



ERIK JONSSON SCHOOL OF ENGINEERING AND COMPUTER SCIENCE

BIOENGINEERING

2020 ANNUAL REPORT

THE UNIVERSITY OF TEXAS AT DALLAS







Human-Centered Engineering for Unprecedented Times

The 2019-2020 academic year brought unique challenges on a global scale. During most of the year, research, instruction and operations continued as usual with innovative research and discoveries as engaged students worked together in classrooms and labs. Suddenly, along with the rest of the world, we adapted to the “new normal” brought about by the COVID-19 pandemic.

The Department of Bioengineering at The University of Texas at Dallas proved to be agile and responsive, quickly transitioning to remote operations while maintaining a high quality student learning experience. Faculty expanded research to include areas relevant to the COVID-19 crisis.

As we continue to move through the uncharted waters of COVID-19, the faculty, staff, and students in the Department of Bioengineering at UT Dallas remain even more committed to engaging in globally relevant work, improving lives and training tomorrow’s biomedical engineers to take on the next challenges. Join us, virtually or in person, during the 2020-2021 academic year as we celebrate 10 years as a department!

Sincerely,

A handwritten signature in black ink that reads "Shalini Prasad". The signature is stylized and fluid.

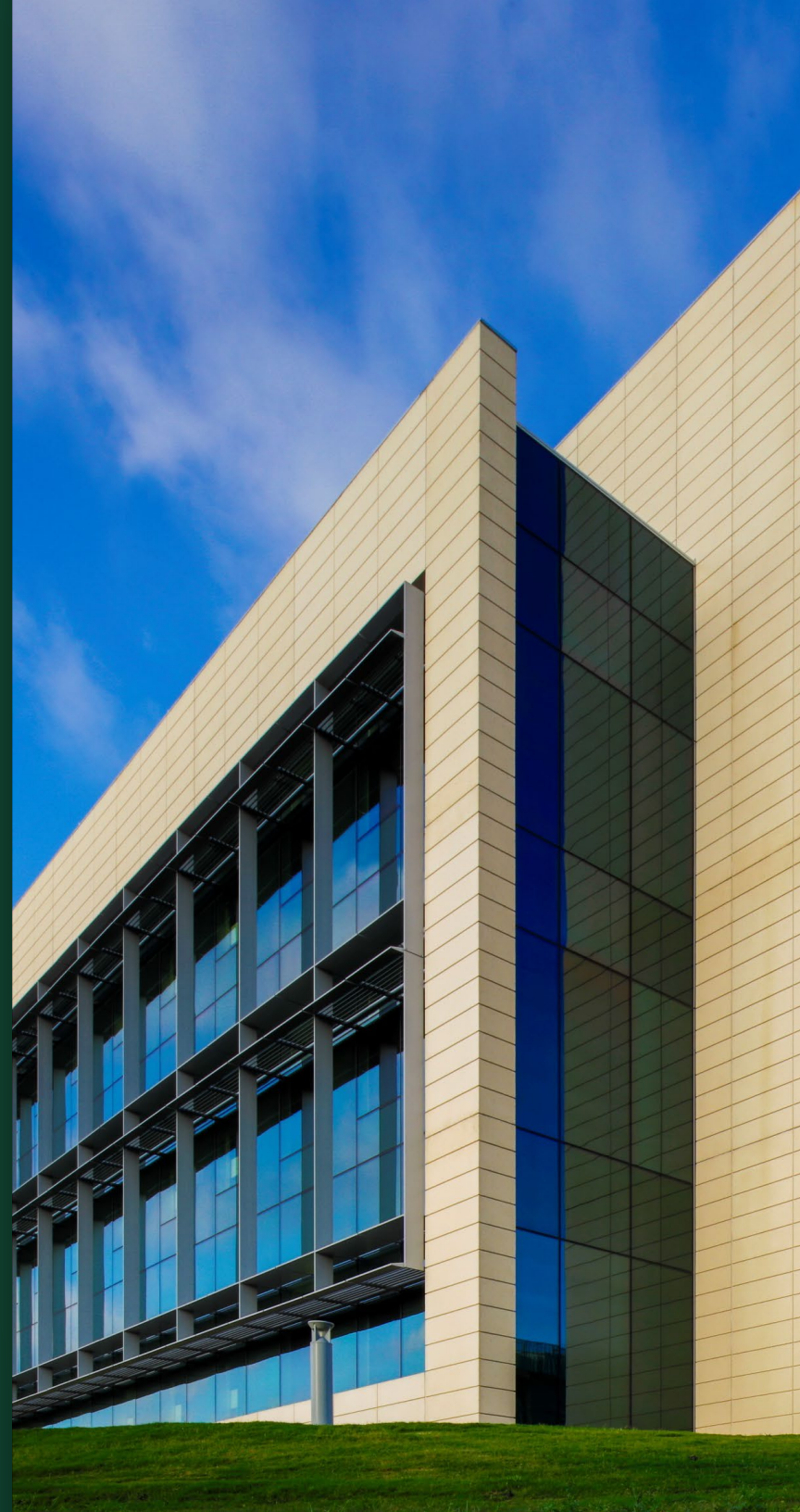
Dr. Shalini Prasad

Head of the Department of Bioengineering
Cecil H. and Ida Green Professor of Systems Biology Science

2020 BIOENGINEERING ANNUAL REPORT
ERIK JONSSON SCHOOL OF ENGINEERING AND COMPUTER SCIENCE

OVERVIEW

THE UNIVERSITY OF TEXAS AT DALLAS





HUMAN-CENTERED ENGINEERING

Welcome to the Department of Bioengineering
in the Erik Jonsson School of Engineering and
Computer Science at UT Dallas.

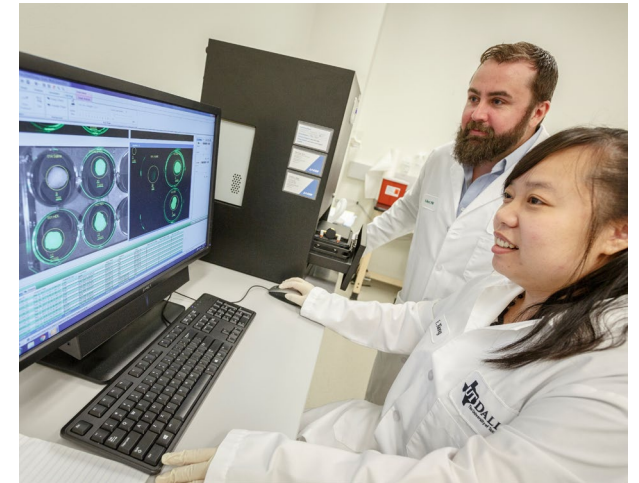


B I O E N G I N E E R I N G

AT THE UNIVERSITY OF TEXAS AT DALLAS

This year, we celebrate 10 years since the department's founding and mark the department's rapid progress.

