USF TECHNOLOGY TRANSFER

BIOPARTNERING

Neuroscience

USF Health Neuroscience Institute (NSI)

USF Health NSI is an ambitious concept designed to accelerate progress in the neurosciences by promoting inter-disciplinary collaborations among USF faculty/staff, as well as with partners outside of the university. These varied alliances occur across subject expertise and bridge domains. The USF Morsani College of Medicine with the NSI collaborate with physicians to better understand the connection between research, treatment and prevention.

NSI is comprised of five academic departments and three affiliated centers:

Department of Molecular Medicine

Department of Molecular Pharmacology & Physiology

Department of Neurosurgery & Brain Repair

Department of Neuropsychiatry

Department of Neurology

Byrd Alzheimer's Center

Parkinson's Center

Center of Excellence for Aging and Brain Repair

USF Health Neuroscience Institute (NSI)

Department of Molecular Pharmacology & Physiology

Research projects in Neuroscience investigate central and peripheral nerve function, dysfunction and survival. Current projects include:

- Investigating pathological signaling in neurological disorders including amyloidopathies and tauopathies such as Alzheimer's Disease.
- Targeting the vasculature/microenvironment to reduce neuroinflammation and neurodegeneration in neurodegenerative diseases.
- Linking vascular dysfunction to neuronal and glial injury in stroke.
- Studying the mechanisms underlying visceral pain from the esophagus – identifying the specific types of sensory nerves involved, their connectivity with CNS networks, and their activation by acid and other irritants associated with esophageal pain and heartburn.
- Determining the role of ligand-gated ion channel receptors in the tuning the signal transmission within the CNS, and how structurally diverse general anesthetics modulate the function of these ion channels.

Department of Neurosurgery & Brain Repair

The Center of Excellence for Aging & Brain Repair (CEABR)

The CEABR is focused on basic and transitional research addressing degenerative diseases such as Alzheimer's, ALS, and Parkinson's' and more acute conditions including spinal cord injury and stroke. CEABR is located on the USF-North Campus and maintains ten full time PhD Neuroscience Research Laboratories.

Research includes ongoing work in the Neural Transplantation Laboratory, where various projects are looking into the use of stem cell therapy to treat neurological disorders and disease; and focus on the discovery and development of drugs primarily focused on the Central Nervous System, in the CNS D^3 Laboratory.

Osman Microsurgical Laboratory

Located on Davis Island, the Osman Laboratory is a fully functional laboratory facility offering opportunities for research and various cadaveric dissection. The lab is available to all residents, fellows, and faculty within the department.

USF Health Neuroscience Institute (NSI)

Department of Neuropsychiatry

The Department of Psychiatry and Behavioral Neuroscience's research division emphasizes innovative, interdisciplinary approaches to complement our compassionate clinical care. They maintain several laboratories including the:

- Ann Lowry Murphey Laboratory of Neuroimmunology
- Cognitive and Neurophysiology of Aging Laboratory
- Innovation in Mental Health (iMH) Laboratory
- Laboratory of Alcoholism and Addictions Neuroscience
- Laboratory of Neuropsychopharmacology
- Roskamp Laboratory

Department of Neurology

The USF Department of Neurology is comprised of centers of excellence, all of which are engaging in cutting-edge clinical and translational research.

Centers of Excellence include:

- Amyotrophic Lateral Sclerosis (ALS)
- Ataxia / Cerebellar Disorders
- Epilepsy
- Headache and Pain Medicine
- Huntington's Disease
- Multiple Sclerosis
- Neuromuscular Disease
- Movement Disorders and Parkinson's Disease
- Stroke and Vascular Neurology

USF Health Neuroscience Institute (NSI)

Byrd Alzheimer's Center

The USF Health Byrd Alzheimer’s Institute is a center of hope for people living with Alzheimer’s disease and other neurodegenerative disorders. Founded in 2002, the institute has grown as a multidisciplinary center of excellence at the University of South Florida that provides compassionate family-centered patient care, performs cutting edge research, and delivers quality public and professional education. With a state-of-the-art building and a highly qualified team of researchers, doctors, clinicians, and educators, the institute is at the forefront of Alzheimer's research and care. The institute brings together USF’s successful laboratory and clinical research programs for treating and preventing memory disorders with advanced services for patients and families, creating unique opportunities to discover solutions to better treat, prevent, and cure Alzheimer’s disease.

