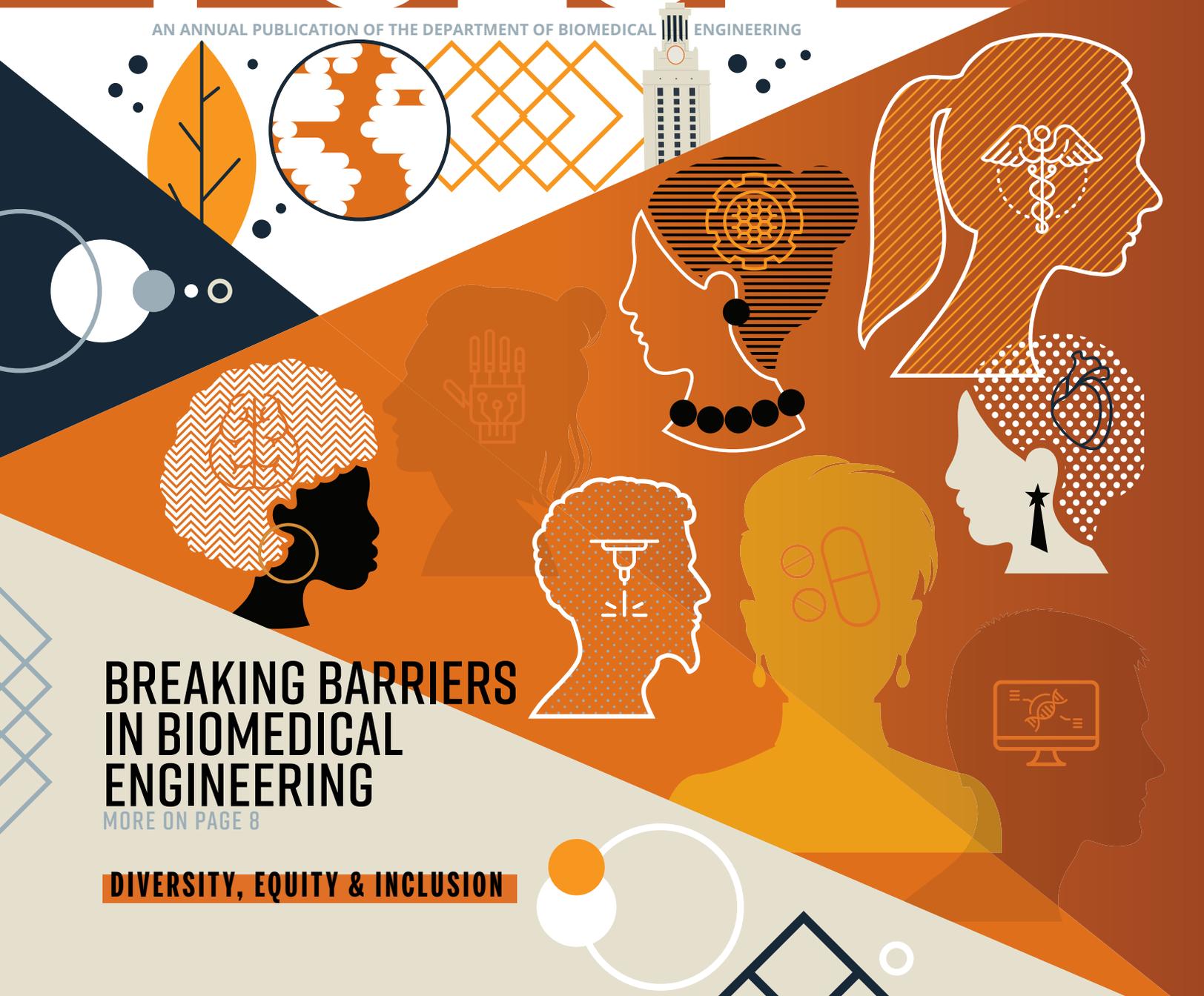




PULSE

AN ANNUAL PUBLICATION OF THE DEPARTMENT OF BIOMEDICAL ENGINEERING



BREAKING BARRIERS IN BIOMEDICAL ENGINEERING

MORE ON PAGE 8

DIVERSITY, EQUITY & INCLUSION



I'M EXTREMELY PROUD of our students, faculty, and staff for adjusting and continuing to fulfill our mission during the tumultuous year that was 2020.