Over the past half century, we have seen computer technology advance at a rapid speed. One of the greatest challenges of this new century is the development of highly technical solutions to medical conditions. The Department of Bioengineering at UT Dallas, one of the fastest growing programs at the University, is well-positioned to create the next generation of engineers proficient at working with both advanced electronics and biological tissue. Biomedical engineering integrates engineering problem solving with medicine and biology.



Students who choose this exciting and challenging major will go on to engineer and innovate medical solutions that will reduce health care costs, improve human health and increase the quality of life for all humankind. The interdisciplinary, hands-on approach to biomedical engineering combines expertise in electrical, mechanical and materials engineering, coupled with the life sciences.

The graduate program grants degrees in biomedical engineering and offers students collaboration opportunities with UT Southwestern Medical Center.



WELCOME DR. GIRGIS OBAID

The Department of Bioengineering is pleased to introduce our newest faculty member, Dr. Girgis Obaid. Obaid's research interests include photo-dynamic therapy and image-guided delivery.

Obaid is a member of the International Photodynamic Association (IPA), the International Society for Optics and Photonics (SPIE) and the American Society of Photobiology (ASP), as well as several additional societies. Previously, Obaid served at Massachusetts General Hospital and Harvard Medical School.

Obaid's research is supported by a National Institutes of Health (NIH) National Cancer Institute (NCI) K99/R00 award and focuses on nanomedicine, molecular imaging and light-activated cancer therapy.

EDUCATION

BS in Biochemistry, University of East Anglia, Norwich, England

PhD in Chemistry, University of East Anglia, Norwich, England

Postdoctoral Fellow and Instructor, Massachusetts General Hospital and Harvard Medical School

RESEARCH INTERESTS

Molecular targeted nanotherapeutics

Molecular imaging

Precision medicine

Optically activatable cancer therapeutics

Photonicly active nanomaterials

Cancers of the head and neck

FACULTY RECOGNITION

Our faculty have been recognized both nationally and internationally by their peers as well as by their colleagues at The University of Texas at Dallas. They excel both in the laboratory and the classroom, as top researchers and dedicated educators.

**Fellows of the American
Institute for Medical and
Biological Engineering (AIMBE)**

Dr. Stuart Cogan

Dr. Baowei Fei

Dr. Joseph Pancrazio

Dr. Jie Zheng

**Fellow of the Society for Lab
Automation and Screening (SLAS)**

Dr. Shalini Prasad

**Senior Member of the
Institute of Electrical and
Electronics Engineers (IEEE)**

Dr. Orlando Auciello

Dr. Kenneth Hoyt

**UT Dallas President's
Teaching Excellence Award in
Undergraduate Education**

Dr. Danieli Rodrigues

**Finalist nominee for the Regents'
Outstanding Teaching Award
(University of Texas System)**

Dr. Danieli Rodrigues

**Fellow of the American Institute
of Ultrasound in Medicine (AIUM)**

Dr. Kenneth Hoyt

**Early Investigator Award at the
2019 International Photodynamic
Association World Congress**

Dr. Girgis Obaid

FACULTY





FACULTY

The Department of Bioengineering has attracted highly qualified faculty including the University's own Vice President for Research, Dr. Joseph Pancrazio, and Dr. Shalini Prasad, head of the Department of Bioengineering, who leads a robust, comprehensive research laboratory with collaborations across the University. Several faculty members have received endowed chairs and other awards in honor of their accomplishments.

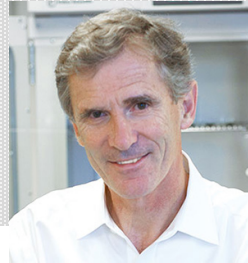
TENURE-SYSTEM FACULTY



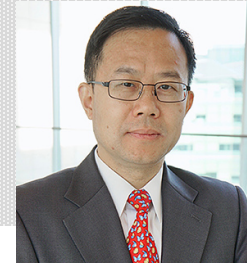
Orlando Auciello
Professor
Distinguished Chair
in Engineering



Leonidas Bleris
Associate Professor
Fellow,
Cecil H. and Ida Green Professor
in Systems Biology Science



Stuart Cogan
Professor



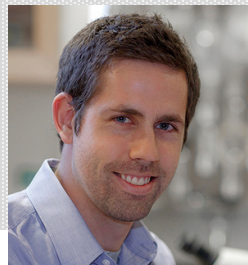
Baowei Fei
Professor
Cecil H. and Ida Green Chair
in Systems Biology Science



Nicholas Fey
Assistant Professor



Heather Hayenga
Assistant Professor



Seth Hays
Assistant Professor
Fellow,
Eugene McDermott Professor



Kenneth Hoyt
Associate Professor



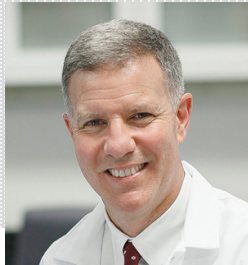
Stephen Levene
Professor

TENURE-SYSTEM FACULTY

CONTINUED



Girgis Obaid
Assistant Professor



Joseph Pancrazio
Vice President for Research
Professor



Shalini Prasad
Department Head
for Bioengineering
Professor

Cecil H. and Ida Green Professor
in Systems Biology Science



Danieli Rodrigues
Associate Professor



David Schmidtke
Professor



Shashank Sirsi
Assistant Professor



Mihaela Stefan
Professor
Eugene McDermott Professor



Victor Varner
Assistant Professor



Taylor Ware
Assistant Professor

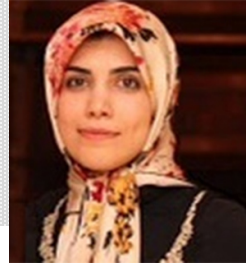
TEACHING FACULTY



Tariq Ali
Senior Lecturer I



Fang Bian
Research Scientist



**Soudeh Ardestani
Khoubrouy**
Senior Lecturer I



Clark Meyer
Senior Lecturer II



Katie Myers
Senior Lecturer I



Joe Pacheco
Senior Lecturer II



Todd Polk
Senior Lecturer II
UTDesign® Capstone
Director for Bioengineering



Ben Porter
Senior Lecturer I



Patrick Winter
Senior Lecturer I

AFFILIATED FACULTY

Poras Balsara

Professor, Electrical and Computer Engineering

Dinesh Bhatia

Professor, Electrical and Computer Engineering

Carlos Busso

Associate Professor, Electrical and
Computer Engineering

Xianming Simon Dai

Assistant Professor, Mechanical Engineering

Crystal Engineer

Research Assistant Professor,
Texas Biomedical Device Center (TxBDC)

Jeremiah Gassensmith

Assistant Professor, Chemistry

John Hart, Jr.

