



UNIVERSITY OF TENNESSEE RESEARCH FOUNDATION

Where Discovery and Opportunity Connect























Table CONTENTS





UTRF'S TECHNOLOGY TRANSFER MISSION

Our mission is to support an entrepreneurial culture, enhance research, and facilitate economic development by commercializing intellectual property created within the University of Tennessee System.

Letter From the President

This year was marked by a global pandemic with worldwide impacts on public health, infrastructure, and the economy. Though it brought about devastating effects, it also revealed an important and often essential contribution of innovation to society: hope. I am proud of the countless innovators at the University of Tennessee who rose to the challenge and provided hope to millions of people.

One 20-year-old invention in particular was used every day in HVAC systems, hospitals, and dusty work environments without much fanfare, until this year. Dr. Peter Tsai, while at the University of Tennessee, created the N95 mask filtration material that ascended into the global media spotlight as essential personal protective equipment for healthcare workers on the front lines in the fight against COVID-19.

Dr. Tsai then came out of retirement to help researchers at Oak Ridge National Lab and UT increase N95 mask material production. He also worked to develop a new hydrocharging method to improve N95 filtration efficiency and has been working with various companies to produce this material.

The pandemic put a national spotlight on our healthcare innovations – from using supercomputers to identify drug compounds, to face shields, mask materials, and apps to help intubated patients communicate. But perhaps more importantly, it revealed how our researchers and their discoveries can make a profound impact on society through protecting and saving human lives.

In FY20, UTRF received a record-breaking 201 invention disclosures, executed 42 license agreements, and launched 6 technology-based startups. The innovations behind these numbers are not limited to COVID-19 research. They



include technology used to fight a billion-dollar soybean crisis, a biopharmaceutical startup demonstrating progress in therapeutics for a rare disease, an advanced composites startup that developed a revisionary carbon fiber dispersion technique, and so much more. Every single day, UT researchers are making important discoveries and advancing technology in their chosen fields.

This year has been difficult for so many, but UT researchers have persevered, using their expertise to help those in need. We are honored to serve UT's faculty, staff, and students across all campuses and institutes as they develop innovations that instill hope for the future. We hope you enjoy the Discover 2020 report, and we look forward to the coming year and achieving new milestones in 2021.

Datto

Stacey S. Patterson, PhD UTRF President



Dr. Tsai worked with the Carbon Fiber Technology Facility team at ORNL to develop an inline charging technology for the meltblown line and coordinated with staff at the Manufacturing Demonstration Facility on material blending. Photo credit: Carlos Jones/Oak Ridge National Laboratory.

COVID-19 Innovators

PANDEMIC RESPONSE

Throughout the COVID-19 pandemic, UT's innovators have risen to the occasion to address some of the biggest issues facing society.

Connecting Research with Industry Partnership Opportunities to Fight a Pandemic

A University of Tennessee Health Science Center (UTHSC) virologist and University of Tennessee Foundation (UTFI) fundraiser are working hard to further the holistic process of drug discovery in the fight against COVID-19 through innovative research and industry partnerships.

Michael Whitt is the associate dean and chair of the Department of Medical Education in the UTHSC College of Medicine and a professor in the Department of Microbiology, Immunology and Biochemistry. He is working with UTRF, other UTHSC researchers, and partners around the world to leverage his vesicular stomatitis virus (VSV) platform. The platform - a reverse genetics system for generating pseudotyped viruses with VSV - results in the assembly of the SARS-CoV-2 spike protein into a modified VSV, allowing researchers to work at a lower biosafety level than they would when working with the live SARS-CoV-2 virus.



As a senior director of development with UTFI, Greg Harris builds relationships with research funders to secure philanthropy for UTHSC's Office of Research priorities, such as research labs. One such lab is the Regional Biocontainment Lab (RBL), directed by Colleen Jonsson. The RBL is currently conducting research on the COVID-19 virus to find a vaccine solution. Greg is in active discussions with several foundations and companies about providing philanthropic support for the COVID-19 research.

In addition to touting the talent and expertise of Colleen and her team, Greg is promoting a UTHSC advantage - the vertical stack or vertical platform. The vertical platform approach refers to the comprehensive nature of drug discovery efforts that can be conducted through the UTHSC system.

Professor Designs and Donates Face Shield for Healthcare Workers

Assistant Professor of Architecture Maged Guerguis saw a way to improve an essential protective device for healthcare workers during the fight against COVID-19, and he responded as architects do: He innovated.

His goal was to improve safety and comfort for healthcare professionals working long hours fighting on the front lines of the pandemic. Guerguis, who teaches design and structural technology, began creating a new face shield in March 2020 that was designated U.S. patent pending (No. 29/733,737) in May 2020. The shield weighs only two ounces, assembles in five seconds, and provides improved comfort and maximum protection for medical professionals.

Throughout the design process, Guerguis collaborated with physicians and nurses from UT Medical Center, East Tennessee Children's Hospital, and Covenant Medical Group, who helped in testing and provided feedback. When students, faculty, and staff returned to the UT campus in Knoxville for the beginning of the fall semester in August, as many as 50,000 uniquely designed protective face shields were ready for distribution to help provide an extra layer of defense against the



DR. PETER TSAI

Peter Tsai may not be a household name, but odds are you know his work.

A former research faculty member of the Department of Material Science and Engineering, Tsai is the architect behind the essential filtration technology in N95 respirators. With the onset of the coronavirus pandemic, he came out of retirement to address the national shortage of N95s.

has worked Tsai in conjunction with UTRF on methods and testing to provide a way for masks to be safely reused, greatly improving the outlook for medical teams and first responders. UTRF has played an important role in connecting Tsai and his research to a growing number of facilities around the world; he has shared his expertise with many companies interested in producing the charged nonwoven fabric or in scaling up production. Tsai has also partnered with Oak Ridge National Laboratory to create a system to quickly produce new mask materials.