Engineers are astutely positioned to solve challenges, and throughout the last academic year, we have seen that occur.

Our *U.S. News & World Report* graduate program ranking jumped up two spots to 17 and our undergraduate program continues to be highly ranked. We added Assistant Professor Evan Wang to our faculty this year, and we adapted our courses to online learning and hybrid models with success.

I encourage you to read this latest issue of *Pulse* to learn about developments and strides we are making, not only on the research front but also in the areas of climate and curriculum. Two initiatives I'm especially proud of are the formation of our Diversity, Equity, and Inclusion Committee, and our offerings of new clinical learning opportunities, both of which you can read more about in this issue.

While the 2020-2021 academic year has been unlike any we have ever seen, I'm optimistic that the character we have built will benefit us as we prepare for the future and continue educating the next generation of biomedical engineers.

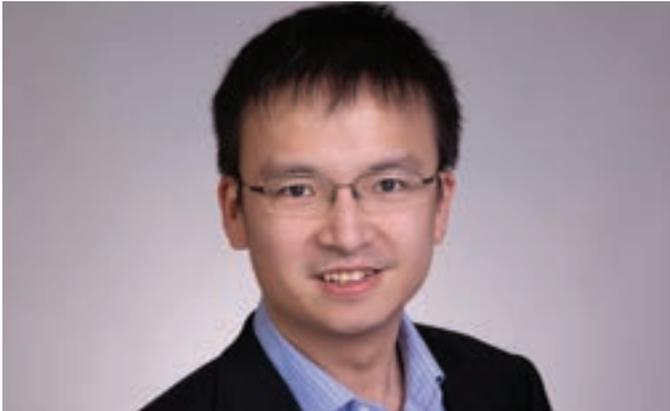
A handwritten signature in black ink, appearing to read 'Shelly Sakiyama-Elbert'.

SHELLY SAKIYAMA-ELBERT

Chair, Department of Biomedical Engineering
Fletcher Stuckey Pratt Chair in Engineering
Cockrell Family Chair for Department Leadership #1

NEW FACULTY MEMBER JOINS UT AUSTIN'S BIOMEDICAL ENGINEERS

Huiliang (Evan) Wang



HUILIANG (EVAN) WANG was welcomed to the faculty by the Department of Biomedical Engineering in January 2021.

Wang joined as an assistant professor. He was previously a postdoctoral researcher at Stanford University. His research focuses on developing new tools to modulate and record neural activity from targeted neuronal populations using minimally invasive methods. His future direction is to develop advanced neural interfacing methods for both clinical applications and neuroscience research.

Wang is the recipient of a National Institutes of Health (NIH) Ko1 Mentored Research Scientist Award and an NIH F32 National Research Service Award Postdoctoral Fellowship.

He received his Ph.D. in materials science and engineering from Stanford University and completed his undergraduate studies in materials science at Oxford University. ■

FACULTY UPDATES

Our faculty are gaining recognition for their innovative research and contributions to the field.

ASSISTANT PROFESSORS AMY BROCK AND JANET ZOLDAN

were promoted to associate professor this year.



PROFESSORS ELIZABETH COSGRIFF-HERNANDEZ AND LAURA SUGGS

were inducted as Fellows of Biomaterial Science and Engineering (FBSE) at the World Biomaterials Congress held virtually from Glasgow, Scotland, on December 11, 2020.



NICHOLAS PEPPAS received the 2020 Oesper Award from the University of Cincinnati's Chemistry Department and the Cincinnati Section of the American Chemical Society. He also was elected President-Elect of the international society of science and engineering Sigma Xi.