Professor, Behavioral and Brain Sciences

Fatemeh Hassanipour

Associate Professor, Mechanical Engineering

Mahadevan Iyer

Research Professor, Electrical and
Computer Engineering

Michael Kilgard

Professor, Behavioral and Brain Sciences

David Lary

Associate Professor, Physics;
William B. Hanson Center for Space Science

Yi Li

Postdoctoral Research Associate

Ann Majewicz Fey

Assistant Professor, Mechanical Engineering

Faruck Marcos

Assistant Professor, Biological Sciences

Issa Panahi

Professor, Electrical and Computer Engineering

Balakrishnan Prabhakaran

Professor, Computer Science

Zhenpeng Qin

Assistant Professor, Mechanical Engineering

Robert Rennaker

Professor, Behavioral and Brain Sciences

Jie Zheng

Professor, Systems Biology;
Chemistry and Biochemistry

ADJUNCT FACULTY

Yasin Dhaher

Professor, Bioengineering,
UT Southwestern Medical Center

Ibrahim Hashim

Professor, Department of Pathology,
UT Southwestern Medical Center

Anke Henning

Director, Advanced Imaging Research Center,
Professor, Bioengineering,
UT Southwestern Medical Center

Lan Ma

Lecturer, Fischell Department of Bioengineering,
University of Maryland

Vinay Nagaraj

Medical Science Liaison, AngioDynamics

Hyun-Joo Nam

Consultant, RES Group Inc.

Alexander Pertsemliadis

Associate Professor, Department of Pediatrics,
UT Health San Antonio – Greehey Children's
Cancer Institute

Matthew Petroll

Chair, Graduate Program in Biomedical Engineering,
Professor, Bioengineering
UT Southwestern Medical Center

Jennifer Seifert

Director, Research and Development,
TissueGen, Inc.

Jay Shah

Assistant Professor, Department of
Orthopaedic Surgery, Sports Medicine Service,
UT Southwestern Medical Center

