M Transportation Institute. Banks also served as TEES director, overseeing research administration, technology commercialization and technology workforce development.

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