ASSOCIATE PROFESSOR JENNY JIANG AND PROFESSOR TYRONE PORTER

were elected to the American Institute for Medical and Biological Engineering (AIMBE) College of Fellows. ■





CREATING CONNECTIONS

“LONELINESS HAS A STIGMA AROUND IT AND PEOPLE DON’T NECESSARILY WANT TO TALK ABOUT IT. BUT IT’S A UNIVERSAL EXPERIENCE.”

*The beginning of the COVID-19 pandemic in March 2020 meant the end of normal campus life. Finishing out the 2020 spring semester and starting the next academic year online isn’t how freshman Aditi Merchant expected her college experience to go. But she also didn’t expect to co-found a startup with a fellow engineering student she met during their first week of classes because they both sat in the front row or their math class. And she certainly didn’t expect the the startup to receive a whirlwind of attention from media outlets like **The Today Show**, **The New York Times**, **Wall Street Journal** and **Houston Chronicle**.*

We interviewed Aditi Merchant (center), who, along with Allen Zhou, an electrical engineering student and Zhou's brother Anthony, a high school senior, developed Big & Mini, a web application that connects senior citizens (Bigs) with youths (Minis) to create mutually beneficial connections and combat social isolation.



How did this idea come about?

When the pandemic began Allen and I talked about how we were both in a place of privilege, and we wanted to do something that allowed us to give back in a way that complemented what we were good at.

And, on a personal level throughout high school and middle school I volunteered at an assisted living community, playing flute. I would stay and talk to residents because they all had such cool stories to share. From those experiences, I got some of the best advice I've been given in my life. One of the biggest factors in the development of Big & Mini was reflecting how big of a role those experiences played in my personal life and how big of a role interacting with older adults could potentially have in other college students' lives.

What's your role on the project?

My role is handling most of the business, non-technical aspects. Finding new organizations to work with, talking with our Bigs and Minis to find out about their experiences or how to make their experiences better. I do the writing and many of the financial tasks and take a lot of the organizations' calls. It's a lot of interactions with people that allows us to come up with new ideas.

How many users do you have?

Over 3,000 on the platform. That boils

down to a little over 1,300 matches. Some are student groups from universities asking for multiple Bigs. Others are senior citizen centers asking for multiple Minis.

What has it been like to be covered by so many media outlets?

A whirlwind to be honest. We got our first story in May after sending out a mini blurb to media outlets. The Houston Chronicle responded. The reporter wasn't sure if he wanted to cover us, but he considered it and talked to his mom, who signed up, which led to the first coverage. Months later we still talk to that reporter, and his mom is still doing Big & Mini calls.

In July we were on The Today Show. I remember one morning we got an email from NBC and we were like "wait, what?" It's been cool to see how people have resonated with the story and how sharing the power of the connections Big & Mini can create.

It's also allowed us to get to know our Bigs' and Minis' stories better because they share them through this media coverage, too.

What have you learned from this experience?

My ultimate goal is to hopefully improve the lives of others in some capacity. I feel that Big & Mini is a manifestation of

that goal. It's taught me so much about business, pitching yourself, telling a story, which I think are skills that are important universally regardless of whether it's with a startup or business or research.

How has biomedical engineering informed this project?

From a BME standpoint there's work to be done in finding out new ways to evaluate how things like loneliness or other social determinants like stress play out in physical health. Biomedical engineering could be applied in how we measure certain solutions or interventions to loneliness. One thing we are currently doing is working with a Texas BME alum, Jared Moon. He's a first-year student at Dell Medical School who introduced us to The Impact Core, which finds projects that have the potential for high impact within the community. Through this, he and DMS students are helping us with organizational recruitment and a pilot program within senior living communities where we measure more health outcomes.

What are your next steps?