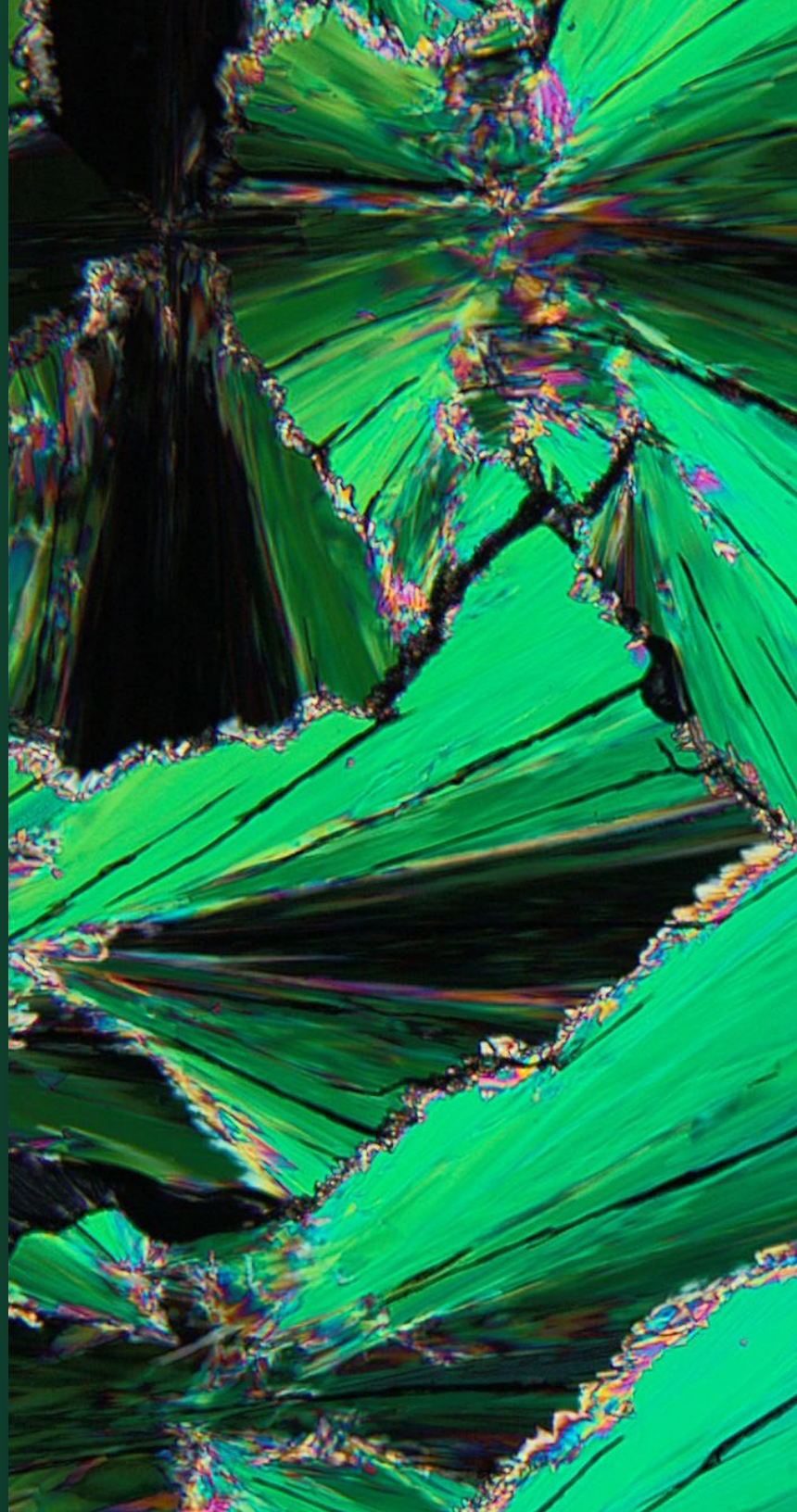
Tre Welch

Assistant Professor, Cardio Thoracic Surgery,
UT Southwestern Medical Center

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RESEARCH

THE UNIVERSITY OF TEXAS AT DALLAS

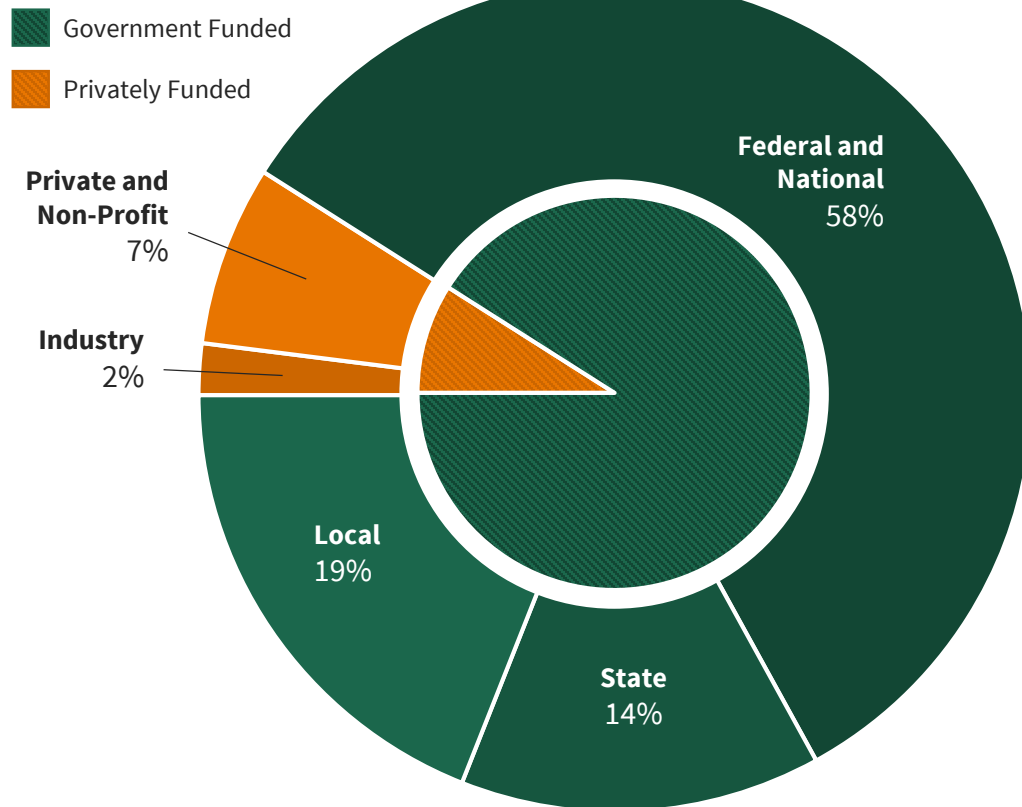


RESEARCH

Interdisciplinary research, especially in clinical settings, is at the core of human-centered engineering. The department has cultivated research partnerships with organizations including UT Southwestern Medical Center (UTSW) and hospitals including the Dallas VA Medical Center. With research opportunities for undergraduate through PhD students, the program is preparing the next generation of researchers as well as future physicians who will be well-versed in emergent technologies for health care.

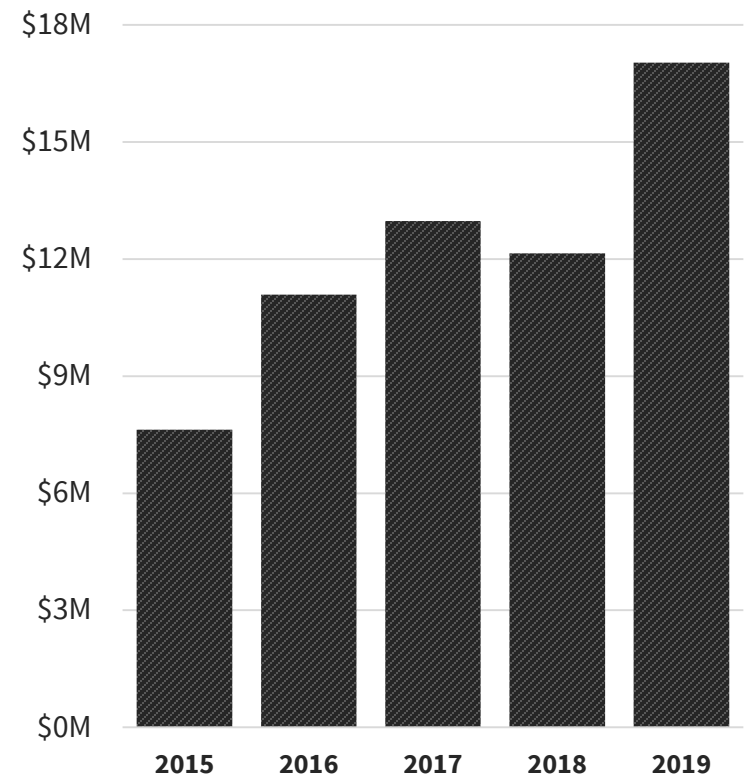
RESEARCH FINANCIALS

FUNDING SOURCES 2019



EXPENDITURES

BY FISCAL YEAR



UT SOUTHWESTERN MEDICAL CENTER COLLABORATIONS

Faculty and students in the Department of Bioengineering at UT Dallas collaborate with UTSW researchers and clinicians to bring groundbreaking discoveries into practice.

UT Dallas welcomed two new doctoral students conducting research with **Dr. Yasin Dhafer**, professor in the Departments of Physical Medicine and Rehabilitation and Orthopaedic Surgery at UTSW. Additionally, during the spring 2020 semester, six UT Dallas bioengineering undergraduate students conducted research in UTSW labs with **Dr. Matthew Petroll**, **Dr. Elena Vinogradov** and **Dr. Yasin Dhafer**.



