10TH ANNUAL

COULTER
PROGRAM AWARDS

Coulter Biomedical Accelerator
University of Missouri

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CHANCELLOR'S WELCOME

The University of Missouri is proud to celebrate the tenth edition of the Coulter Program Awards. These awards highlight the ideas that emerge when cross-disciplinary scholars collaborate to solve grand challenges and advance biomedical innovation.

Wallace Coulter, the namesake of the Coulter Foundation programs, was a biomedical engineer and one of the most influential inventors of the 20th century. He compiled 85 patents, including one for the Coulter Principle: a means for counting and sizing microscopic particles suspended in a fluid.

Honoring his legacy, MU will help the next Wallace Coulter thrive with our multidisciplinary landscape. We are among the nation's leading research institutions and a member of the prestigious Association of American Universities. Our comprehensive assets — including the country's most powerful university research reactor — foster scholarship across the disciplines, and our land-grant mission brings this capacity together with our commitment to serve the people of Missouri.

The NextGen Precision Health initiative is a great example of this prowess. This initiative — and its corresponding facility — will revolutionize health care for our citizens, eliminate health care disparities and transform community health through cross-disciplinary collaborations. It has helped Mizzou attract world-class researchers, and it will fuel their discoveries through robust partnerships with government agencies and industry leaders. We will be able to develop groundbreaking, personalized treatments tailored to an individual's unique patient factors, once more highlighting why our scholars are among MU's most valuable resources.

We are grateful for the Coulter Program Awards. It gives our researchers the recognition they deserve.

Mun Y. Choi PhD
President, University of Missouri System
Chancellor, University of Missouri

COULTER BIOMEDICAL ACCELERATOR WELCOME

The Coulter Biomedical Accelerator Program capitalizes on the best of academia and industry to accelerate the translation of biomedical innovations into products that improve patient care. Engineer-clinician teams with proprietary technologies that represent solutions to unmet clinical needs receive gap funding needed to perform research experiments that validate their innovations. The teams also receive customized business counseling and access to marketing, regulatory and reimbursement experts to confirm that their solutions represent viable business opportunities. Tracking of project progress toward funded milestones through active post-award project management by the Coulter Program Office ensures accountability and prepares teams for follow-on opportunities. As a result, projects de-risked by the Coulter Program are likely to attract investors and industry partners that can provide the funding needed to continue commercialization of the technologies. We are excited to announce that the program has awarded its tenth round of funding to innovators at the University of Missouri.

In 2021, three new project teams received funding to advance the translation of their discoveries from bench to bedside.

These include "IBDEEP", a software product that will use deep learning and whole slide imaging to accurately detect dysplasia in inflammatory bowel disease (IBD) patients. People with IBD are at high risk for developing dysplasia and colorectal cancer (CRC) — early and accurate detection and treatment of dysplasia are key to reducing mortality from CRC in these patients. IBDEEP will assist pathologists with early diagnosis of IBD-associated dysplasia, and have the potential to not only improve clinical outcomes, but also significantly lower health care costs.

The second project, titled "CORE Autism," will use a smart phone-based software application in conjunction with a smart watch to continuously collect and analyze real-time voice data from clinical trial participants with autism spectrum disorder (ASD), and provide a purely objective measurement of social engagement in a real-world environment. Aimed at improving the lives of autistic individuals, this product has the potential to significantly improve current social assessment methods used in trials in ASD. The application platform can also be modified to add future modules such as stress assessments and measurement of repetitive motor movements which are targeted in many ASD clinical trials as well.

Duchenne muscular dystrophy (DMD) is a rare genetic disease that is characterized by progressive muscle degeneration and weakness, and is eventually fatal. The third project team is developing a biomimetic micro scaffold "Dystrophix" that has the potential to fortify dystrophic muscles with minimal side effects in patients suffering from DMD. Dystrophix will be injected locally, thereby affecting all muscles within a myofascial compartment.

The projects selected in 2021 involve a total of seven co-investigators from the MU School of Medicine, College of Engineering and School of Health Professions.

The Coulter Program is delivering practical solutions to real medical problems to advance the health of Missourians, the nation and the world by inspiring a generation of new knowledge, intellectual capital and economic development strategies. In direct alignment with the university's vision for excellence, the program is nurturing and building on Mizzou's rich ecosystem of qualified scientists, internationally recognized research and unique infrastructure. The $4.6 million invested in Coulter research projects to date has already led to four "Coulter Wins," and $26.3 million in new government grants and $7.4 million in investment funding raised by startup companies that have licensed technologies de-risked through the Coulter Biomedical Accelerator. These numbers will continue to increase as the program continues.

We would like to congratulate our 2021 Coulter-funded investigators and thank our Coulter Oversight Committee, which includes experts from industry and academia, for their remarkable and continued support. Their contributions will advance translational research at MU for years to come.

Sheila Grant, PhD
Principal Investigator,
MU Coulter
Biomedical Accelerator

William Fay, MD
Co-Principal Investigator,
MU Coulter
Biomedical Accelerator

Lisa Lorenzen, PhD
Co-Principal Investigator,
MU Coulter
Biomedical Accelerator

COULTER OVERSIGHT COMMITTEE

David Anderson, PhD
Chief Scientific Officer, Ivogen (Subsidiary of Nanova Biomaterials, Inc.)

Bob Basore
Independent Business Consultant

Charles W. (Bill) Caldwell, MD, PhD
Professor Emeritus, Pathology and Anatomic Sciences, University of Missouri; President and Chief Scientific Officer, GenomicPathways, Inc.