We are working on an app for users on iPads and such, and we're working on making our organization platform scalable, so we can reach both older and younger adults in a quicker fashion. ■

PARTNERSHIPS IN MEDICINE—EDUCATION

This past year saw the addition of partnerships between the Department of Biomedical Engineering the Dell Medical School, The University of Texas MD Anderson Cancer Center and Austin-area hospitals to create collaborative opportunities between students, researchers, and clinicians.

CLINICAL INNOVATION DESIGN PROGRAM

The Department of Biomedical Engineering and Dell Medical School have partnered to launch robust new hands-on training experiences in the Clinical Innovation Design (CID) program, which was implemented last fall. Participants in the CID program practice design thinking and are involved in all aspects of medical device development and innovation, from needs assessment and analysis of current solutions to prototyping and business plan development.



^ CLOCKWISE FROM TOP LEFT: Kayli Kallina (DMS student), Morgan Gaither (DMS/biomedical engineering dual degree student), Hayley Meier (graduate student in biomedical engineering), and Raghav Upadhyaya (graduate student in computational science, engineering and mathematics)

The CID program pairs third-year medical students from the Dell Medical School with master's students from the Cockrell School of Engineering at UT Austin for nine months. During the first six weeks of the program sub-teams, made up of two students, observe clinical needs across a specific clinic service area. The pilot team is based in the Texas Center for Pediatric and Congenital Heart Disease located at Dell Children's Medical Center.

The two sub-teams spent approximately 500 hours observing 13 clinical areas where patients with congenital heart disease receive their care. Examples of these areas include cardiac surgery, anesthesia, perfusion, critical care unit, the catheter lab and fetal cardiology, among others.

The teams made 358 standalone observations and used a thorough assessment process, including needs acceptance criteria, team interest, stakeholder input and market analyses, to narrow down their selections and ultimately choose two clinical needs.

By the end of the spring semester, the student teams brainstormed solutions for their selected clinical need, prototyped their solution and wrote a business plan for the medical device they develop.

MAKING CLINICAL IMMERSION AVAILABLE AND EQUITABLE FOR ALL

This year the Department of Biomedical Engineering in partnership with Dell Medical School launched an Imaging Clinical Immersion course. The class is available to graduate students, but professors Mia Markey



< These students are identifying clinical challenges with Dell Medical School's Dr. Celeste Sheppard in Maternal Fetal Medicine, one of five clinical areas students can work in. L-R: Naazneen Ibteha, Orhun Davarci, Aleah Eskin, Dr. Celeste Sheppard.

and Grady Rylander, who designed the course, initiated a pilot version of the course during the spring 2021 semester to see how elements may be incorporated for all biomedical engineering students.

For one semester, teams of three to four students work with clinicians at Austin area hospitals in one of five specialty areas: diagnostic medicine, maternal fetal medicine, cardiology, surgical oncology or gastroenterology. By the end of the semester, students should have identified a clinical problem and have some initial ideas about how they may solve it. A student or student team is successful in the program if the clinical mentor decides to take action on the student's assessment, for example, by sponsoring a senior design team in the future.

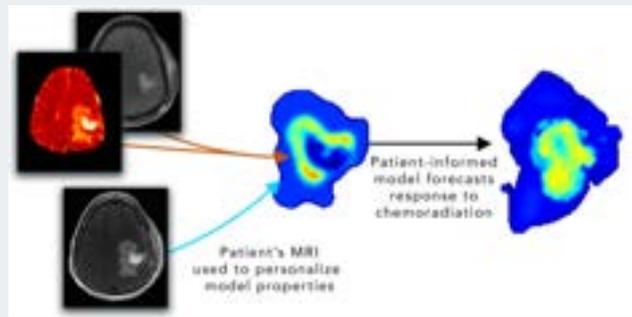
“IN SENIOR DESIGN, PROJECT SPONSORS GIVE OUR STUDENTS A PROBLEM TO SOLVE. THIS COURSE IS SIMILAR IN THAT IT FOCUSES ON DESIGN, TOO, BUT THE STUDENTS THEMSELVES ARE OBSERVING AND IDENTIFYING A PROBLEM AND SEEING HOW THEY, AS ENGINEERS, MAY CONTRIBUTE,” SAYS MIA MARKEY.