< Background: COVID-19. Image courtesy of Jill Hemman/Oak Ridge National Laboratory, U.S. Dept. of Energy.

Right: Researcher works in the UTHSC COVID-19 Lab. Photo credit: UTHSC/Natalie Brewer.

Below: UT Assistant Professor of Architecture Maged Guerguis and IACMI Chief Technology Officer Uday Vaidya display the UT Shield in the IACMI-supported Fibers and Composites Manufacturing Facility. Photo credit: IACMI.







Above: Dr. Koszalinski testing the SFM-V app. Photo credit: UTK Nursing.

Right: Dr. Merlin Theodore, director of the DOE's Carbon Fiber Technology Facility at ORNL, and Dr. Peter Tsai, inventor of N95 filter media, hold a sample of filter media for face masks. Photo credit: Carlos Jones/Oak Ridge National Laboratory/US Department of Energy.







spread of the COVID-19 virus. The 50,000 shields for the UT campus were produced under the guidance of UT professor Uday Vaidya of the Department of Mechanical, Aerospace, and Biomedical Engineering.

Healthcare Apps Provide High-Quality, Patient-Centric Care During COVID-19

Two new healthcare apps created by University of Tennessee, Knoxville, researchers demonstrate their ability to make a difference in the healthcare system and support vulnerable and atrisk populations during the COVID-19 pandemic.

Rebecca Koszalinski, assistant professor of nursing, developed her app SFM-V for end users who have disabilities, such as cerebral palsy or spina bifida. SFM-V allows users to easily communicate with their providers in acute-care settings by indicating their pain level, specific needs, and advanced care planning preferences.

Thereasa Abrams, an assistant professor of social work, created the Bridge Mobile App for Burn Patients. Developed by an interdisciplinary team of UT researchers and the Firefighters Burn Center in Memphis, the HIPPA-compliant app provides patients with wound care instructional videos, connects them with recovery resources, and lets them chart their pain, anxiety, itch, and mood levels, which their providers can access. Thereasa explained that her app can also offer effective, remote self-care during the pandemic.

Other COVID-19 Projects

• UT led the tooling effort to successfully mold COVID-19 testing tubes and caps per industry partner requirements.



COVID-19 Whistle



COVID-19 Testing Tube and Cap

- A joint UTHSC-ORNL team has been developing the COVID-19 "whistle," a simple device for collecting respiratory samples that can be used to gather material for diagnostic COVID-19 screening.
- UTRF research partner Veru opened a Phase II clinical trial to test whether treatment with Veru-111 could reduce the proportion of SARS-CoV-2 patients progressing to respiratory failure.
- UTRF startup Azimuth Sleep Solutions received an FDA Emergency Use Authorization for the PortPatch[™], a new product that allows CPAP and BiPAP to be more safely used in medical facilities by reducing the emission or airborne particulates.
- UT innovators, together with two doctors from Nashville, developed a patient barrier to reduce the risk of exposure of care providers to aerosol from COVID-19 patients during intubation. The patient barrier enables easy access to the patient and to the IV ports.

DECADE INREVIEW

The innovation landscape is constantly evolving with new products, services, and companies entering the market each year. Looking back over the past decade, we're presented with a long list of accomplishments in commercialization because the faculty, staff, and students at the University of Tennessee continue to develop new intellectual property that shapes the future of research and technology.

UTRF from 2010 to 2020

Part of UTRF's core mission is to promote the commercialization of intellectual property through helping these innovators and entrepreneurs bring their products to market or launch new companies with UT technologies. Since 2010, UTRF has assisted in numerous notable product launches, including: Persist orchardgrass, one of the most popular commercial forage grasses currently in use throughout the nation; the SEFM app, used to create a more realistic experience to instruct future nurses in monitoring babies and mothers during labor; RetinaVue, an ophthalmic telemedicine platform for diabetic retinopathy screening; and DocuCare, an electronic health record that teaches students and health care professionals how to document and retrieve patient data.

The past decade has also been busy for UTRF subsidiaries and startups. During this period, UTRF formed five vital subsidiaries: Cherokee Farm Development Corporation (CFDC) in 2011; Space Institute Research Corporation (SIRC) in 2011; Collaborative Composite Solutions Corporation in 2014; Cherokee Farm Property Investments (CFPI) in 2014; and Clinical Trials Network of Tennessee (CTN2) in 2017. UTRF helped launch 23 startups in the fields of medical education, medical devices, biotechnology, agriculture, pharmaceuticals, green chemistry, and diagnostics. Some of these startups include Hubble Telemedical (2010), Entac Medical (2012), Prisma Renewable Composites (2015), and Genera (2012). Most recently, Genera secured a \$118 million investment to build its first manufacturing facility in Vonore, Tennessee, to produce its Earthable paper and packaging products.

Additional elements of UTRF's core mission encourage an entrepreneurial culture and promote research and education. To do so, UTRF actively participates in launching and sponsoring new programs and event opportunities at UT and across the region.

At the beginning of the decade, UTRF established the Commercialization Analyst Program to provide qualified graduate students with hands-on experience in the commercialization of intellectual property. Additionally, in collaboration with Life Science Tennessee, UTRF helped expand the nine-week Scipreneur Challenge to hold events both in Memphis and Knoxville, where participating teams of students, scientists, clinicians, and mentors create a business plan for STEM-related intellectual properties and compete in a final pitch competition.

In 2015, UTRF joined the Innov865 Alliance to develop, support, and promote Knoxville's entrepreneurial ecosystem and has helped host the National Science Foundation (NSF) Innovation Corps (I-Corps) regional workshop series since 2017. Other relevant events and programs include Senior Design, the Rise & Grind series, Southeast XOR, Entrepreneur-In-Residence at UTHSC, Phase II Maturation Grants at UTHSC, and SBIR Training sessions.