Elias Caro, MS
President, BioComX

Gregory Della Rocca, MD, PhD
Associate Professor of Orthopaedic Surgery, University of Missouri School of Medicine

William Fay, MD
Professor of Medicine and Medical Pharmacology; Senior Associate Dean for Research, University of Missouri School of Medicine; J.W. and Lois Winifred Stafford Distinguished Chair in Diabetes and Cardiovascular Research

Randel Frazier, MS
Board of Directors, Sealantis LTD

James (Jim) Gilkerson, DVM
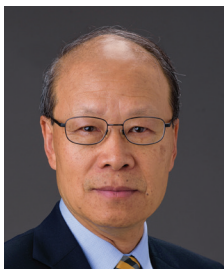*Independent Business Consultant*

Sheila Grant, PhD
Associate Vice Chancellor for Research and Strategic Initiatives; Professor of Biomedical, Biological and Chemical Engineering, University of Missouri

Lisa Lorenzen, PhD
Assistant Vice Chancellor for Technology Advancement, University of Missouri

Karen Spilizewski, MS, MBA
Vice President, RiverVest Venture Partners

Jinglu Tan, PhD
Professor of Biomedical, Biological and Chemical Engineering; Professor and Director, Division of Food Systems and Bioengineering, University of Missouri

Bill Turpin
Independent Business Consultant

Alan Wright, MD, MPH
Vice President Medical Affairs, North America, bioMérieux

COULTER PROGRAM OFFICE

Jaya Ghosh, PhD
Program Director, MU Coulter Biomedical Accelerator; Lead Program Manager, Midwest Biomedical Accelerator Consortium (MBArC)

The Coulter Program Office is responsible for implementing the "Coulter Process," which is internationally recognized as the recipe for successful translation of biomedical research projects. The Coulter Process is based on the Stage-Gate™ product development process commonly used by industry to move new products from idea to market launch. In the case of the Coulter Program, the goal is to take ideas for solutions to unmet clinical needs developed by engineer-clinician teams to the point that a commercial entity or professional investor (e.g., venture capitalist, angel investor) sees enough value to provide the funding needed to continue the commercialization process.

Coulter Awards also come with individualized counseling, connections to industry experts, marketing, regulatory and reimbursement consulting support, and introduction to potential customers, partners and investors. To assist project teams seeking a Coulter Award, the Program Office offers a 12-session Boot Camp. During Coulter Boot Camp, the project teams — mentored by instructors, business advisers and experts — are guided through a series of lectures and interactive exercises to pressure-test the commercial viability of their ideas using universal business criteria as well as the unique requirements of biomedical product commercialization. Boot Camp provides teams with an opportunity to learn how to pitch their project to potential investors and partners as they prepare their pitch for a Coulter Award. Students enrolled in MANGMT/BIOL_EN 8200 offered by the MU Robert J. Trulaske, Sr. College of Business pair up with the teams going through Coulter Boot Camp to learn what it takes to commercialize life science innovations by working on real-world problems and potential solutions.

The active engagement of the Coulter Program Office in every funded project is what ultimately makes the Coulter Program successful in accelerating the movement of biomedical innovations out of the University and into companies that can continue commercialization of the technologies.

The Program Office would like to extend a special thank you to the following, for their continued support of the Coulter Biomedical Accelerator Program:

Richard Barohn, MD
Executive Vice Chancellor for Health Affairs and Hugh E. and Sarah D. Stephenson Dean, School of Medicine

Latha Ramchand, PhD
Provost and Executive Vice Chancellor for Academic Affairs, University of Missouri

Tom Spencer, PhD
Vice Chancellor for Research and Economic Development, University of Missouri

Noah D. Manring, PhD
Dean, College of Engineering; Chair, Department of Mechanical and Aerospace Engineering, University of Missouri

Project: IBDEEP: Diagnostic Tool to Prevent Colorectal Cancer in Inflammatory Bowel Disease Patients

PRINCIPAL INVESTIGATORS

PRAVEEN RAO, PhD
Departments of Health Management and Informatics, and Electrical Engineering and Computer Science

DEEPTHI RAO, MD
Department of Pathology

In the United States, 70,000 new inflammatory bowel disease (IBD) cases are diagnosed every year, and an additional 1.6 million IBD patients undergo frequent endoscopies and biopsies for monitoring disease progression. The annual health care financial burden of IBD is $31 billion. Patients with IBD are at high risk for developing dysplasia and colorectal cancer (CRC). Early and accurate detection and treatment of dysplasia are key to reducing mortality from CRC in IBD patients. However, dysplasia detection is challenging due to the subtle, unconventional, multifocal nature of the lesions that are located among inflammatory pseudopolyps or scarred post-inflammatory background mucosa. With the recent identification of six new types of nonconventional dysplasia, detection of IBD-associated dysplasia has become significantly more challenging to pathologists, thereby increasing the chance of missed diagnosis leading to rise in CRC rates and mortality. The envisioned product, IBDEEP, is a software that will use deep learning and whole slide imaging to accurately detect dysplasia, and assist pathologists with early diagnosis of IBD-associated dysplasia, potentially improving clinical outcomes and significantly lowering health care costs.
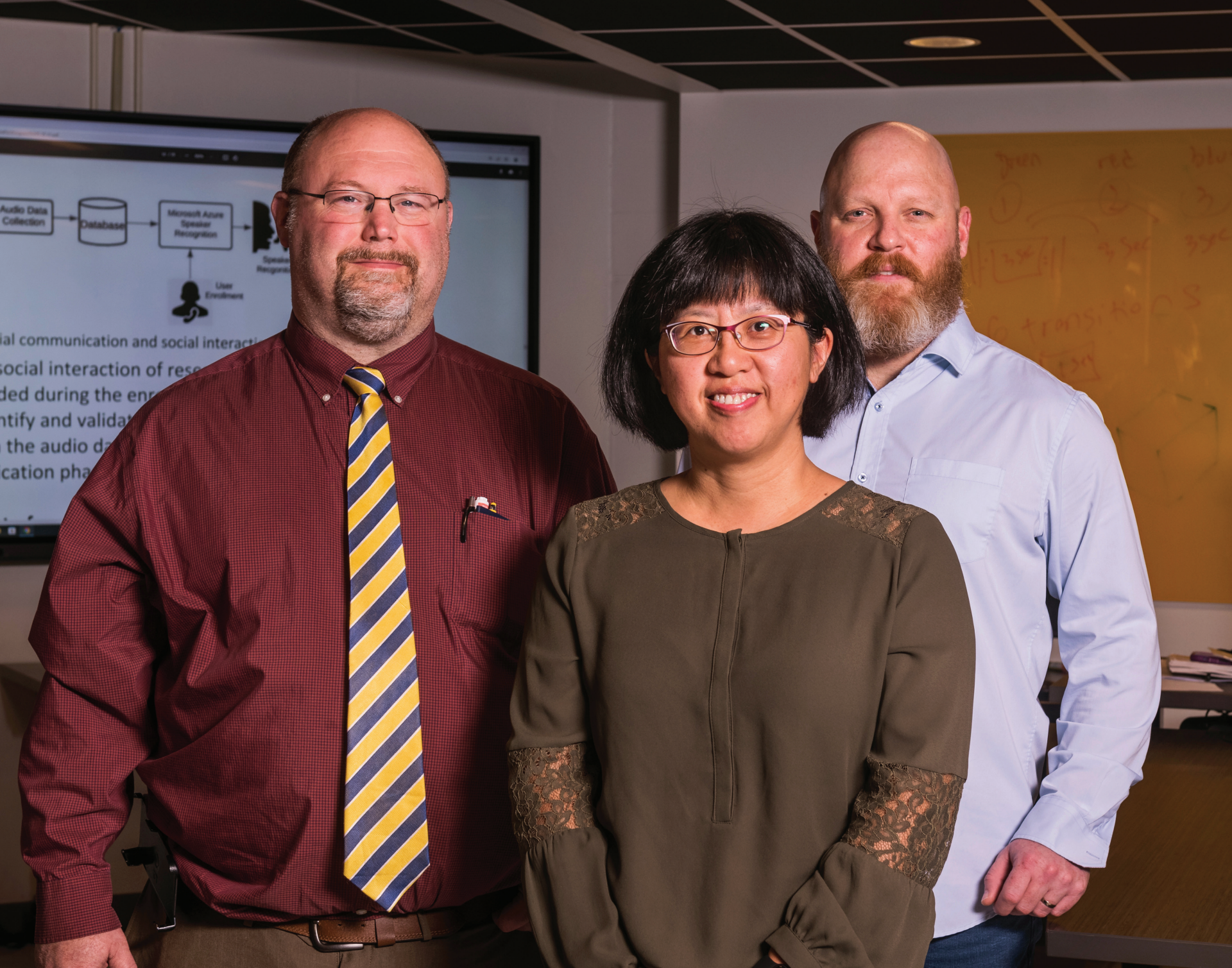
CORE Autism: Mobile Real-Time Voice Activity Tracking for Autism Social Interaction Measurement