During the pilot program, a mix of undergraduate and graduate students took the course to provide data on how the course, or elements of it, could be made available for all biomedical engineering students.”

“We're looking for ways to scale our clinical opportunities available to more students, not just a select few,” says Markey. “We've collected data from this semester to find out how many hours students were in the clinic, what they were doing or who they were talking to, to assess the most valuable parts, which we then will figure out how we can include in other areas of the biomedical engineering curriculum. Our goal is to figure out how we can share the benefits that come from this clinical immersion experience with every student in BME.”

UT AUSTIN AND MD ANDERSON COLLABORATE IN UNITED FIGHT TO END CANCER

Also this year, The University of Texas MD Anderson Cancer partnered with UT Austin's Oden Institute for Computational Engineering and Sciences and



^ Sequential MRI data are used to forecast tumor response to chemo-radiation, which can then be directly compared to patient outcome. The long-term goal is to establish patient-specific mathematical models that can accurately predict response, so that interventions can be optimized for each individual patient.

Credit: David Hormuth (UT Austin), Caroline Chung (MDACC)

the Texas Advanced Computing Center (TACC) to build a strong collaboration in oncological data and computational science.

The collaboration between the three UT System institutions, based in Houston and Austin, will support the development of teams that bring together MD Anderson's oncology expertise and data with novel mechanism-based computational modeling techniques led by researchers at the Oden Institute and TACC.

The initiative builds upon ongoing collaborations between the Oden Institute's Center for Computational Oncology, led by professor of biomedical engineering Tom Yankeelov and MD Anderson's Department of Imaging Physics, led by John Hazle.

Last fall, the collaborative initiative funded its first five projects, two of which focus on projects from biomedical engineering researchers. Angela Jarrett is working with Maia Rauch from MD Anderson on developing models to forecast and develop therapies for triple-negative breast cancer, while David Hormuth is working with Caroline Chung of MD Anderson on using computational models of the underlying biology to fundamentally change how radiotherapy and chemotherapy are personalized to improve survival rates for brain cancer patients.

“These extremely exciting projects sit at the interface of cancer, mechanism-based modeling and computation, and promise to significantly advance our ability to fight this disease,” said Tom Yankeelov. “The vision and quality of these investigators are extraordinary, and one would be hard-pressed to assemble such talents anywhere else in the country. This team sets the stage for many more such collaborations between the Oden Institute, MD Anderson and TACC.” ■



BREAKING BARRIERS

IN BIOMEDICAL ENGINEERING



Promoting diversity, equity and inclusion in education are goals that are often talked about in university settings. But to communities of students, it may not always be apparent what actions academic departments take to address challenges in these areas.

In an effort to be more transparent, the BME Department formed a Diversity, Equity, and Inclusion Committee to listen to input and strategize a long-term plan to embrace differences, improve access to opportunities, and create a wider sense of belonging for students, faculty and staff.

If we expect to improve health care for all communities, we need the perspectives and voices from different communities to be present. But, what are the roadblocks to entry for students and faculty? Where are there barriers to promotion and success? These are some questions the committee intends to learn.

“We first recognize that our community does not reflect the diversity we need to achieve our mission of developing clinically translatable solutions and educating the next generation of biomedical engineers,” says professor Elizabeth Cosgriff-Hernandez, chair of the committee, which also includes other faculty members, students and staff.

“We need to remove barriers to access and make a more equitable admissions process, but we also need to foster environments where every student can thrive once they’re here,” Cosgriff-Hernandez says.

The committee plans to conduct a series of townhall meetings with various constituent groups to evalu-

ate the BME Department holistically and then present a long-term strategic plan in the fall.