In terms of metrics, UTRF has more than doubled its disclosure numbers and licenses executed since 2010. Throughout the decade, UTRF brought in over \$18.68 million in license revenue with a total of 1,392 disclosures and 226 license agreements. Meanwhile, total capital raised by UTRF startups surpassed \$200 million.



"We celebrate our UT faculty, staff, and students for their continued commercialization efforts and achievements over the past 10 years," said Stacey Patterson, UTRF president and University of Tennessee vice president for research, outreach and economic development. "I am proud to lead the UTRF team and look forward to continuing to serve UT through our technology transfer mission into the next decade."





UTRF NUMBERS

UTRF provides the tech transfer services to faculty, staff, and students system-wide.



\$3.8 M Paid to UT Inventors

\$1.3 M Paid to UT Colleges & Departments

~\$5.4 M UT Research Contracts

Due to IP

UTRF FIVE YEAR \$350+ Million TOTAL IMPACT

~\$214 M

Capital Raised by UTRF Affiliated Companies

424 Research Support Agreements

> \$3.5 M Investments in Patent Protection

~\$123 M UTRF's Wholly Owned Subsidiaries' Financial Impact to UT

Patents

477 Filed over the last 5 yrs

> **111** Filed FY20

141 Issued over the last 5 yrs

28 Issued FY20 10% UT Battelle

9% Provisionals

20%

Never Licensed

UTRF Patent Portfolio

Numbers representative of FY2020 period.

19% Previously Licensed 42% Licensed



Supporting the Entrepreneurial Community



SEAK Therapeutics founder Wei Li is a Pharmaceutical Sciences professor at the University of Tennessee Health Science Center and Director of the UT College of Pharmacy Drug Discovery Center. He described the process of founding the company as a steep learning curve, but also a rewarding experience. He is thankful for UTRF's support along the way.



Prototype of the TEL BOXX[™]. Photo credit: Tickle College of Engineering.

"We are proud to help advance UT technology startups that positively contribute to the economic growth of our region. The significant increase in startup numbers for FY 2020 reflect both the hard work of innovators across the UT System and the UTRF licensing staff's dedication to supporting our entrepreneurial community."

- Stacey Patterson, UTRF President

The University of Tennessee has a wealth of innovators across the UT System who are constantly contributing their passions and skills to bring new ideas, goods, and services to the market. Committed to supporting entrepreneurial activity in the region, UTRF provides these innovators with many of the necessary resources to form a startup from UT innovations or intellectual property.

In fiscal year 2020, UTRF assisted in the launch of six startup companies based on UT intellectual property:

Attralus, Inc.

Attralus is a clinical-stage biotechnology company focused on amyloidosis, including novel diagnostics and therapeutics. They are fighting to improve the lives of patients suffering from systemic amyloid diseases such as AL (light chain), ATTR (transthyretin), and LECT2 amyloidosis. Attralus is developing peptide-based immunotherapies and cell therapy that targets phagocytosis of amyloid deposits leveraging the exquisite binding properties of its peptide technology. Attralus' technology has broad applications and the potential to address up to 30 systemic amyloid based diseases.

Azimuth Sleep Solutions, Inc.

Azimuth Sleep Solutions is on a mission to eradicate obstructive sleep apnea. With over 20 years of experience in care of patients with obstructive sleep apnea, the Azimuth team works closely with leaders in the field of sleep medicine and dental science to design products to meet the treatment needs of customers. The team is working to build the future of CPAP mask design.

Endeavor Composites, Inc.

Founded in June 2019, Endeavor Composites, Inc. is committed to a cleaner world by providing a zero-waste solution for fiber and composite manufacturers. Its nonwoven technology can transform any fiber trims, short spools, early production fibers and recycled fibers into a new product to cater to the advanced composites industry. These nonwoven fabrics are guaranteed to be defect-free, perform with excellent quality control, and tailored to specific customer needs.







NPI, Inc.





NPI, LLC

Launched in 2020 by Ryan Yates, a Principal Scientist at the University of Mississippi School of Pharmacy's National Center for Natural Products Research, NPI, LLC is a technologydriven natural product discovery and development company, which leverages its cutting-edge artificial intelligence and machine learning algorithms, along with its deep expertise in natural product chemistry and pharmacology, to assist dietary supplement companies in the development of their botanical innovation pipeline. The company also pursues the development and commercialization of its proprietary botanical ingredients, which includes its SmartCore technology licensed from UTRF.

Tel Boxx, LLC

Tel Boxx, LLC, was formed by two UT alumni Drs. Nima Tamaddoni and Graham Taylor, to further develop and sell a product called the Tamper Evident Box. The TEL BOXX[™] proactively limits hospital exposure to non-reimbursable costs due to patients with a history of IV drug use, who are historically uninsured or Medicaid insured. In collaboration with nurses and UTRF. the TEL BOXX[™] was developed by Dr. Matthew Mench, with key additional contributions to the initial design by Drs. Chad Duty and Matthew Young. The TEL BOXX[™] has been used by 11 hospitals in 8 states. The cost-effective design is the only tamper evidence device that can be used on IV lines while infusing patients.

SEAK Therapeutics

Founded in November 2018, SEAK Therapeutics focuses on advancing drug development for pediatric cancers. In September 2019, the National Cancer Institute awarded the startup with a oneyear, Phase I SBIR grant in the amount of \$299,823 to further develop its current lead compound. In September 2020, SEAK was awarded a second Phase I SBIR grant from the NCI for \$400,000.