PRINCIPAL INVESTIGATORS

FANG WANG, PhD
Department of Electrical Engineering and Computer Science

BRAD FERGUSON, PhD
Department of Health Psychology

DAVID BEVERSDORF, MD
Department of Neurology

Autism Spectrum Disorder (ASD) affects one in every 44 children in the United States, and is characterized by persistent deficits in social communication, social interaction, and restricted and repetitive patterns of behavior. Many clinical trials conducted in ASD to determine if a new treatment is safe and effective, target these social deficits, but objective measurements of how changes in sociability are determined are severely lacking. Currently, social assessments in clinical trials in ASD rely on parent reports and brief interviews in a laboratory setting that are highly subjective and unnatural. This can contribute to the failure of a clinical trial, which not only delays or prevents important life-impacting treatments from getting to market, but also costs millions of dollars. To address this important unmet need, the team

is developing a smart phone-based software application that works in conjunction with a smart watch to continuously collect real-time voice data from clinical trial participants. This will provide a purely objective measurement of social engagement in a real-world environment in ASD. This product has the potential to significantly improve current social assessment methods used in trials in ASD. Aimed at improving the lives of autistic individuals, the initial target market will be pharmaceutical companies and contract research organizations (CROs) engaged in clinical trials in ASD. The application platform can also be modified to add future modules such as stress assessments and measurement of repetitive motor movements which are targeted in many ASD clinical trials as well.
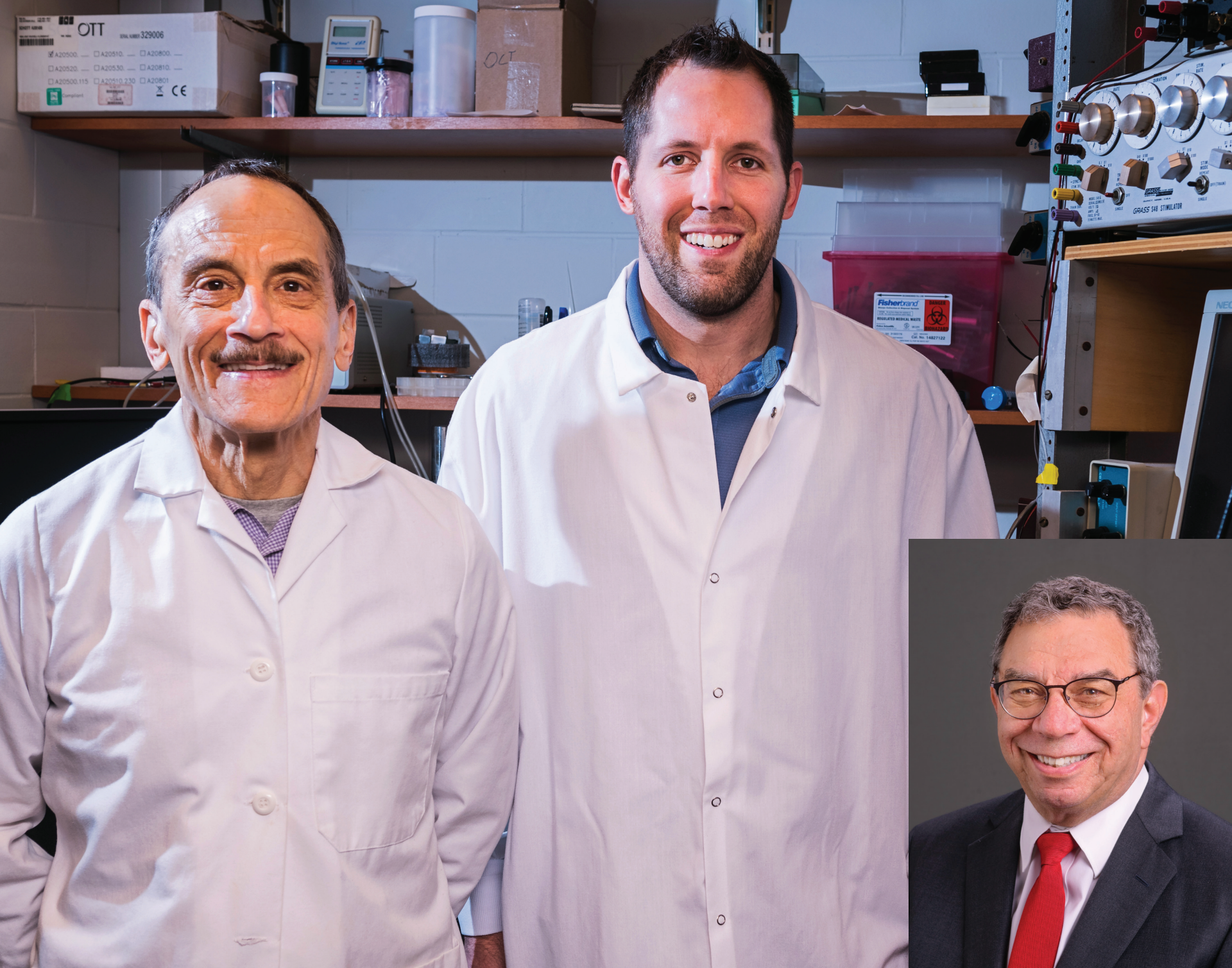
Dystrophix: Local, Structural Scaffold to Stabilize Limb Muscle in Muscular Dystrophy