“Our goals are to listen to our communities and then identify needs, prioritize them and create measurable outcomes that will allow us to track our progress,” says Cosgriff-Hernandez. “In addition to focusing on recruitment and diversifying our community, we have to look at the climate within Texas BME, ask how we’re evaluating students and faculty and ask if those methods are equitable.”

Examples of changes the committee may suggest or has already worked on include: implementing a holistic graduate program admissions process; efforts to address inequities in mentoring during application preparation; and removing the burden of the GRE for differing student populations. Many graduate programs, including Texas BME, have recently waived the GRE requirement, as there are other, more informative measures of evaluating student applicants. Another area committee members are investigating is including recognition of diversity initiatives as part of faculty tenure and promotion.

“Ultimately we want to make sure we are meeting the needs of the community, which is why we are first holding these townhalls to get input from constituents to find out the challenges from each of our communities,” Cosgriff-Hernandez says.

Part of that transparency has involved making resources more available on the BME website and through the creation of a website for Graduate Students for Underrepresented Minorities (GUM), a student group whose goal is to help build communities across the Cockrell School of Engineering. The committee received funding through a seed grant for Actions that Promote Community Transformation from the UT Office of the Executive Vice President and Provost as part of one of the university’s wider efforts. ■

**YOU
BELONG
HERE**

FOR MORE INFORMATION
bit.ly/bme-diversity-equity-and-inclusion



FACULTY EFFORTS

Professor Elizabeth Cosgriff-Hernandez and **Department Chair Shelly Sakiyama-Elbert** are members of BME Unite, a national network of women deans, chairs and distinguished faculty in biomedical engineering. Earlier this year, this group called upon the National Institutes of Health (NIH) and other major funding agencies to address disparities in allocating support for Black researchers in an open letter published in *Cell*.

Cosgriff-Hernandez was also recently elected to the American Institute for Medical and Biological Engineering Board of Directors as Council of Societies Chair. In this role, she will coordinate similar diversity efforts across professional societies.

Professor Tyrone Porter, the BME Department's first Black professor, participated in virtual events, one hosted by the University of Washington. The event called "Experiences of Black STEM in the Ivory: A Call to Disruptive Action," inspired and challenged participants to take action to address racial inequalities in STEM. Dean Sharon Wood also spoke at the event. Porter also gave a talk titled "Cultural Tax: The Cost of Being the Only or the Few," this year through the Gladstone Institutes' series Amplified: Race and Reality in STEM.

Professors Mia Markey and **Tyrone Porter** serve as Minority Affairs Representative and DEI Representative, respectively. In these roles, both work on diversity efforts within the larger Cockrell School and university communities.

"WE KNOW STEM IS DOMINATED BY MAJORITIES. BEFORE I CAME TO GRADUATE SCHOOL I WORKED IN INDUSTRY AND SAW THE SAME THING. GUM AND THE DEI COMMITTEE ARE GOOD EFFORTS TO BUILD REPRESENTATION IN STEM AND HELP FOSTER ENTRY OF NEW STUDENTS."

—Andrew Robinson, GUM Founding Officer

DIVERSITY, EQUITY & INCLUSION FROM A STUDENT'S PERSPECTIVE



DESTINY HARRIS is an undergraduate representative who serves as a peer coach with the Women in Engineering Program and is finance chair with the UT chapter of the National Society of Black Engineers (NSBE). "100 percent don't know what I'd be doing in college without WEP or NSBE. My closest friends are in these groups. I get advice and learn about resources I may need. These are the groups that gave me the warmest welcome at UT Austin." One reason why Destiny is on the DEI committee is to encourage work that helps future BME students feel a similar sense of community.



JAZ MITCHELL is an undergraduate student representative and has been a member of UT's chapter of the National Society of Black Engineers (NSBE) since her first day on campus. NSBE's mission is to increase the number of culturally responsible Black engineers who excel academically, succeed professionally, and positively impact the community. "We have study nights together, create opportunities for professional development, host resume workshops, and do community service." She currently serves as the organization's secretary and oversees NSBE's communication efforts.