Science Over Judgement: Text-based Counseling Application for Young Adults Grappling with Substance Use

At Behavioral Labs, participants struggling with cannabis use disorder or use of other substances enroll in a program where they receive automated, personalized text exchanges. The exchanges occur 16 out of the program's 30 days, lasting anywhere from 5 to 10 minutes. This approach leverages Peer Network Counseling (PNC-txt) technology, an intervention that integrates motivational interviewing and peer network strategies with therapy techniques, to offer young adults an on-demand and effective way to decrease or abstain from substance use.

Dr. Michael Mason, Betsey R. Bush Endowed Professor of Children and Families at Risk in the Center for Behavioral Health Research, developed the PNC-txt technology from his years of experience studying adolescent and young adult substance use treatment and prevention. He also serves as the Chief Research Officer and Co-Founder of Behavioral Labs.

When speaking about the Behavioral Labs' approach, Michael explains:

"We are not in users' faces telling them that cannabis is bad and that they should stop. This program is for people that feel like their cannabis use is starting to run their lives. It's coming from them, having them talk about their own need to change; we are the facilitators in trying to activate their motivation."

To start the transition from lab to market, he enlisted his brother Roy Mason, who has over 30 years of experience at Fortune 500 companies, to serve as the Chief Operations Officer. In turn, Roy brought on fellow business leader Rich Weymer to act as the startup's Chief Executive Officer.







Dr. Ghossein gives an overview of Endeavor Composites.

Endeavors in Advanced Composites: UT Startup Recycles Fibers for Nonwoven Mats

Endeavor Composites has developed an innovative mixer system that can disperse long (1 to 1.5 inches) carbon fibers in water, producing defect-free nonwoven mats for use in fiber-reinforced composites manufacturing — a challenge that researchers have been unsuccessfully attempting to solve for the past few decades. The technology offers numerous advantages over current fiber dispersion techniques and meets a critical need to prevent the waste of scrap and recycled fibers caused by rise in demand for carbon fibers in the composites industry. The technology also addresses the automotive industry's current emphasis on using lightweight materials to increase fuel efficiency, which has larger future implications for the marine and aerospace industries.

After filing an invention disclosure on the technology, inventor Hicham Ghossein worked with UTRF to file a patent application and execute a license to his company. He expressed appreciation for UTRF's support during the entire process, remarking that the team was very helpful and flexible.

He joined ORNL's Innovation Crossroads program, and as a Cohort 3 participant, he outlined two program goals: build a scaled-up machine to process the fabric beyond the current lab-scale production and create a database to validate that he has a working, viable product.

"As scientists and engineers, we want to see our ideas grow and mature," he explained. "No one wants to discover something and see it put on a library shelf. Being in an ecosystem with organizations and programs like UTRF, IACMI, and Innovation Crossroads that help you see your work become significant is a huge value for us."

Commercialization Analysts



"Sometimes the invention disclosures are in fields I essentially have to learn a whole new vocabulary to understand; it's a good challenge. The UTRF staff takes time to work closely with us on complex technologies. They do a really good job and understand that we don't always have experience in the area that we are working on."

Luke Erwin, Multi-Campus Office Intern, 2020-2021



"I applied for the program to gain more patent experience and insight into the inner workings of the commercialization process. My typical workload consists of conducting IP, marketing, and industry analyses Through the internship, I hope to learn more about a future career path in IP law."

Liam O'Donnell, Health Science Center Office Intern, 2020



"Working at UTRF allowed us to see the IP process for technologies from start to finish, not just from a legal perspective. I think getting that extra perspective will be beneficial for a career in many other fields, in addition to IP law."

Dalton Howard, Multi-Campus Office Intern, 2020-2021

UTRF's internship program offers valuable career experience to UT law students, graduate students, and post-doctoral researchers interested in the commercialization process of innovations from the University of Tennessee.

Interns in UTRF's Commercialization Analyst Program work closely with the technology managers, getting an inside look at the progression of innovations, from initial discovery to commercial product. In this program, interns benefit from an approach that merges science with law, business development, and entrepreneurship. They have the opportunity to evaluate intellectual property, conduct market and industry analyses, develop marketing materials, and do targeted marketing.



OUTREACH EVENTS









18 | UTRF DISCOVER 2020





- Volkswagen Group of America, ORNL, and UT announced a collaboration to create Volkswagen's first innovation hub in North America at the UT Research Park at Cherokee Farm.
- UTRF Vice President Maha Krishnamurthy shares with UT College of Law students about the UTRF Commercialization Analyst program.
- UTRF Technology Manager Kusum Rathore speaks to UTK MABE students about the importance of protecting their intellectual property and ways that UTRF can assist in the process.
- **4.** Geetika Singh, UTRF Ximbassador, presents on the Ximbassador program at UTHSC.
- The Commission of Knox County presents Dr. Peter Tsai with an honorary resolution for his contribution to improving global public health and innovations in material sciences.
- 6. Kickoff to the 2020 Memphis Scipreneur Challenge. The nine-week program showcases STEM-related IP and provides entrepreneurship training to teams of students and postdoctoral fellows.
- 7. UTRF Senior Staff Attorney Lakita Cavin and Technology Manager Kusum Rathore presented a Technology Transfer Basics webinar outlining the technology transfer process, services provided by UTRF, and insight into the commercialization of UT innovations.
- Innov865's Startup Day 2020 winners included the Innov865 Crowd Favorite prize, Quantum Lock; the first recipient of the Innov865 Impact Award, N95 mask material developer Dr. Peter Tsai; and the judges' choice, 490 BioTech.
- UTRF Technology Manager Nghia Chiem serves as a judge for Vol Court and poses with the Spring 2020 winners.
- 10. Leaders from the UT Medical Center and OrthoTennessee gather at the UT Research Park at Cherokee Farm to break ground on UT Medical Center's Advanced Orthopaedic Institute.









In each monthly newsletter, UTRF shines the inventor spotlight on a UT faculty member. These features provide an opportunity to support and encourage the inventors who partner with UTRF to bring their innovations to market.