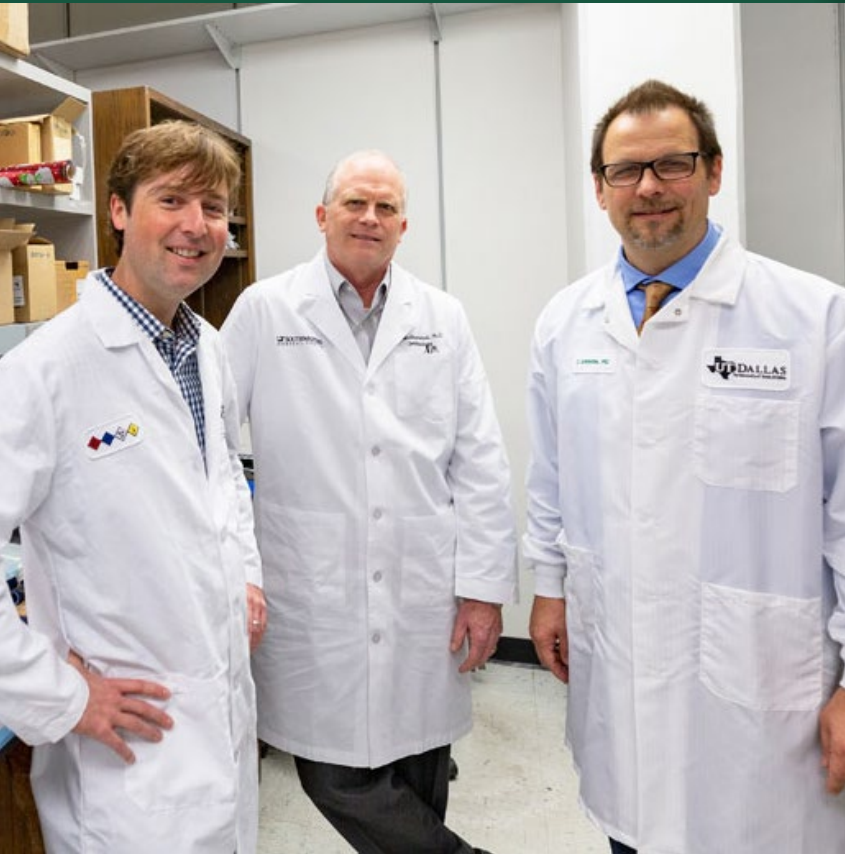
RESEARCH AREAS

Dr. Victor Varner and **Dr. David Schmidtke** worked with UTSW faculty on three different projects:

They investigated corneal keratocyte healing following injury to the eye with **Dr. Matthew Petroll**, professor in the Department of Ophthalmology at UTSW. This research is funded by a \$1.8M grant from the National Institutes of Health. UT Dallas students **Kevin Lam** and **Tarik Shihabeddin** are currently working on this project.

They are studying the role of spatial protein presentation in kidney epithelial cell tubule formation. Members of the Center for Regenerative Science and Medicine at UTSW including **Dr. Thomas Carroll**, **Dr. Denise Marciano** and **Dr. Ondine Cleaver** as well as UT Dallas students **Tarik Shihabeddin** and **Gauri Renake** contributed to this project.

They studied muscle cell responsiveness to overactive bladder medications with **Dr. Philippe Zimmern** from the Department of Urology.



Left to right: Dr. Victor Varner, Dr. Matthew Petroll and Dr. David Schmidtke

RESEARCH AREAS

Dr. David Schmidtke is working with UTSW faculty on three additional projects:

Development of novel microfluidic devices for intracellular protein delivery with **Dr. Nikhil Munshi**, associate professor in the Department of Internal Medicine. UT Dallas student **Chaitra Telang** works on this project.

Regulation of host inflammation by NADPH oxidase 2 signaling with **Dr. Jessica Moreland**, professor in the Department of Pediatrics.

Effect of high shear on neutrophil function in VAD patients with **Dr. Matthias Peltz**, associate professor in the Department of Cardiovascular and Thoracic Surgery.



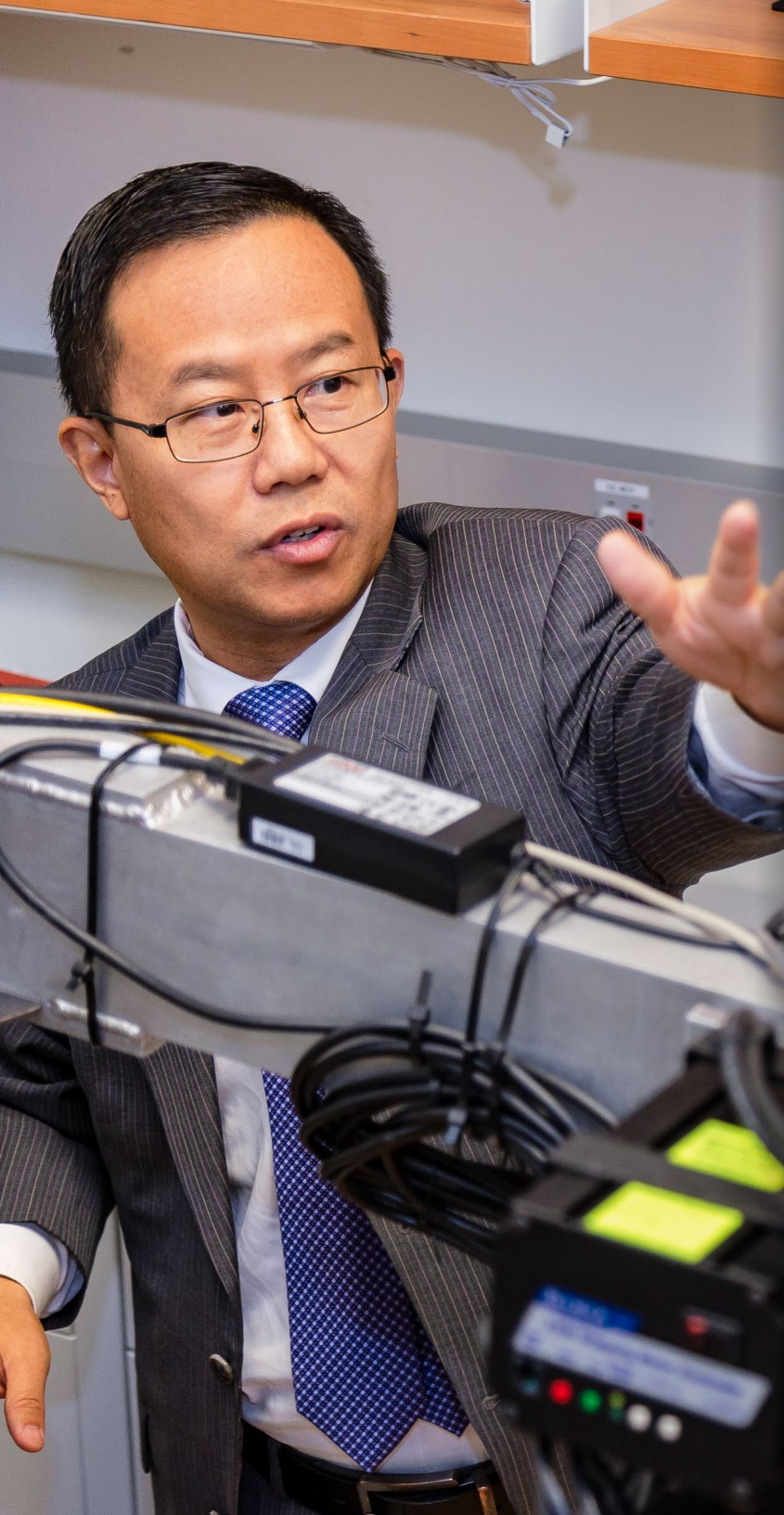
Dr. David Schmidtke displays a microfluidic device used to fabricate tiny strands of collagen called fibrils to advance his team's research on the eye's repair process.