ANDREW ROBINSON is a founding officer and current treasurer of Graduate Students for Underrepresented Minorities (GUM), an organization that strives to build communities for minorities across the Cockrell School of Engineering. He serves as the graduate student representative for the Texas BME DEI Committee. ■

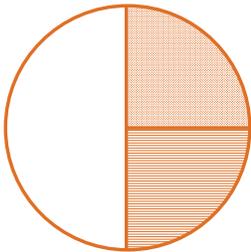
TEXAS BIOMEDICAL ENGINEERING IN 2020

STUDENTS

UNDERGRADUATE



137 bachelor's degrees awarded in 2019



50% of graduates secure industry jobs

25% pursue medical degrees

25% pursue graduate degrees

553 enrolled undergraduate students

1440 average SAT score of admitted students

50% participate in internship programs

74% participate in research groups or labs

31% participate in study abroad programs

AFTER GRADUATION

\$72,090 average starting salary

GRADUATE

107 enrolled Master's students

7 enrolled Doctoral students

3.78 average GPA of admitted students

8 National Science Foundation fellows

24 Master's degrees awarded in 2020

16 Doctoral degrees awarded in 2020

100% of Ph.D. students receive full funding

10% receive an external fellowship

OUR B.S. GRADUATES ARE ACCEPTED TO TOP SCHOOLS, INCLUDING

- Georgia Tech
- Rice
- University of Michigan
- Northwestern
- UC Berkeley

among many other universities.

ALUMNI

1,817

biomedical engineering alumni around the world



OUR GRADUATES FIND POSITIONS AT TOP COMPANIES, INCLUDING:

- Epic
- Merck
- GE Healthcare
- Stryker
- Amazon
- Proctor & Gamble

among many other organizations.

RESEARCH



\$12.9M
in research expenditures

AREAS

Biomedical Imaging and Instrumentation

Cellular and Biomolecular Engineering

Computational Biomedical Engineering

Cellular, Tissue and Molecular Biomechanics

CENTERS

James T. Willerson Center for Cardiovascular Modeling and Simulation

Center for Computational Oncology

Center for Emerging Imaging Technologies

Institute for Biomaterials, Drug Delivery and Regenerative Medicine

PAPERS AND PATENTS

191 research papers and publications in 2020

42 patents filed in 2020

FUNDING

\$12.9 million in research expenditures in 2020

FUNDING SOURCES

National Science Foundation

National Institutes of Health

U.S. Department of Defense

University fellowships

Diversity fellowships

FACULTY

26 core faculty

20 endowed faculty positions

19 affiliated faculty around the world

AWARDS

6 National Science Foundation CAREER Award recipients

17 American Institute for Medical and Biological Engineering fellows

4 American Association for the Advancement of Science fellows

4 National Academy of Inventors fellows

2 National Academy of Engineering members

2 National Academy of Medicine members

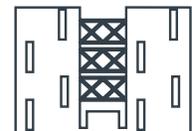
1 American Academy of Arts and Sciences member

FACILITIES



Biomedical Engineering Building

- 106,000 square feet
- LEED Silver certification
- Opened doors in 2008



Engineering Education and Research Center

- 430,000 square feet
- Multidisciplinary research labs
- Student project center
- Opened doors in 2017

RESEARCH ON THE RISE

MANUEL RAUSCH



Rausch received an NSF Faculty Early Career Development Program (CAREER) award. He was awarded for his proposal, *Toward a Fundamental Understanding of Why Thrombus Dissolves, Persists, or Breaks Off*.

JEANNE STACHOWIAK



Stachowiak received a five-year R35 grant from the National Institutes of Health to research protein networks as synergistic drivers of cellular membrane remodeling.

AMY BROCK



Brock received a five-year U01 grant from the National Cancer Institute with a goal of quantifying the dynamics of drug resistance from experimental data and integrating that information into mathematical models that can predict patient-specific treatments and schedules.