PRINCIPAL INVESTIGATORS

RICHARD BROW, PhD
Department of Materials Science and Engineering (MS&T)

STEVEN SEGAL, PhD
Department of Medical Pharmacology and Physiology

RICHARD BAROHN, MD
Department of Neurology

Duchenne muscular dystrophy (DMD) is a rare genetic disease that is characterized by progressive muscle degeneration and weakness, and is eventually fatal. DMD occurs in 1 in 3500-5000 males born worldwide, and more than 90% patients use wheelchairs by age 15. It primarily affects males, but, in rare cases, can also affect females. The global DMD treatment market is growing at an annual rate of 5% and consists of 290,000 patients paying an average of $2.9B/year for treatment. The major burden facing DMD patients and their families is the decline in mobility from a lack of the gene dystrophin. Dystrophin deficiency leads to fragile muscle fibers that are easily damaged. FDA-approved and pipeline therapies are fraught with drawbacks that include no improvement in muscle function, and secondary consequences of front-line medications. The team is developing a biomimetic micro scaffold (Dystrophix) that has the potential to fortify dystrophic muscles without side effects. Dystrophix will be injected locally, thereby affecting all muscles within a myofascial compartment.

WINNERS OF PREVIOUS YEARS

Smart Surveillance System (S3) for Monitoring Vascular Bypasses/Stents at Home

PRINCIPAL INVESTIGATORS

MIHAIL POPESCU, PhD
Department of Health Management and Informatics

JONATHAN BATH, MD
Department of Surgery

2020

Mizzou Point-of-Care Assessment System (Mizzou PASS): Portable Multidimensional Assessment Tool for Management of Concussive Injuries

PRINCIPAL INVESTIGATORS

TRENT GUESS, PhD
Department of Physical Therapy and Orthopaedic Surgery

REBECCA BLISS, DHSc, PT, DPT
Department of Physical Therapy

2020

TumorTrap: Efficient, Low-cost and Rapid Microfluidic Circulating Tumor Cell Detection Chip

PRINCIPAL INVESTIGATORS

JAE KWON, PhD
Department of Electrical Engineering and Computer Science

JUSSUF KAIF, MD, PhD
Department of Surgical Oncology

2020
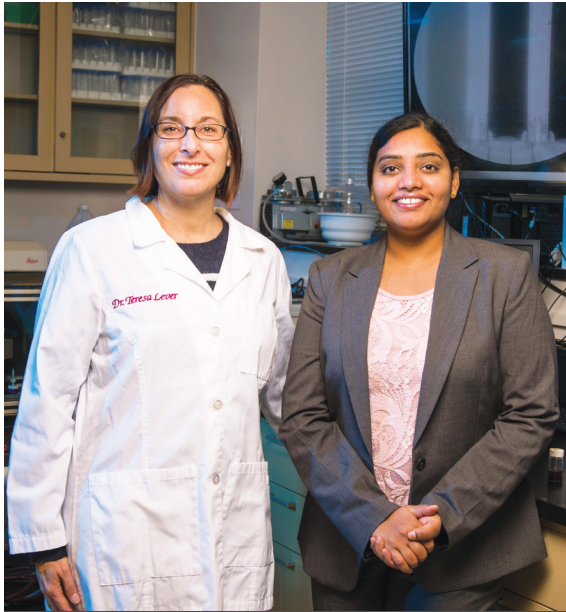
Golden Gullet: Sustainably Synthesized, Gold Nanoparticle-Based, Ready-to-Use, Palatable and Edible Contrast Agent for X-Ray Swallow Studies

PRINCIPAL INVESTIGATORS

KIRUBA KRISHNASWAMY, PhD
Department of Biomedical, Biological and Chemical Engineering

TERESA LEVER, PhD
Department of Otolaryngology

2019
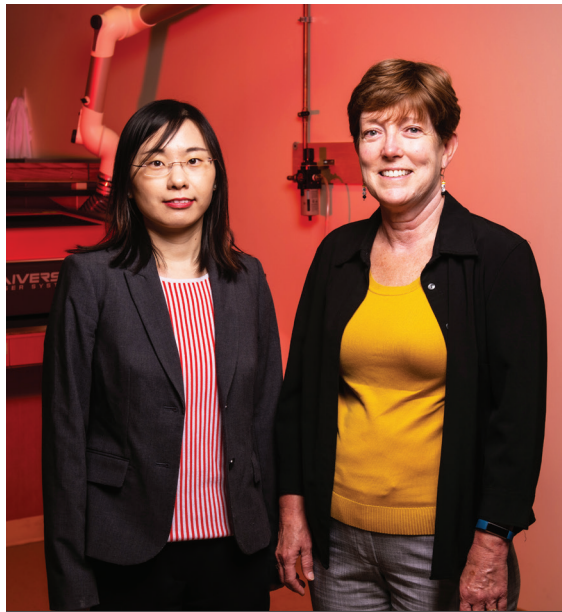
Pressure-Sensor-Integrated Smart Bandage for Improving Adherence to Offloading Diabetic Foot Ulcers

PRINCIPAL INVESTIGATORS

XUEJU "SOPHIE" WANG, PhD
Department of Mechanical and Aerospace Engineering

CAROLYN CRUMLEY, DNP, RN, ACNS-BC, CWOCN
Sinclair School of Nursing

2019

Smart Monitor for the NICU: Adaptive System for Detection and Prediction of Apnea, Desaturation and Bradycardia in Premature and Low Birth Weight Infants