UDAY VAIDYA

Department of Mechanical, Aerospace & Biomedical Engineering (MABE), UTK

Dr. Uday Vaidya serves as the UT/ORNL Governor's Chair in Advanced Composites Manufacturing, the Director of the Fibers and Composites Manufacturing Facility, and the Chief Technology Officer at the Institute for Advanced Composites and Manufacturing Innovation. Throughout his illustrious career, Uday's work has greatly contributed to research and development of engineered polymers, fibers, and composites.

THEREASA ABRAMS College of Social Work, UTK

Dr. Thereasa Abrams, assistant professor of social work at the University of Tennessee, Knoxville, is seeking to improve outcomes for burn survivors. Thereasa's research interests focus on burn patients and how social workers might better meet the needs of survivors in underserved regions of the country. Currently, much of her work focuses on the development of a healthcare app, the Bridge Mobile App for Burn Patients.





TAREK HEWEZI Department of Plant Sciences, UTIA

A professor in the Department of Plant Sciences at the UT Institute of Agriculture, Dr. Tarek Hewezi and his team study parasitic nematodes, with a special focus on soybean cyst nematodes. As soybeans represent one of the largest agricultural commodities in the U.S., this parasite not only endangers soybean farms but poses a threat to agricultural trade and exports. Fortunately, Tarek and his team have identified several novel major SCN resistance genes.



PATTI LITTLE Department of Anesthesiology, UTHSC

The University of Tennessee Health Science Center's Patti Little, MD, assistant professor in the Department of Anesthesiology and physician at Regional One Health, is passionate about science and innovation. Dr. Little spends much of her time caring for extremely ill patients. In this environment, she realized a true need for a device that had only been an idea in her mind for several years.



JEREMY SMITH

Department of Biochemistry & Cellular and Molecular Biology (BCMB), UTK

Dr. Jeremy Smith is a molecular biophysicist who uses the laws of physics and principles of chemistry through supercomputing to understand biological systems. He serves as the UT/ORNL Governor's Chair for Molecular Biophysics and is the director of the UT/ORNL Center for Molecular Biophysics. He currently leads a team using ORNL's IBM AC922 Summit supercomputer to identify promising compounds that may result in a drug to fight COVID-19.

VINCE PANTALONE

Department of Plant Sciences, UTIA

Dr. Vince Pantalone is a professor in the Department of Plant Sciences and project leader for the Soybean Breeding and Genetics Program. He and his team work to develop new soybean varieties with increased disease resistance and higher, better-quality yields for farmers. His research centers on targeting genetically improved germplasm and new cultivars with enhanced productivity, disease resistance, herbicide tolerance, and tolerance to biotic and abiotic stresses.

FENG-YUAN ZHANG

Department of Mechanical, Aerospace & Biomedical Engineering (MABE), UTSI

Dr. Feng-Yuan Zhang seeks to make hydrogen a more viable source for highefficiency energy conversion and storage through his work on nanotechnology and micro-/nano-electromechanical systems (MEMS/NEMS). As a professor of Mechanical, Aerospace and Biomedical Engineering and founder of the NanoHELP Lab at UTSI, he emphasizes the importance of technology integration and interdisciplinary collaborations to create a more sustainable future.

VALERIA VÁSQUEZ

Department of Physiology, UTHSC

Dr. Valeria Vásquez is an associate professor in the Department of Physiology in the College of Medicine at the University of Tennessee Health Science Center. Her research aims to understand the functional and structural basis of mechanosensitive ion channels responsible for touch, pain, and proprioception. Her research career is an inspiring example of dedication to innovation and inclusion.



College of Medicine, UTHSC

While serving as the Robert Kaplan Executive Dean of the College of Medicine and Vice Chancellor for Health Affairs at UTHSC, with a research focus in translational immunology, Dr. Scott Strome is also passionate about entrepreneurship. From providing investigators with unique access to funding opportunities to bringing high-quality jobs to the community, he believes entrepreneurial efforts add considerable value to universities.



Dr. Jonathan Wall, a professor and Director of Research at the University of Tennessee Graduate School of Medicine and Interim Chief Scientific Officer of biopharmaceutical startup Attralus, has made it his mission over the last two and a half decades to study amyloidosis. His team has received over \$10 million in grants from the NIH and contract funding for work that focuses on the development and translation of novel diagnostic and therapeutic reagents for this rare disease.





MICHAEL MASON

Department of Public Health, UTK

Dr. Michael Mason is the Betsey R. Bush Endowed Professor of Children and Families at Risk in the UT College of Social Work's Center for Behavioral Health Research. He studies adolescent and young adult substance use treatment and prevention, along with social and environmental influences on substance use and mental health.



The annual maturation program aims to assist researches in advancing new technologies on the path to market by awarding up to \$15,000 in direct costs to the highest ranking proposals. The program is open to researchers, faculty, staff, and students across all University of Tennessee campuses and institutes.