Byrd Alzheimer's Center and Research Institute at a Glance

Overview:

- Conducting laboratory research to understand the changes in the brain that cause dementia and to develop approaches for the prevention and treatment of Alzheimer's disease
- Conducting clinical trials to test treatments for individuals with all stages of memory loss
- Providing state-of-the-art diagnostic evaluations and the highest level of patient care to individuals with Alzheimer's disease and other memory problems
- Supporting family caregivers by providing educational programs, support groups, counseling, and information
- Providing education and training for healthcare professionals, service providers, and students
- More than 6,000 patient visits per year
- Home to Center for Memory CARE (Clinical Assessment, Research and Education)

Technologies

Investigating the Role of BIN1's SH3 Domain in Alzheimer's Disease

USF Tech ID# 23T146

Overview: Genome-wide association studies have identified Bridging Integrator 1 (BIN1) as the leading susceptibility locus for the development of late-onset AD after apolipoprotein E. AD-associated BIN1 variants are thought to increase its expression. BIN1 is alternatively spliced to form various tissue/cell-type-specific, and ubiquitous, isoforms that engage in multiple cellular pathways including endocytosis, cytoskeletal remodeling, generating membrane curvature, and synaptic transmission.

USF investigators have solved the crystal structure of human BIN1's SH3 domain to 1.6 Å. The KD for BIN1's SH3 domain and FL 0N4R WT Tau identified at 1.136µM, a transient but strong interaction as most SH3 domains bind partners between 1- 100µM. The ultimate goal of this work is to identify small molecule inhibitors against BIN1's SH3 domain to contribute to the development of future therapeutics against Alzheimer's disease.

Effects of CAPE on Fibrinogen-induced Neurodegeneration

USF Tech ID# 23T139

Overview: Elevated levels of fibrinogen (Fg) are found during neuroinflammatory diseases, including traumatic brain injury, resulting in its extravasation and deposition in the brain parenchyma. Caffeic acid phenethyl ester (CAPE) is a specific inhibitor of NF-kB activity.

USF investigators studied the effects of CAPE on Fg-induced upregulation of the pro-inflammatory cytokines and neuronal death through the inhibition of NF-kB activity. The results suggest that CAPE can protect against Fg-induced oxidative damage, cytokine overexpression, and neuronal death through the inhibition of NF-kB, despite the propensity of the interaction of Fg and neurons.

Fenchol as a Stimulator of Free Fatty Acid Receptor and other uses thereof

USF Tech ID# 21B131

Overview: Alzheimer's disease is commonly associated with a high accumulation of amyloid-beta (Ab) and the formation of neurofibrils, leading to neuron death and a decline in memory. The mechanisms surrounding increased Ab formation are not understood, and current therapies targeted towards reducing Ab levels are not successful. This novel method demonstrates that by suppressing free fatty acid receptor 2 (FFAR2) contributes to Ab accumulation. This led to the discovery of Fenchol, a natural compound, being used to decrease AD pathology by activating FFAR2 signaling, preventing progression of the disease.

Advantages:

- Fenchol as a natural compound is easy to produce
- Alzheimer's disease progression can be prevented with activation of FFAR2
- Findings from this technology could be used to study treatment methods of other neurodegenerative diseases

Technologies

Novel Sulfono-γ-AA Peptides as Potential Treatment for Neurological Disease and to Promote Neuron Generation

USF Tech ID# 20A115

Overview: Effective therapies and/or cures for central nervous system (CNS) disorders like Alzheimer's which impose a tremendous socioeconomic burden are currently lacking.

The invention describes the development of a new peptidomimetics. Sulfono-γ-AA peptides take advantage of immense chemical diversity and has been tested for anti-amyloid aggregation activity and neuronal toxicity. The results demonstrated a peptide named 125-6b can inhibit amyloid beta aggregation and also can promote neuron growth. It can also prevent memory impairment on APP/PS1 mouse model. This peptide can be used for any neurological disease treatment and able to fix neuronal damage.