PRINCIPAL INVESTIGATORS

ROGER FALES, PhD
Department of Mechanical and Aerospace Engineering

JOHN PARDALOS, MD
Department of Child Health

2019
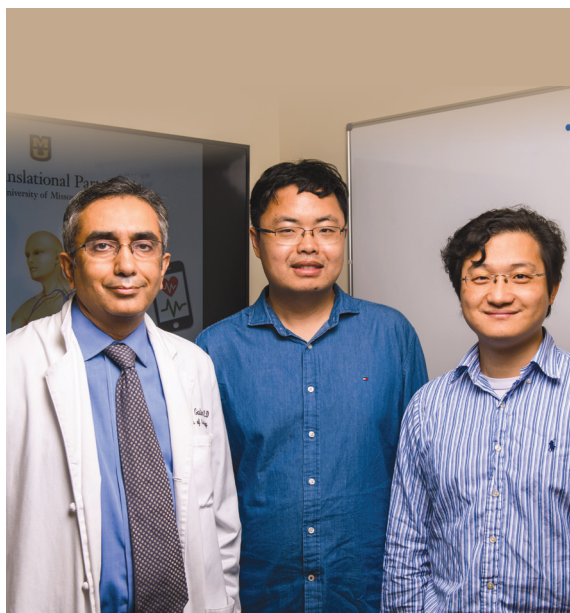
Tiger Patch for Comfortable, Adhesive-Free, Long-Lasting and Accurate Cardiac Monitoring

PRINCIPAL INVESTIGATORS

ZHENG YAN, PhD
Departments of Biomedical, Biological and Chemical Engineering, and Mechanical and Aerospace Engineering

JIAN LIN, PhD
Department of Mechanical and Aerospace Engineering

SANDEEP GAUTAM, MD
Department of Cardiology

2019
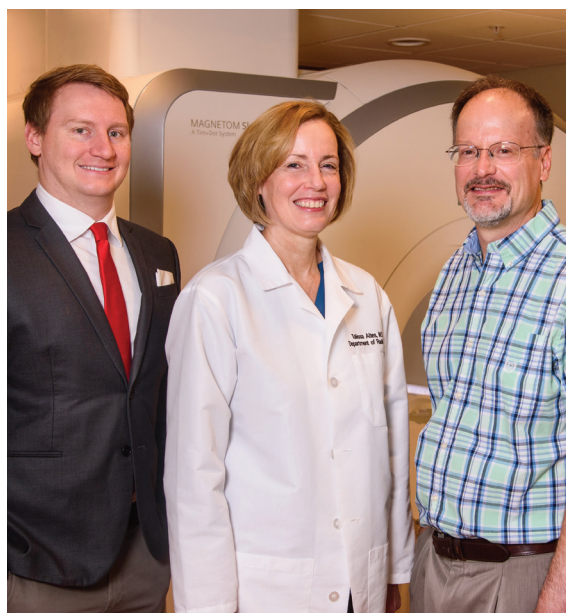
HeartSpeed: Fast Cardiac MRI Exams With the Freedom to Breathe

PRINCIPAL INVESTIGATORS

ROBERT THOMEN, PhD
Department of Biomedical, Biological and Chemical Engineering

STEVEN VAN DOREN, PhD
Department of Biochemistry

TALISSA ALTES, MD
Department of Radiology

2018

T-Meter: Sensitive, Low Cost Testosterone Testing at the Point of Care

PRINCIPAL INVESTIGATORS

MARIA FIDALGO, PhD
Department of Civil and Environmental Engineering

LUIS POLO-PARADA, PhD
Department of Medical Pharmacology and Physiology

LILIANA GARCIA-VARGAS, MD
Department of Clinical Medicine - Endocrinology

2018
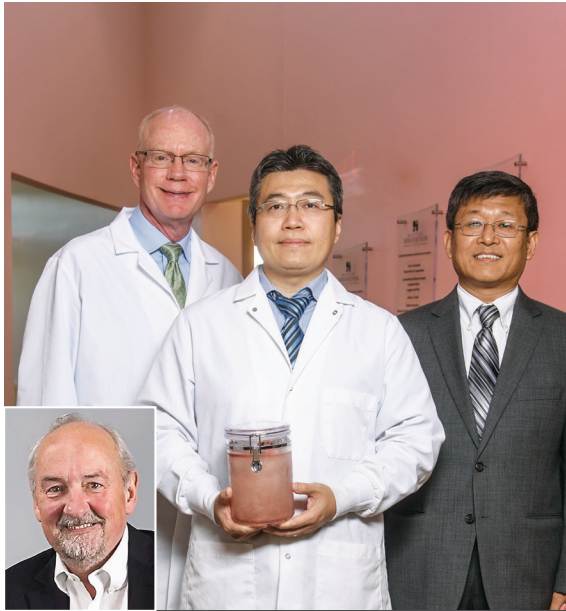
Frozen Hearts: Novel Cryopreservation Media for Cardiac Transplantation

PRINCIPAL INVESTIGATORS

YUWEN ZHANG, PhD
Department of Mechanical and Aerospace Engineering

XU HAN, PhD
Departmet of Cardiovascular Medicine

MIKE HILL, PhD
Department of Medical Pharmacology and Physiology

WILLIAM P. FAY, MD
Departments of Internal Medicine and Medical Pharmacology and Physiology

2018

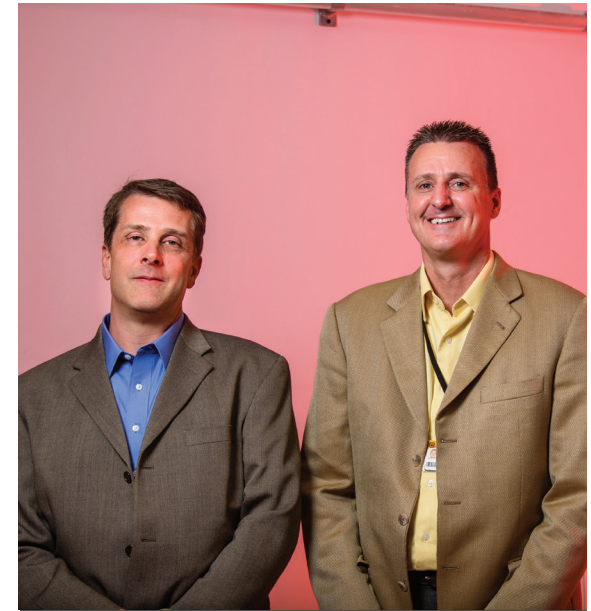## BioJoint Flex: A Simple Solution for Stiff Knees

PRINCIPAL INVESTIGATORS

TRENT GUESS, PhD
Departments of Physical Therapy and Orthopaedic Surgery

JAMES COOK, DVM, PhD
Department of Orthopaedic Surgery

2017

Mizzou Knee Arthrometer Testing System (MKATS): An Easy-To-Use Tool for Accurate Screening, Diagnosis and Treatment Monitoring for Knee Ligament Injuries