2020 TECHNOLOGY MATURATION GRANT RECIPIENTS

| Inventors | Technology |
|--|---|
| Deidra J.H. Mountain UTGSM - Department of Surgery | Preclinical Validation of Liposome Delivery System Developed for Gene Therapeutics |
| Xueping Li, Tami Wyatt, Susan Hébert, & Sheila Taylor <i>UTK - HITS Lab (Department of Industrial and Systems Engineering; College of Nursing)</i> | SaaS Provisioning of the Simulated Electronic Fetal Monitoring (SEFM) App |
| Lisa Merritt & Xueping Li UTK - College of Nursing (HITS) | A Pilot Study for the eVisit Simulation App |
| Jillian McCarthy Maeder & Michael Berry UTK - Department of Audiology & Speech Pathology; Department of Computer Science | Vocabulary Coordinator (VocaCoord): A Speech to Text Solution to Accessing Academic Vocabulary |
| Patti M. Johnstone, Kelly R. Yeager, Emily Noss, & Molly Erickson <i>UTK - Department of Audiology & Speech Pathology</i> | Pediatric Auditory Recognition Test (PART) |
| Michio Kurosu UTHSC - Department of Pharmaceutical Sciences | In Vivo Evaluation of a Novel DPAGT1 Inhibitor, APPB, Using Patient-Derived Xenograft Models |
| Frank Park UTHSC - Department of Pharmaceutical Sciences | Cannabinoids and Kidney Injury |
| Jonathan Spagnoli, Jarrod Young, & Tim Jancelewicz UTHSC - Department of Pediatric Surgery; Simulation Center (CHIPS) | An Ultrasoundable Extracorporeal Life Support Training Solution for Team Practices |
| Ryan Meacham, Jake Morris, Joseph Abou- Rahma, & Jake Spurlock UTHSC - Department of Pharmaceutical Sciences | Life Pen Smoking Cessation Platform |



"Once you make a discovery, it can be very difficult to find your way to the market. I would not be able to do that without UTRF's help. It's outstanding. I have never seen any research foundation do what they do. They are very persistent and helpful. I think we are fortunate to have UTRF in this capacity at UT."

- Dr. Tarek Hewezi

PATH TO Market





Above: Dr. Hewezi with lab members.

Top right: Infant Pericardiocentesis Trainer inventor team at UT Day on the Hill.

Bottom Right: Dr. Jonathan Wall and the amyloidosis research team. Photo credit: UT Graduate School of Medicine.



The journey of bringing a technology from initial discovery to the marketplace can be a long and challenging process. Industry landscape changes constantly, and companies consistently raise the bar on the amount of data and de-risking they require prior to licensing. Commercialization occurs in a "learn fast" environment where innovators must be willing to respond to evolving industry needs.

UTGSM Innovators Demonstrate Progress in Therapeutics for Systemic Amyloidosis

A team of researchers from the University of Tennessee Graduate School of Medicine has spent more than two decades investigating systemic amyloidosis, a rare and often fatal disorder with few treatments. Their work played an integral role in moving discoveries out of the lab and into clinical trials, helping launch a biopharmaceutical company focused on improving patient outcomes.

Dr. Jonathan Wall, a professor and Director of Research for the University of Tennessee Graduate School of Medicine, serves as the Interim Chief Scientific Officer of Attralus, a biopharmaceutical startup that seeks to advance transformative therapeutics and diagnostics for systemic amyloidosis. Jon and four team members from the Amyloidosis and Cancer Theranostics Program at UT founded the startup (originally named Solex) in 2011. Spencer Guthrie, CEO of Attralus, joined the team in October 2019 to help secure funding to advance their discoveries and navigate the commercialization process.

Attralus recently announced the completion of its \$25 million Series A financing led by venBio Partners. This funding will allow Attralus to continue to validate its panamyloid imaging agent and advance two therapeutic candidates into clinical development for treatment of amyloidosis.

UTRF helped patent and license Jon and his team's technologies, along with protecting his interests and publication rights. Currently, Attralus has licensed 13 issued patents and patent applications spanning five different disclosures submitted to UTRF between 2010 and 2020.

New License for a UTIA Technology to Fight Billion-Dollar Agricultural Crisis

For Dr. Tarek Hewezi, associate professor in the Department of Plant Sciences at the University of Tennessee Institute of Agriculture (UTIA), a recent research license marks a great accomplishment and lays the groundwork for a potential long-term industry partnership.

Using a novel epigenetic approach, Tarek and his team identified several soybean cyst nematode (SCN) resistant genes, which have shown significant potential to develop disease-resistant plant varieties: a discovery that could save the soybean industry billions of dollars every year. In May 2020, UTRF executed an exclusive option agreement with GDM, a major international soybean genetics and breeding company for Tarek's technology, "Discovery of Major Genes Controlling Soybean Resistance to Soybean Cyst Nematode."



Dr. Wall in his lab.



Genetically engineered soybean plants

The execution of this agreement follows years of diligent research, technology evaluation, and marketing efforts. Since 2013, UTRF has partnered with Tarek to protect his innovations through four invention disclosures, one issued patent, and two pending patent applications. But protecting innovations is only one step in the commercialization journey. Gaining the interest of a commercial partner often requires proactive and targeted efforts; there is no guarantee that "if you build it, they will come." In this case,



Infant Pericardiocentesis Trainer demonstration at UT Day on the Hill.



resistant to soybean cyst nematode.

UTRF and Tarek executed non-disclosure agreements with several companies, conducted four separate marketing campaigns from 2017 to 2019, and contacted 80 individual companies. Tarek also received two UTRF Technology Maturation Grants (2014, 2018), which aim to assist researchers to advance their technologies on the path to market by awarding up to \$15,000 in direct costs to the highest-ranking proposals.

UTHSC Researchers and Practitioners Collaborate to Develop Life-Saving Technology

A new healthcare invention from the University of Tennessee Health Science Center's (UTHSC) Center for Healthcare Improvement and Patient Simulation (CHIPS) in Memphis is a true testament to scientific collaboration and the power of the University of Tennessee ecosystem.

In April 2019, a team of researchers and practitioners debuted an Infant Pericardiocentesis Trainer at the Patent Ductus Arteriosus (PDA) Symposium in Memphis. The team includes Jonathan Spagnoli, lead inventor and CHIPS simulation specialist; Jarrod Young, CHIPS simulation operations lead; Dr. Sandeep Chilakala, associate professor of pediatrics-neonatology; and Dr. Ranjit Raju Philip, assistant professor of pediatrics-cardiology.