Advantages:

- Could be an effective treatment for Alzheimer
- Might be able to fix neuronal damage and promote neuron growth
- Minimal toxicity thus would minimize the side effects

Novel Fatty Acid Derivates for the Treatment of Neurological Disorders

USF Tech ID# 20B172

Overview: The FK506-binding protein (FKBP51) is an important co-chaperone of the 90 kDa heat shock protein (Hsp90) machinery. Single nucleotide polymorphisms in FKBP5 gene, coding for FKBP51, can combine with stress to elevate FKBP51 levels and increase risk for major depression, post-traumatic stress disorder (PTSD), and anxiety disorders. FKBP51 levels also increase with age and are further elevated in the brains of Alzheimer's disease (AD) patients.

USF researchers have identified three fatty acid derivatives (FADs) that prevent the upregulation of FKBP51 following stress. Thus, ablating stress induced FKBP51 by these FADs or their synthetically modified forms in patient groups with PTSD, AD, anxiety disorders etc. could benefit from this discovery.

UBE3A Gene Therapy for the Treatment of Tauopathies

USF Tech ID# 22A008

Overview: Alzheimer's disease (AD) is a neurodegenerative disease that involves the accumulation of A-Beta proteins and Tau proteins within the brain and leads to cognitive impairments. Accumulation of these proteins can occur in various parts of the brain, causing a decline in synaptic plasticity. Ubiquitin ligase 3A (UBE3A) protein which is critical for normal synaptic function is reduced in AD. UBE3A gene therapy in a mouse model of tauopathy increased the expression of UBE3A protein, decreased tau pathology, and rescued cognitive deficits.

Technologies

Use of Auranofin as an Inhibitor of Atypical Protein Kinase C for Treatment of Neurodegenerative Disorders

USF Tech ID# 21B142

Overview: There is an on-going need for effective treatments for Alzheimer's disease, Frontotemporal dementia (FTD), Parkinson's disease, ALS and other neurodegenerative disorders. A common denominator in these disorders is the activation of the NFkappa-B dependent inflammatory pathway. Auranofin (AF) is used in the treatment of rheumatoid arthritis, can be given orally, and crosses the blood brain barrier.

New research at USF shows that AF blocks aPKC activation by insulin or other factors and prevents the activation of NFkappa-B and inflammation. aPKC controls beta-secretase levels and tau phosphorylation. We seek a pharmaceutical company, as a partner, to study the effectiveness of AF and its potential in treating patients with Alzheimer's disease, FTD and other neurodegenerative disorders.

Advantages:

- Potential treatment for Alzheimer's, FTD, and other neurodegenerative disorders
- Results show that various factors including insulin led to activation of aPKC and the NFkappa-B inflammatory pathway in brain neurons and glial cells
- Auranofin (AF) is an FDA approved drug for other uses, thus relatively easy to conduct studies
- International (PCT) patent application recently filed

Chaperoning Tau Seeding And Propagation

USF Tech ID# 22A028

Overview: Tauopathies are neurodegenerative diseases characterized by the abnormal accumulation and aggregation of tau within the nervous system. Tau pathology develops in a predictable pattern along synaptically connected brain regions due to transcellular propagation of misfolded tau or "tau seeding".

USF investigators have previously shown molecular chaperones regulate and influence aspects of tau aggregation and toxicity through various facets. Recent studies show that molecular chaperones can be used to affect changes in in vitro seeding activity. USF investigators have identified several chaperones that significantly change seeding activity and have confirmed the use of an in vivo seeding model for future studies and are able to assess differences in tau seeding severity and spread of tau seeding.

Technologies

22A057 Transcriptome Profiling of Bin1 Conditional Knockout in a Tauopathy Mouse Model

USF Tech ID# 22A057

Overview: The loss of late-onset Alzheimer's disease risk factor BIN1 expression in forebrain excitatory neurons and oligodendrocytes attenuated hippocampal tau pathology in PS19 tau-transgenic mice. To characterize BIN1 function in tau pathogenesis, USF investigators profiled forebrains of PS19:Bin1-cKO and PS19:Cre (tau pathology) as well as Bin1-cKO and Emx-Cre mice by RNAseq analysis.