PRINCIPAL INVESTIGATORS

TRENT GUESS, PhD
Departments of Physical Therapy and Orthopaedic Surgery

JAMES COOK, DVM, PhD
Department of Orthopaedic Surgery
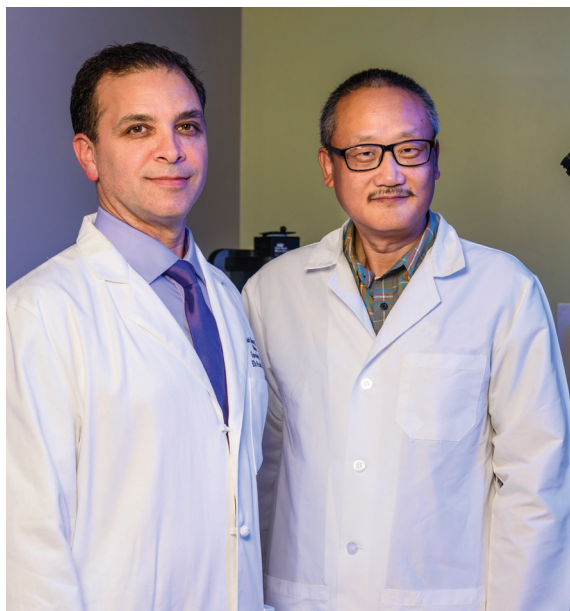
2017

OPT-Enhanced Colposcopy: 3D Detection of Precancerous and Cancerous Lesions for Image-Guided Biopsy

PRINCIPAL INVESTIGATORS

GARY YAO, PhD
Department of Bioengineering

MARK HUNTER, MD
Department of Gynecologic Oncology

2017

Tongue Twister: Mobile Health App for Early Detection and Monitoring of Tongue Dysfunction Caused by Neurological Disorders

PRINCIPAL INVESTIGATORS

FILIZ BUNYAK ERSOY, PhD
Department of Computer Science

YUNXIN ZHAO, PhD
Department of Computer Science

TERESA LEVER, PhD
Department of Otolaryngology

MILI KURUVILLA-DUGDALE, PhD
Department of Communication Science and Disorders

2017
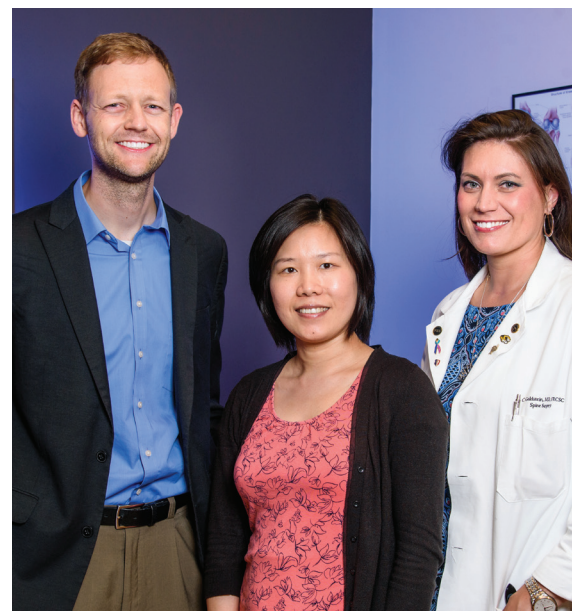
CelluloGel: Injectable Osteomodulatory Hydrogels for Vertebral Compression Fracture Repair

PRINCIPAL INVESTIGATORS

BRET ULERY, PhD
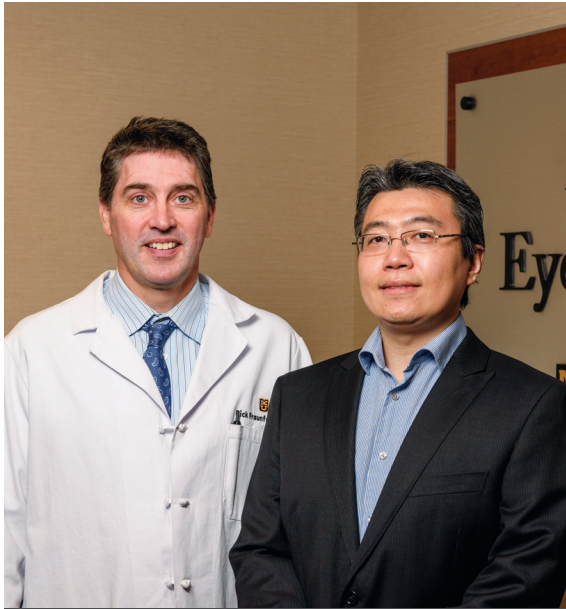*Department of Chemical Engineering*

ELLEN WAN, PhD
Department of Bioengineering

CHRISTINA GOLDSTEIN, MD
Department of Orthopaedic Surgery

2016

Corneal Cryopreservation and Storage System

PRINCIPAL INVESTIGATORS

XU HAN, PhD
Department of Mechanical and Aerospace Engineering

FREDERICK FRAUNFELDER, MD, MBA
Department of Ophthalmology

2016

Near Infrared Navigation System (NAVI) for Image-Guided Surgery in Coronary Artery Bypass Grafting