RESEARCH AREAS

Dr. Baowei Fei is working with **Dr. Ivan Pedrosa**, professor in the Department of Radiology at UTSW, to develop machine learning and radiomics techniques to assess the aggressiveness of renal cell carcinoma and to predict therapeutic response.

Funded through a Cancer Prevention and Research Institute of Texas (CPRIT) grant, Fei also collaborates with **Dr. Baran Sumer** and **Dr. Larry Myers** to develop a smart surgical microscope for rapid cancer detection during surgery. The device combines hyperspectral imaging with artificial intelligence.

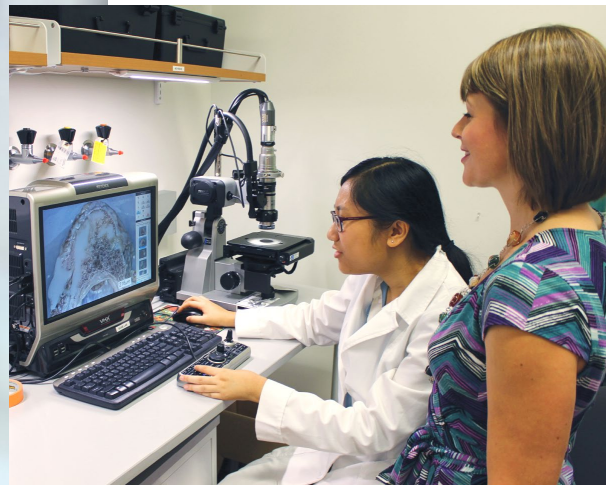
Dr. Girgis Obaid initiated a research collaboration with **Dr. Debabrata Saha**, associate professor in the Department of Radiation Oncology, to establish the radiation dose dependence of excited photo-activable nanoparticles for cancer therapy. The dose parameters will then be used to compare photodynamic therapy and radiotherapy using bioengineered tumor-specific nanoparticles in vitro and in animal models of head and neck cancer. UT Dallas undergraduate student **Mina Guirguis** is gaining research experience through work on this project.



RESEARCH AREAS

Dr. Danieli Rodrigues, associate professor, collaborated with **Dr. Javier LaFontaine**, professor in the Department of Plastic Surgery, and **Dr. George Tye Liu**, associate professor in the Department of Orthopedic Surgery, to develop innovative orthopedic implant surface approaches to induce healing in diabetic patients. UT Dallas students **Alexandra Arteaga**, **Lidia Guida**, and **Jiayi Qu** are working on this project.

Dr. Heather Hayenga, assistant professor, collaborated with **Dr. Kimberly Kho**, in gynecology, to develop a permanent intrafallopian tube contraceptive device. UT Dallas student **Lucero Ramirez** is working on this project.