Differentially expressed genes (DEG) analysis showed significant enrichment of actin binding, actin filament binding, and calmodulin-binding genes in the PS19:Bin1-cKO transcriptome. The analyses also identified 397 DEGs unique to PS19:Bin1-cKO mice, and only 22% were annotated to neurons and oligodendrocytes, revealing a complex noncell-autonomous response to BIN1 loss in PS19 mice. The gene ontology analysis found two categories: "regulation of immune system process" and "immune response". Together, transcriptomics analyses demonstrate the role of BIN1 in the actin binding function, regardless of tau pathology, and in neuroinflammation, regulation of immune system process, and gliosis in the context of tau pathology.

Split Tau Oligomerization Assay

USF Tech ID# 20B201

Overview: Oligomeric tau species are crucial to induce tau transmission between neurons and toxicity within neurons. USF investigators established a novel technique to measure tau oligomierization via visualizing green fluorescent protein (GFP). Mouse neuronal cells were used as the in vitro model to stably over-express two split superfolder GFP that each fused with a monomeric human tau. Dimerization of tau molecules immediately induce GFP complementation and fluorescence.

The process of tau oligomerization can be visualized by detecting green fluorescence and thus provides a valuable tool for investigating tau oligomer modifying drugs.

Technologies

Neural Stimulation System Including a Microheater

USF Tech ID# 22A128

Overview: Electrical stimulation is the basis for many biomedical devices like cochlear implants, pacemakers, and retinal implants. They are used in treatments to restore muscular and sensory neuron functionality, or to reduce pain. In these systems, current is applied to a desired tissue to effectively stimulate it. Unfortunately, this is not localized as the current will spread through the tissue, limiting the spatial resolution. Thus, an alternative form of stimulation is needed to improve device precision and resolution.

Microheaters is a potential solution to this issue that is more easily integrated with existing biomedical devices. Microheaters produce heat via the Joule heating effect wherein electrical current is run through high resistance materials to output thermal energy. They are highly localized, allowing the stimulated area to be precisely controlled. Also, they can be used in a hybrid stimulation system with traditional electrical current to reduce current spread while maintaining cell integrity. Microheaters could greatly improve the resolution of biomedical devices, aiding the patients who rely on such equipment.

Novel Therapy for Covid-19 Induced Alzheimer and Related Dementias

USF Tech ID# 22A129

Overview: COVID-19 is primarily a respiratory disease; however, neurological symptoms are also reported in a subpopulation of infected COVID-19 individuals with substantially higher rates, up to 84 percent in severe COVID-19 cases affecting an estimated 30 million Americans. For instance, patients with previous severe COVID-19 exhibit a 10-year average drop in their global cognitive performance. Complementary studies combining neuroimaging and cognitive screening implicate COVID-19-induced impairment of the frontal cortex, a critical area for cognitive function.

A multidisciplinary group of investigators at the USF in a series of studies discovered novel targets for attenuation of new-onset Alzheimer's disease (AD). Specifically, this invention provides a method of preventing AD onset following severe COVID using a novel RNA-nanosystem carrying dual (brain and CNS)-targeted dendriplexes (DPX) delivered via the nose-to-brain axis. These DPXs provide the opportunity to combine the payloads producing short hairpin RNAs (shRNAs) targeting neuro-inflammation and/or neurodegeneration.

Technologies

Novel Compounds for the Treatment of Neurodegenerative Diseases

USF Tech ID# 17B152

Overview: Alzheimer's Disease is a complex neurodegenerative condition that afflicts 25 million people worldwide. Current drugs produce minor improvement of symptoms without preventing or reversing AD's progression. Three proteins have been identified in the onset of similar neurodegenerative conditions: amyloid beta peptides, tau peptides, and synuclein. Their aggregation in the brain is related to the onset and persistence of AD, yet no current drugs or therapies target them.

Researchers at USF have identified a potent molecule, HW-C-9, that can disrupt aggregation of Abeta peptides, Tau peptides, and synuclein, and therefore could be used to treat Alzheimer's disease, Huntington disease, and other neurodegenerative diseases. This molecule could be used for the early diagnosis, prevention and cure of the above diseases.