PRINCIPAL INVESTIGATORS

RAGHURAMAN KANNAN, PhD
Departments of Bioengineering and Radiology

AJIT THARAKAN, MD
Department of Surgery

2016

ENSUR: A Novel Diagnostic Prenatal Genetic Test

PRINCIPAL INVESTIGATORS

RAGHURAMAN KANNAN, PhD
Departments of Bioengineering and Radiology

DANNY SCHUST, MD
Department of Obstetrics, Gynecology and Women's Health

2016
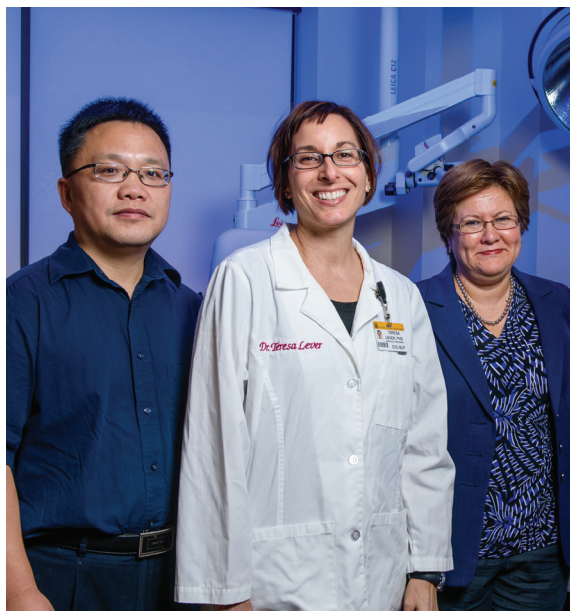
Down the Hatch Solutions

PRINCIPAL INVESTIGATORS

FILIZ BUNYAK ERSOY, PhD
Department of Computer Science

ZHIHAI (HENRY) HE, PhD
Department of Electrical and Computer Engineering

TERESA LEVER, PhD
Department of Otolaryngology

2016

Intelligent Oxygen Control for NICU Patients

PRINCIPAL INVESTIGATORS

ROGER FALES, PhD
Department of Mechanical and Aerospace Engineering

JOHN PARDALOS, MD
Department of Child Health

RAMAK AMJAD, MD
Department of Child Health

2015

Panacea's Cloud: Augmented Reality System for Mass Casualty Disaster Triage and Coordination

PRINCIPAL INVESTIGATORS

PRASAD CALYAM, PhD
Department of Computer Science

SALMAN AHMAD, MD
Department of Surgery

2015

Germ Sensor System for Rapid Detection of Salmonella and Other Pathogens

PRINCIPAL INVESTIGATORS

MAHMOUD ALMASRI, PhD
Department of Electrical and Computer Engineering

SHUPING ZHANG, PhD, DACVM
Department of Veterinary Pathobiology

2015

DR Sensor for Early Detection of Diabetic Retinopathy

PRINCIPAL INVESTIGATORS

RAGHURAMAN KANNAN, PhD
Departments of Bioengineering and Radiology

DEAN HAINSWORTH, MD
Department of Ophthalmology

2015

Safer Laser Handpiece for Dermatology Treatments

PRINCIPAL INVESTIGATORS

RANDY CURRY, PhD
Department of Electrical and Computer Engineering

NICHOLAS GOLDA, MD
Department of Dermatology

2015

Implantable Antennas for Biomedical Telemetry

PRINCIPAL INVESTIGATORS

RANDY CURRY, PhD
Department of Electrical and Computer Engineering

RENEE SULLIVAN, MD
Department of Medicine

2014
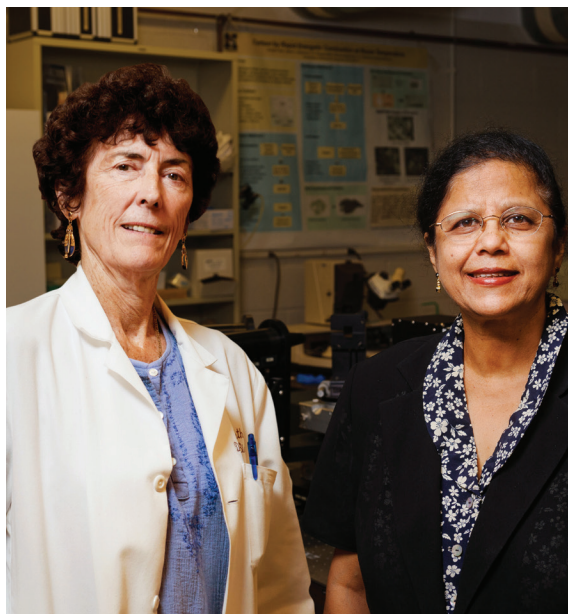
Plasmonic Grating Point-of-Care System for Detection of TB

PRINCIPAL INVESTIGATORS
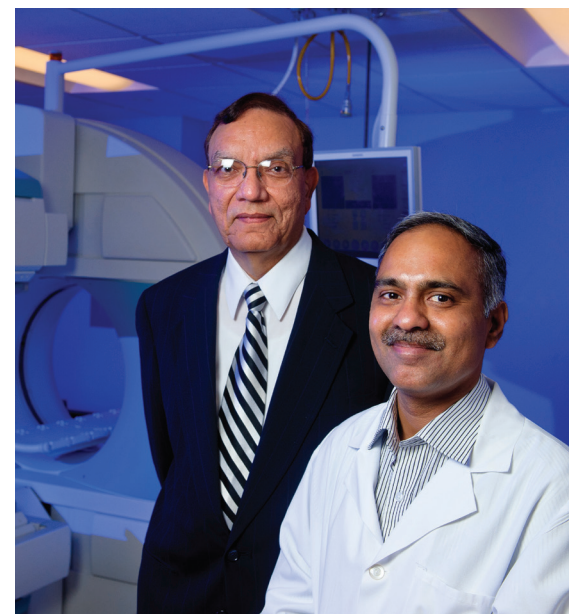
SHUBHRA GANGOPADHYAY, PhD
Department of Electrical and Computer Engineering

CAROLE MCARTHUR, MD, PhD
Department of Oral and Craniofacial Sciences, University of Missouri-Kansas City

2014

RTN-Scan: A Novel Molecular Probe for Early Detection of Recurrent and Metastatic Breast Cancer

PRINCIPAL INVESTIGATORS

RAGHURAMAN KANNAN, PhD
Departments of Bioengineering and Radiology

AMOLAK SINGH, MD
Department of Radiology

2014

Engineered Osteochondral Allograft for Knee Cartilage

PRINCIPAL INVESTIGATORS

CLARK HUNG, PhD
Department of Biomedical Engineering, Columbia University

JAMES COOK, DVM, PhD
Department of Orthopaedic Surgery

2014

A Tapered and an Anatomically Shaped Osteochondral Allograft System
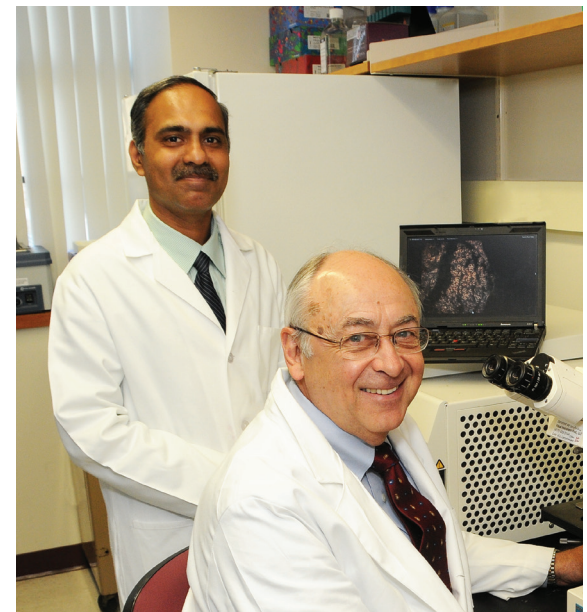
PRINCIPAL INVESTIGATORS