STUDENTS



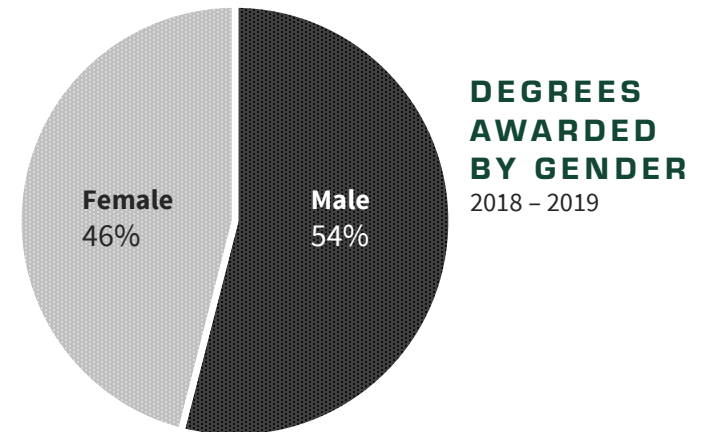
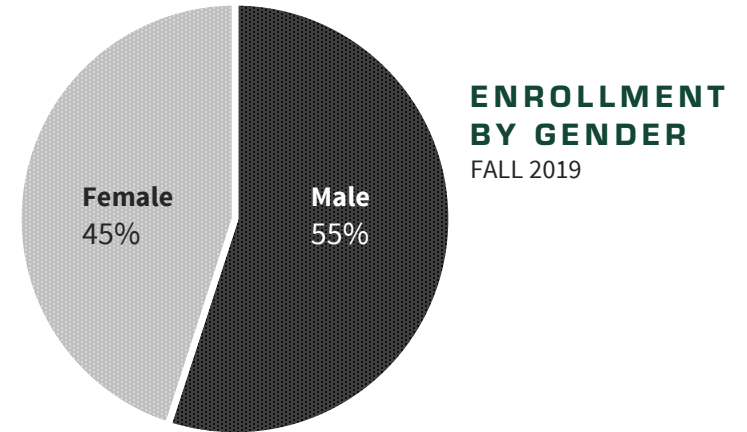
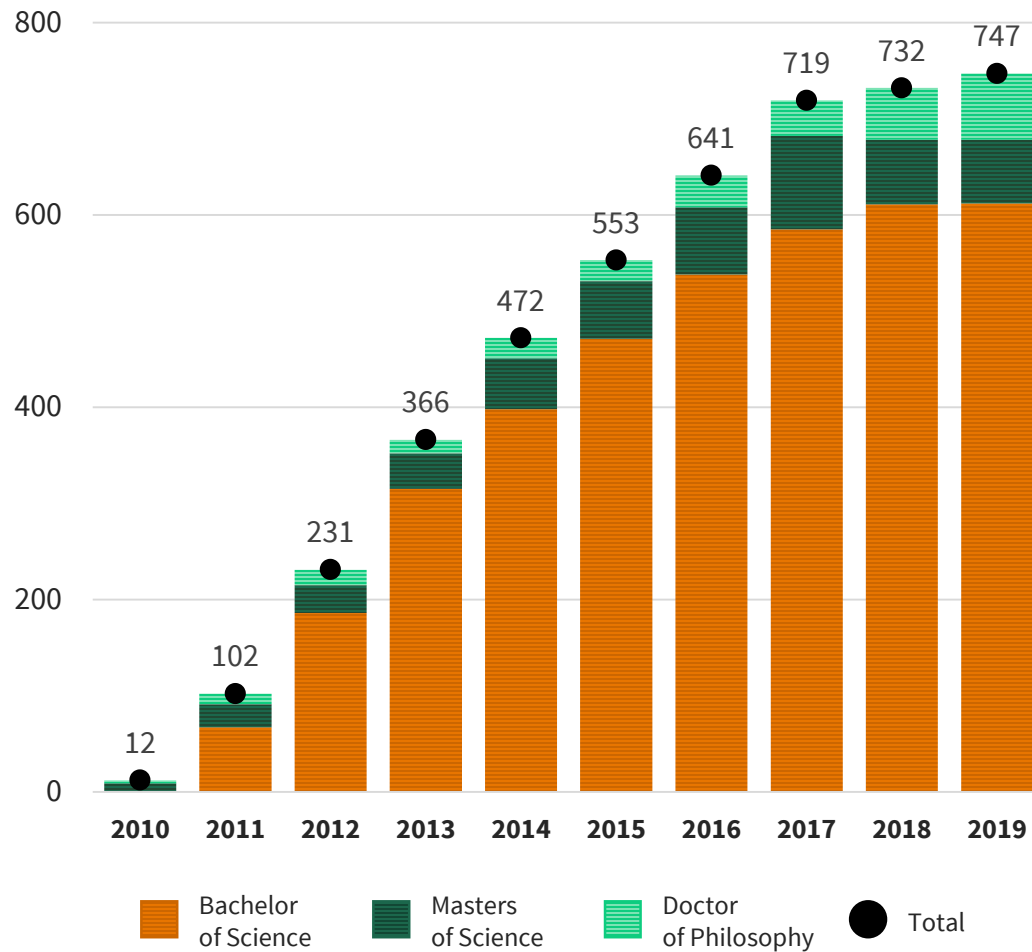
STUDENTS

Bioengineering students have unique opportunities to excel in research, as well as participate in the Jonsson School's signature UDesign® Capstone program where they put their expertise to work toward solving real-world problems.



ENROLLMENT AND DEGREES

HISTORICAL ENROLLMENT



BIOENGINEERING STUDENT AWARDS

Students have received significant awards in the past year, including nationally prestigious fellowships. As the program has grown exponentially over the years, it has attracted students who are serious about gaining the mentorship and research opportunities needed to excel in their fields.



STUDENT AWARDS

Graduate and Alumni

Excellence in Education Doctoral Fellowship

to **Kaitlin Rabe** (PI: Dr. Nicholas Fey), Winner

*Erik Jonsson School of Engineering and Computer Science,
UT Dallas, Dallas, TX*

The Rehab Week Award

to **Hassan Jahanandish** (PI: Dr. Nicholas Fey),
Finalist

*IEEE/RAS-EMBS International Conference on Rehabilitation Robotics
(ICORR) and RehabWeek, Toronto, CA*

Three Minute Thesis (3MT) Competition

Kara Peak (PI: Dr. Victor Varner)

Excellence in Education Doctoral Fellowship

to **Emily Levy** (PI: Dr. Nicholas Fey), Winner

*Erik Jonsson School of Engineering and Computer Science,
UT Dallas, Dallas, TX*

National Defense Science and Engineering Graduate (NDSEG) Fellowship Program

to **Jacob Boehm** (PI: Dr. Nicholas Fey), Finalist

U.S. Department of Defense, Washington, DC

National Science Foundation Graduate Research Fellowship

Danny Lam '18

PhD student at Case Western Reserve University

STUDENT AWARDS

Undergraduate

Bioengineering Departmental Undergraduate Research Competition

1st : Joel Epperson

*Use of Retrieval Tasks to Rehabilitate
Sensorimotor Impairments Due to Brain Injury*

PI: Dr. Nicholas Fey

2nd : Alikhan Fidai

*A Failure Mechanism Analysis of Zirconia
Dental Implant Systems*

PI: Dr. Danieli Rodrigues

3rd : Jeremy Warren

*Atrial Septal Defect Generation for
Modeling with Finite Elements*

PI: Dr. Clark Meyer (Dr. Heather Hayenga Lab)

4th : Smriti Natarajan

*Late-colonizing Bacterial Adhesion on
Surface-treated Titanium vs Zirconia*

PI: Dr. Danieli Rodrigues

IEEE Region 5 Outstanding Student Member Award

MD Fiaz Islam Bhuiyan

PI: Dr. Baowei Fei

Intuitive Best Student Paper Award at the International Conference of SPIE Medical Imaging

Matthew Pfefferle

PI: Dr. Baowei Fei

National Science Foundation Graduate Research Fellowship

Honorable Mention

Benjamin Allsup

STUDENT ORGANIZATIONS



Alpha Eta Mu Beta (AEMB)

The organization was established, and officers were selected, in late fall 2019. Membership opened in early spring 2020 and began meeting spring 2020.

President: Emma Henderson

Vice President: Megan Zachariah

Secretary: Alikhan Fidai

Treasurer: Han Lai

Faculty Mentor: Shashank Sirsi



Biomedical Engineering Society (BMES)

President: Benjamin Allsup

Vice-President: Emma Henderson

Secretary: Sruthi Dubagunta

Treasurer: Ashleigh Abusomwan

STUDENT ORGANIZATIONS

CONTINUED



Bioengineering Graduate Student Association

In the first year of operation, the BMEN Graduate Student Association hosted several workshops, seminars, socials, and other events for Bioengineering MS and PhD students. New students were welcomed at the beginning of each semester with departmental socials; including a scavenger hunt and bingo competition. Bioengineering labs participated in pie making and pumpkin carving contests during the fall semester, and students attended a holiday party with cookie decorating for some end-of-semester relaxation. The BMEN GSA organized practice sessions for qualifying exams, where PhD students could present their research plan and get feedback from their peers. The group also hosted speakers from Abbott Neuromodulation and several UT Dallas offices who discussed industry and academic careers while providing resources for career development and skill-building.