The Infant Pericardiocentesis Trainer educates medical professionals in blind or ultrasound-guided infant pericardiocentesis. Pericardiocentesis is the definitive emergency treatment for tamponade, a life-threatening condition caused by fluid accumulation around the heart. The condition rarely occurs, yet when it does, the procedure must be conducted accurately within a matter of minutes. Due to the rarity of the condition, physicians with limited exposure to it might spend much of their career lacking the knowledge or skill needed to perform this life-saving procedure.

Jonathan and the team designed the trainer (which is placed in a baby doll to increase the realistic nature of the simulation) with ultrasound-capable tissue that allows for the option of blind or guided access into the pericardium, the outside membrane of the heart. To make the trainer even more realistic, it features dual chambers with separate fluid ports and colors that provide visual feedback for the trainee. Essentially, if a trainee inserts the needle too far, they would see a different color.

Another vital part of the collaborative process has been UTRF.

"UTRF showed us the potential we didn't know our technology had," Jonathan said.

With UTRF's guidance, Jonathan and the team attended UT Day on the Hill, meeting with state legislators and gaining valuable connections and visibility. The latest Memphis Scipreneur Challenge also featured the technology.

PATENTS FY 2020

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Research Foundation

United States

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of America

 Andrew Samer Sa Samer Sam Samer Sam Samer Samer

ENTED STATES PATENT.

Michelle I. Lee-



Issued Patents 7/01/2019- 6/30/2020

- **10,355,268** Carbon-Metal Oxide Composite Materials and Their Use in Anodes of Lithium and Sodium Ion Batteries
- 10,351,768 Intrinsic and Activated A4BX6 Scintillators
- **10,369,133** Immunosuppresive Compounds and Therapeutics
- **10,372,148** Power System Disturbance Location Determination Based on Rate of Change of Frequency
- 10,371,740 Power System Disturbance Localization Using Recurrence Quantification Analysis and Minimum-Volume-Enclosing Ellipsoid
- 10,381,656 Nanocomposite Electrode Material for Proton Conducting Fuel Cell
- **10,377,945** Mixed Halide Scintillators for Radiation Detection
- 10,390,543 Foaming and Emulsifying Properties of High Pressure Jet Processing Pasteurized Milk
- **10,391,472** Surface-Functionalized Polyolefin Fibers and Their Use in Methods for Extracting Metal Ions from Liquid Solutions
- 10,407,343 Method of Producing Geopolymer Cement Utilizing Desulfurized Red Mud
- 10,440,874 Flex Roller-Crimper for Improved Management and Termination of Cover Crops and Other Plant Material
- **10,441,570** Selective Androgen Receptor Degrader (SARD) Ligands and Methods of Use Thereof
- 10,447,038 Microgrids with Dynamically Configurable Boundaries Including Multiple Main Grid Feeder Coupling Locations and Methods of Operating the Same
- 10,450,610 Single Nucleotide Polymorphisms (SNP) and Association with Resistance to Immune Tolerance Induction

| 10,457,956 | SCN Plants and Methods for Making the Same |
|------------|--|
| 10,470,993 | Tooth Remineralization Compositions and Methods |
| 10,481,120 | Droplet Based Measurement of Specific Capacitance and Interfacial Tensions |
| 10,516,089 | Memory Cell Comprising Coupled Josephson Junctions |
| 10,522,842 | Reversible Bifunctional Air Electrode Catalyst for Rechargeable Metal Air Battery and Regenerative Fuel Cell |
| 10,525,037 | Compounds for Treatment of Cancer |
| RE47838 | Inhibitory Peptides of Viral Infection |
| 10,584,403 | Surface-Hardened Aluminum-Rare Earth Alloys and Methods of Making the Same |
| 10,591,617 | Perovskite-Type Halides and Methods Thereof |
| 10,597,354 | Selective Androgen Receptor Degrader (SARD) Ligands and Methods of Use Thereof |
| 10,598,704 | Universal Grid Analyzer |
| 10,602,951 | Methods of Predicting and Monitoring Labor |
| 10,603,006 | Systems and Methods for Predicting Gastrointestinal Impairment |
| 10,637,293 | Dual-Frequency Mode Transmitter for Wireless Power Transfer |
| 10,646,568 | Targeting Immunotherapy for Amyloidosis |
| 10,654,809 | Selective Androgen Receptor Degrader (SARD) Ligands and Methods of Use Thereof |
| 10,662,148 | Selective Androgen Receptor Modulator and Methods of Use Thereof |
| 10,670,626 | Test Fixture for Observing Current Flow Through a Set of Resistors |

10,676,539 Tissue Plasminogen Activator Antibodies and Methods of Use

Featured Inventors

UT researchers who submitted invention disclosures 7/01/2019 - 6/30/2020.

Aaron Garringer Aaron Wilson Abdelrahman Ali Mohammed Akram Amir Mustafa Saad Alex Ruzicka **Alexander Terekhov** Allen Hailong Lyu Aly Fathy Amalia Laurene Kappel **Amelia Brown** Ammaar Abidi Andrei Cozma Andrew Ten Eyck Andy Miller **Anna Furches Anthony Sheyn** Aria Crysta Deluna Austin Michael Schmidle **Bamin Khomami** Ben Mohr **Benjamin Schwartz Beverly Marie Wesh Bingrui** Li **Bob Moore Brett Compton Brian Canfield Brian Edwards Brian Mendoza** Caen Ang Cameron William Oakley Caroline Placidi De Bortoli **Celeste Pelletier** Chanho Lee **Chao-Yie Yang Charles Bond Charles Melcher Chengwen Zhang** Chujie Zeng **Colleen Jonsson Cong Trinh Curtis Anthony Haley Daelyn Greene Daniel Caleb Rucker** Daniel Joseph Rutstrom **Daranee Versluis Darin Johnston David Anderson David Garcia David Michael Harris**