FERRIS PFEIFFER, PhD
Departments of Bioengineering and Orthopaedic Surgery

JAMES STANNARD, MD
Department of Orthopaedic Surgery

2014

A Novel Nanoplatform for Accurate Detection of Biomarkers in Tumor Tissues

PRINCIPAL INVESTIGATORS

RAGHURAMAN KANNAN, PhD
Departments of Bioengineering and Radiology

GERALD ARTHUR, MD
Department of Pathology and Anatomical Sciences

2013

An Embolic Protection Device to Aid in Transcatheter Aortic Valve Implantation and Prevent Neurological Dysfunction
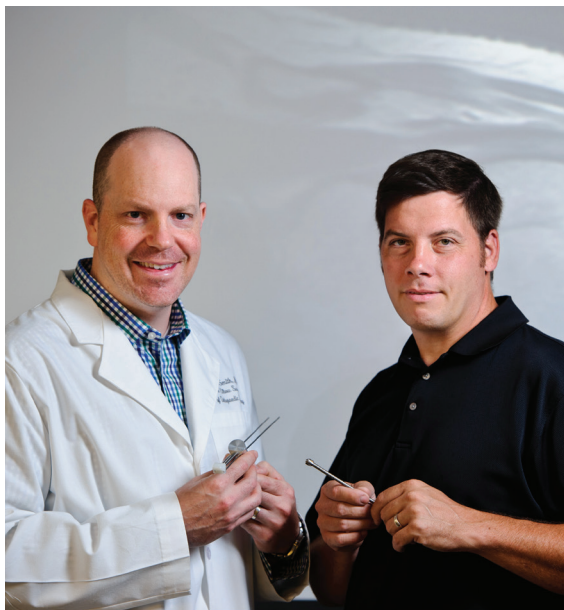
PRINCIPAL INVESTIGATORS

A. SHERIF EL-GIZAWY, PhD
Department of Mechanical and Aerospace Engineering

RAJA GOPALDAS, MD
Department of Surgery

2013

A Bone-Tendon Allograft System Optimizing Tissue Healing and Biomechanical Strength for Human Rotator Cuff Repair

PRINCIPAL INVESTIGATORS

FERRIS PFEIFFER, PhD
Departments of Bioengineering and Orthopaedic Surgery

MATTHEW SMITH, MD
Department of Orthopaedic Surgery

2013

Electrical System for the Rapid Detection of Viable Bacteria in Blood Cultures

PRINCIPAL INVESTIGATORS

SHRAMIK SENGUPTA, PhD
Department of Bioengineering

JOHN PARDALOS, MD
Department of Child Health

2012

A MicroRNA-Based Molecular Diagnostics Platform, Focused Initially on Monitoring Lung Cancer Therapy

PRINCIPAL INVESTIGATORS
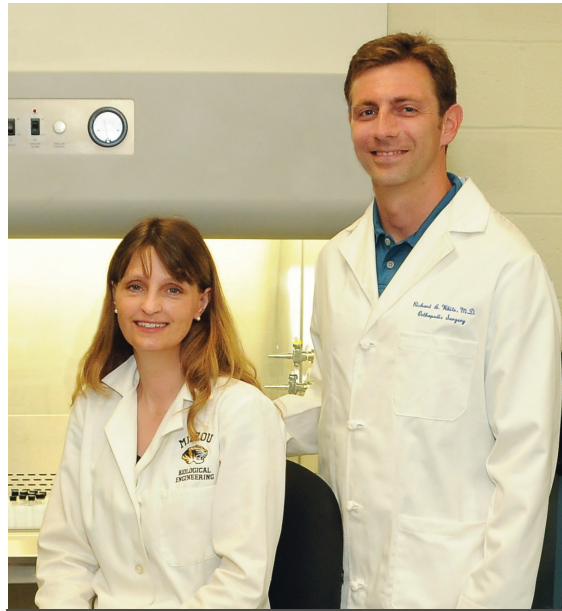
LI-QUN GU, PhD
Department of Bioengineering

MICHAEL WANG, MD, PhD
Department of Pathology and Anatomical Sciences

2012

Technology for Producing Superior ACL Grafts by Conjugating Nanomaterials with Acellular Biologically Derived Tissue

PRINCIPAL INVESTIGATORS

SHEILA GRANT, PhD
Department of Bioengineering

RICHARD WHITE, MD
Department of Orthopaedic Surgery

2012

A Photoacoustic Instrument for Depth Profiling and Imaging of a Burn to Aid Wound Management Decisions and Debridement
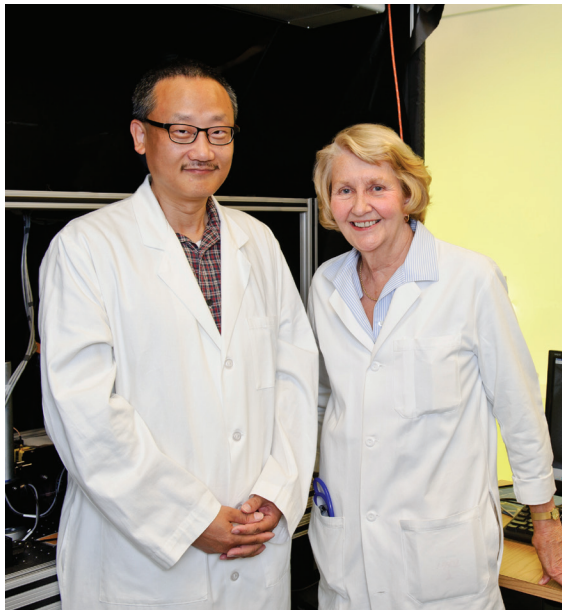
PRINCIPAL INVESTIGATORS

JOHN VIATOR, PhD
Department of Bioengineering

STEPHEN BARNES, MD
Department of Surgery

2012

Technology for Capturing Parameters of the Pupillary Light Reflex in Infants and Toddlers and Determining Its Utility for Earlier Detection of Neurodevelopmental Disorders Than is Currently Possible

PRINCIPAL INVESTIGATORS

GANG YAO, PhD
Department of Bioengineering

JUDITH MILES, MD, PhD
Department of Child Health

2012

Coulter Biomedical Accelerator

University of Missouri