BO ZHAO



Zhao received approval for his NIH Pathway to Independence R00 Award. The award will provide \$750,000 over the course of three years for Zhao to continue his research project, *Optimized Magnetic Resonance Fingerprinting for Rapid Volumetric Quantitative Neuroimaging*.

STUDENT NEWS



^ **Loop Medical Innovations** has designed a smart spirometer that can be used at home as a telehealth option for measuring lung function.

Five biomedical engineering seniors designed a telehealth solution for lung function testing that is normally used during in-person office visits. Team members **Ajay Thatte, Abhishek Dasgupta, Eshan Sayani, Ronit Kar and Juan Villacres Perez** comprise the team called Loop Medical Innovations. Loop Medical Innovations is working on prototyping a minimum viable product and raising funds to launch pilot testing. They have been selected for a 2021 Blackstone Launchpad Fellowship, which will connect them with mentors and provide them with a \$5,000 grant. They also took 4th place at the DisrupTexas Undergraduate Pitch Competition.



Yin-Jui (Derek) Chang, a graduate student working with assistant professor Samantha Santacruz, received a Brain Computer Interface Society Student Award, a Government Scholarship to Study Abroad from the Ministry of Education for Taiwan and a 2020 Trainee Professional Development Award from the Society for Neuroscience. Chang works on neural recording research.

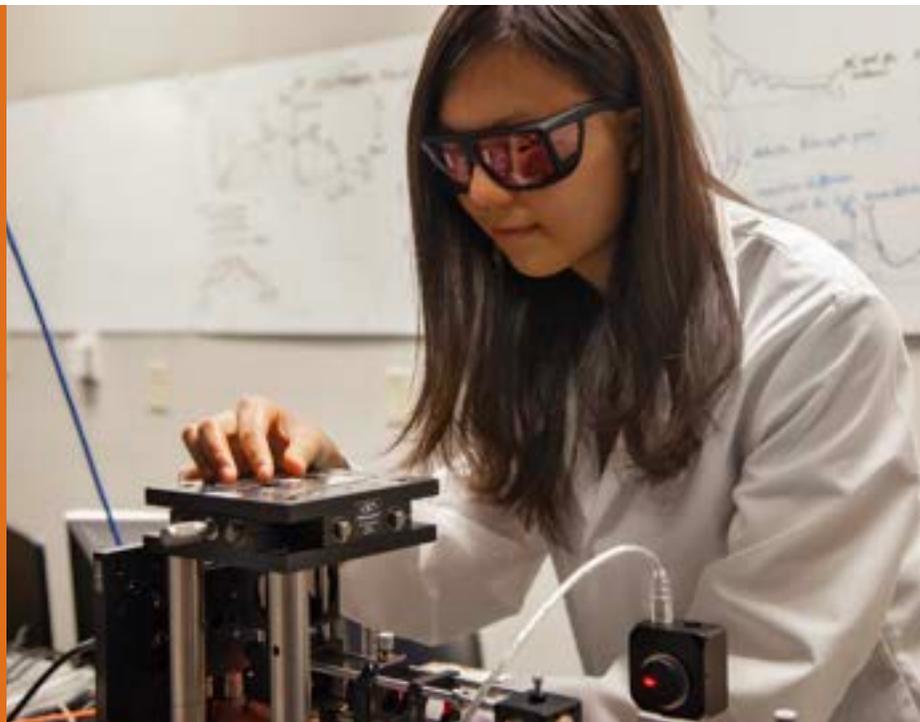
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RETURN SERVICE REQUESTED

#GRExit

Texas BME is now a member of team **#GRExit!**
We are now permanently waiving the GRE for
graduate admissions in biomedical engineering
at UT Austin. This change aligns with our holistic
admissions process.



STAY CONNECTED @UTBIOMEDICAL

Make a Gift to the Department of Biomedical Engineering
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