David Paul Harper Dayakar Penumadu **Deidra Mountain Dibyendu Mukherjee Dong-Jin Hwang** Doug McCaughan **Douglas Aaron Duane Miller Dustin Gilbert Elijah Davis Elizabeth Fitzpatrick Emily Noss Enzo Dinglasan Eric Heidel** Eric Wade **Ethan Patrick Connor** Fan Zhang **Feng-Yuan Zhang** Francisco Gutierrez Frank Park Fred (Fei) Wang Fuhua Li **Gaoqiang Yang** Gary Wilkerson **George Huang George Laggis Greg Lambert** Guannan Zhao Haley Cassandra Dylewski Handong Gui Harley Ashton Dukes Harry Kochat Hassan Almoazen Hatim Kamal Henry Iduoze Henry Yin Holly T. Nielsen Huangqing Xiao Hunter Potter Hunter Rice Hyeongmin Seo Hyo Young Choi Ibrahim Abdullah S Altarjami Jacen Moore **Jack Gotcher Jacob Morris Jacob Spurlock** Jacqueline Johnson







Jake A. Childs







James Evans Lyne James Foster James William Smitherman Jamie Coble **Jarrod Young** Jason Hayward Jayne Wu Jens Gregor Jeremy Smith Jessie Daniel Ringley Jessie Erin Richards **Jianxiong Jiang Jiawang Liu** Jie (Jayne) Wu Jillian McCarthy Maeder Joey Michaud John Larese John Luke Lindsey John Munafo John Sorochan Jon Wall Jonathan Spagnoli Jong-Won Lee Jordan Thomas Suggs Jose Lino Vasconcelos da Costa Joseph Abou-Rahma **Joseph Ramos** Josh Campbell Joshua Sangoro Joy Zhao Juan Luis Jurat-Fuentes Jud Laughter Judith Soberman Julio Cordero-Morales Jun Lee Junming Yue Justin Holt **Justin Rhinehart** K.A. Foyez Mahmud Kaitlin Elizabeth Glynn Karen M. Tobias Ke Nguyen Kellen John Glasscock Kelly Yeager **Kelsie Shea Kenneth Hohmeier** Kenneth Stephenson Kevin Bai Kevin Jiju Mathew **Kevin Michael Smith Kevin Sisco Kevin Staton Kinsie Arnst** Koushik Mondal **Kristen Secora** Kui Li Kyle McLean **Kyle Ross Houston**

Kyley Dickson L. Darryl Quarles Lee Leonard Leon Tolbert Leonard Lothstein Liesel Schneider Lilian Parker Lin Zhu Lisa Merritt Liyan Zhu Luis Romero-Garcia Luis Stand Stracuzzi Luke Miller M. Boyd Gillespie Maged Samir Guerguis Mahul Amin Maria Gomes-Solecki Mariya Zhuravleva Mark Terrell Gragston Mark Whorton Marko Radic Matthew D. Watters Matthew Layne Matthew Mench **Matthias Lorenz** Melissa Clasby Meng Xie Merry Koschan **Michael Cole Thomas** Michael D. Vose **Michael Freeman Michael Gomez Michael Lee Winstead** Michael Liesenfelt Michael Mason **Michelle Lehmann** Mina Fahmy Mina Sartipi **Mitchel Dewayne Horton** Mojdeh Dehghan **Molly Erickson** Monica Jablonski Nader Naghavi Nawajes Mandal **Neal Stewart Neil Hayes Nicholas Ryan Collins Nick Barton** Nick Hysmith Nicolas Raymond Murray Nicole McFarlane Ning Tong Nisha Nair **Owen Phillips Ozlem Kilic** Patricia Little Patti Johnstone **Peiyong Chen**







Featured Inventors 7/01/2019- 6/30/2020

Peter Liaw Peter Tsai Pevton Holman Phil Kreth Piet Jones Preetam Sharma Ramesh Narayanan **Randall Jones Rian Cho** Richard Gerhold Jr. **Richard Grambergs** Richard Lee Sarten **Richard Steiner Robert Garibav** Ruida Hou **Russell Lee Leonard** Ryan Ginder Ryan Meacham Sam Jurek Sam Mattern-Schain Samantha Rose Maness Samuel Dagogo-Jack Samuel Evans Sarbottam Piya Saroj Khanal Scott Lenaghan Scott Strome Shanshan Deng Shantaveer Gangu Shigetoshi Eda Shule Yu Sigun Wang Sophia Elizabeth Sapp Soubantik Palchoudhury Souvik Banerjee **Stephen Andrew Sarles** Stephen Brown Stephen Kania Subhadeep Chakraborty Sungwoo Yang Suresh Babu Susan Hamilton Susan Hebert Tao Fei Tarek Abdel Fattah Hewezi Terry Price Thamarai Ponnusamy **Thomas Patrick Kinsey Tiffany Seagroves** Tim Hodge **Timothy Flerlage Timothy Patrick Mannon** TJ Hollingsworth Tom Berg Toni Wang **Tony Schmitz**

Tyler Mccubbins Uday Vaidya Vahid Disfani Valeria Vasquez Wei Li Weikang Wang Wen Zhang Wenpeng Yu Wes Hines William Penley Davis Xueping Li Yali He Yan Lin Yilu Liu **Ying Yu** Yongtao Liu Yunchao Li Yuntao Wu Zachary Nolan Zane Chapman Zhihao Jiang **Zhiqiang Xie Zhongjie Sun** Zhongzhi Wu Zhousheng Xiao Zibin Guo



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UTRF is a non-profit 501(c)(3) organization that promotes the commercialization of UT intellectual property, encourages an entrepreneurial culture, contributes to state and regional economic development, and promotes research and education to benefit the people of Tennessee and beyond.



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