Officers 2019-2020

President: Rebecca Frederick

Vice President: Sayali Upasham

Treasurer: Aditi Bellary

Historian: Joshua Usoro

Public Relations Chair: Lucero Ramirez

Alumni Outreach Chair: Muskan Pawar

UTDESIGN® CAPSTONE

The UTDesign® Capstone program is designed to provide a hands-on learning opportunity for students.

In the program, senior undergraduate students earning degrees in biomedical engineering work in teams to solve real-world problems for corporate and University sponsors over two semesters. While the studio space was closed to students following the COVID-19 campus lockdown in spring of 2020, several teams continued to work on their projects remotely.

"We have merged the biomedical and mechanical engineering capstone classes to provide a richer experience for our students," said Dr. Todd Polk, faculty sponsor. "On average, more than 50% of the teams are multidisciplinary, with students from both biomedical and mechanical engineering as well as students from electrical and computer engineering," said Dr. Joe Pacheco, faculty sponsor. "We strive to provide our students with a real world engineering experience and have organized UTDesign® Capstone like a company." Polk added, "We treat them like working engineers from day one, and the overall experience has proved to be highly beneficial to them as they enter the professional world after graduation."





UTDESIGN[®] CAPSTONE

At A Glance

SUMMER 2019 THROUGH SPRING 2020

27

teams with
bioengineering
students

101

bioengineering
students participated

Interdisciplinary Team Sponsors

Abbott Laboratories

Bridging Biosciences

Essilor Group

Klockner Pentaplast Group

Laerdal

Mechanical Ingenuity Corp.

Motorola Solutions Inc.

Orthofix

OsteoMed

Bleris laboratory,

The University of Texas at Dallas

Fei laboratory,

The University of Texas at Dallas

NanoTech Institute,

The University of Texas at Dallas

Sirsi laboratory,

The University of Texas at Dallas

UT Southwestern Medical Center

ThorMed Innovation

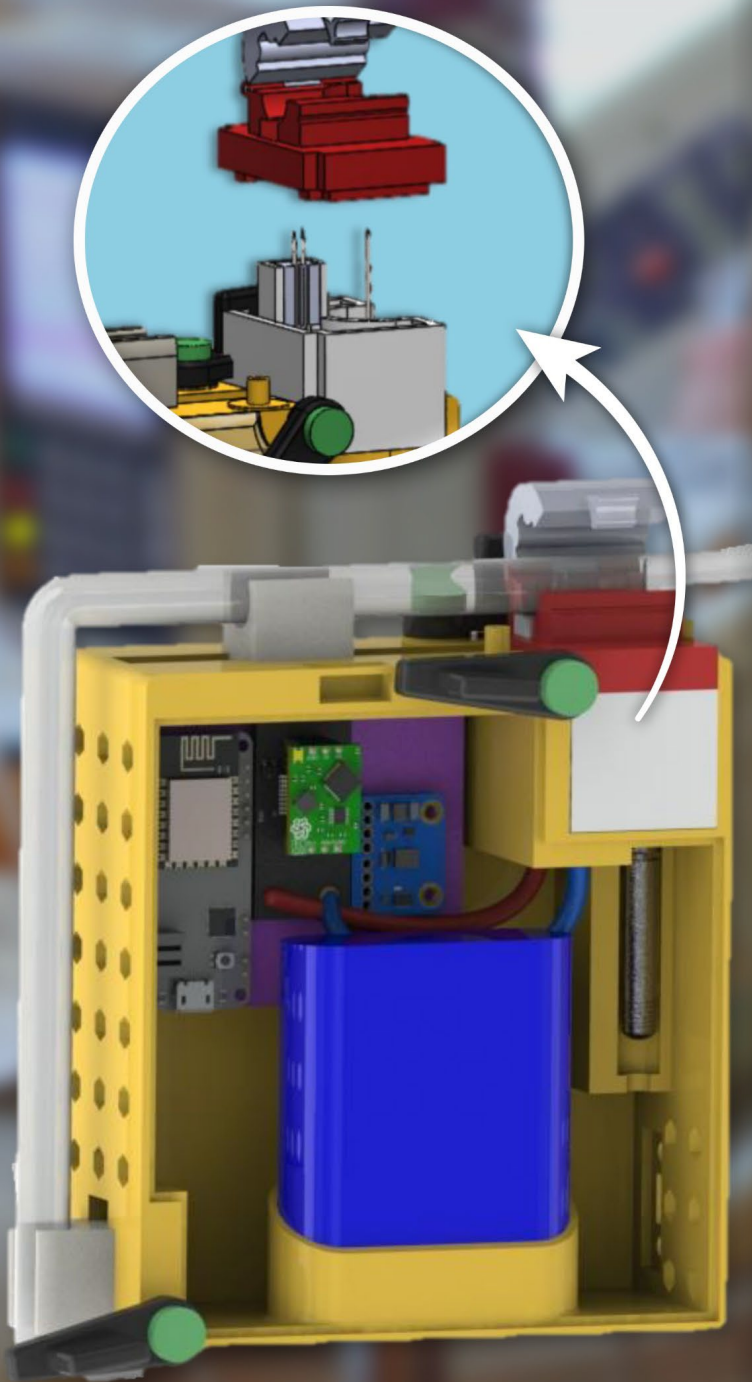
UTDESIGN[®] EXPO

Winning Team

FALL 2019



Winning team “Nephrolitics” created a real-time kidney function monitoring system for sponsor UT Southwestern Medical Center. Team members from left to right include seniors **Ryan Finnie**, mechanical engineering; **Justin McFarlane**, biomedical engineering; **Luis Jule**, biomedical engineering; **Saud Madani**, mechanical engineering; **Alexander Harper**, mechanical engineering; and **Daniel Kaminski**, biomedical engineering.





B I O E N G I N E E R I N G
SAVE THE DATE

10 YEAR SYMPOSIUM

April 8-9, 2021

be.utdallas.edu

The background image shows a modern, multi-story building with a glass facade and a person walking in the foreground. The building has a prominent entrance with a glass canopy. The overall image has a teal/green tint.

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BIOENGINEERING

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