Advantages:

- Treats underlying cause of AD instead of just treating symptoms
- Disrupts the aggregation of AD-causing proteins
- Has the potential to prevent or reverse AD and other related neurodegenerative diseases

Accounting for Affect in Pain Level Recognition

USF Tech ID# 20B182

Overview: Automated pain assessment is an essential component in clinical settings to ensure prompt intervention and appropriate treatment. Depending on the context, relying on verbal methods, such as pain scales and questionnaires, for pain assessment may not be objective, reliable, actionable, and scalable.

The present invention provides a computer-implemented method for identifying a pain level of a patient of interest. The system includes a video image capture device to capture image data of a patient of interest, one or more sensors to capture bio-potential data of the patient of interest, and processing circuitry configured as a neural network that implements a neural network-based model to receive and process the image data and the bio-potential data from the patient of interest to determine a pain level of the patient of interest. This invention provides an improved system and method for the assessment of pain experienced by a patient in a real-world setting.

Advantages:

- Differentiates between pain and non-pain stimuli
- Assesses pain in a real-world setting
- Might help doctors know the criticality of the injury based on the accurate pain measurement
- Will help detect the pain level of babies and unconscious patients

Technologies

Neuro-Voting: A Brain-Computer Interface

USF Tech ID# 22A099

Overview: USF researchers have created a brain-computer interface that enables a person to vote and make selections using only their brain activity, without utilizing any other physical input. The non-intrusive process employing a wearable headset enables users to choose their preferred candidate to vote for. A machine learning algorithm is used by the voting system to categorize brain data and forecast user votes. The system may be set up to synchronize with the user's brain activity to preserve the uniqueness and veracity of each vote (as a mental fingerprint). The benefit of such a method is that it can help elderly people and physically challenged employees who could accidentally cast their ballots. Such a method may be used wherever a decision or a choice needs to be made, such as in window shopping, computer interfaces, MCQ tests, etc. It is not just restricted to voting. These assistive technologies have countless potential applications.

Advantages:

- No physical movement of the body is required, just mental intellect for making selections
- Highly accurate in making the choice, as accompanied by machine learning classifier to improve the performance
- Useful for aged people and with physical disabilities
- Not limited just to voting but finds its application in various day-to-day activities

Technologies

Classification of Brain Cell Proliferation Based on Deep Learning

USF Tech ID# 22A088

Overview: Microglial cell proliferation in neural tissue occurs during infections, neurological disease, neurotoxicity, and other conditions. In common clinical studies, quantification of microglial proliferation requires an extensive degree of manual cell counting by a trained expert, but this approach is subjective, error prone, time- and labor-intensive. Automatic methods are needed such as Machine Learning. Some previous work has been done on the automatic segmentation of these cells at high magnification, but they require a human-in-the-loop in one form or another.

An alternative method has been purposed that uses Deep Learning at low magnification. This method uses an ensemble of snapshots to automatically classify mouse brains as having high or low density of cells based on the classification of images at low magnification with minimal expert time requirement. It has been seen on a novel dataset of 14 mice that this method gives quick and accurate estimates of cell density at low magnification. This approach could potentially benefit a wide variety of studies across the diverse disciplines of neuroscience.

Advantages:

- Minimal expert time requirement
- Solves problem at low magnification
- Provides quick and accurate estimates of cell density

Asymmetrical Bike for Limb Exercise

USF Tech ID# 21B160

Overview: Patients with unilateral limb impairment have difficulty in performing functional limb movements. Current rehabilitation bikes for limb exercise use fixed symmetrical pedaling rates of the legs and hands which limit access for these patients. This invention proposes an Asymmetrical Bike for Limb Exercise (ABLE) which allows the asymmetric pedaling rate between legs or between hands, which may facilitate the recovery of functional walking and arm movements. It provides the ability for a nonconventional user such as an individual with MS, stroke, and/or Parkinson's Disease to exercise and improve their health as it helps them to use both the upper appendage and the lower appendagewhich improves blood circulation.

Advantages:

- Flexible pedaling with adjustable rates
- Facilitates functional limb movements in people with unilateral limb impairment
- Rehabilitative device for people with asymmetrical limb impairment as it helps in therecovery of functional walking and arm movement

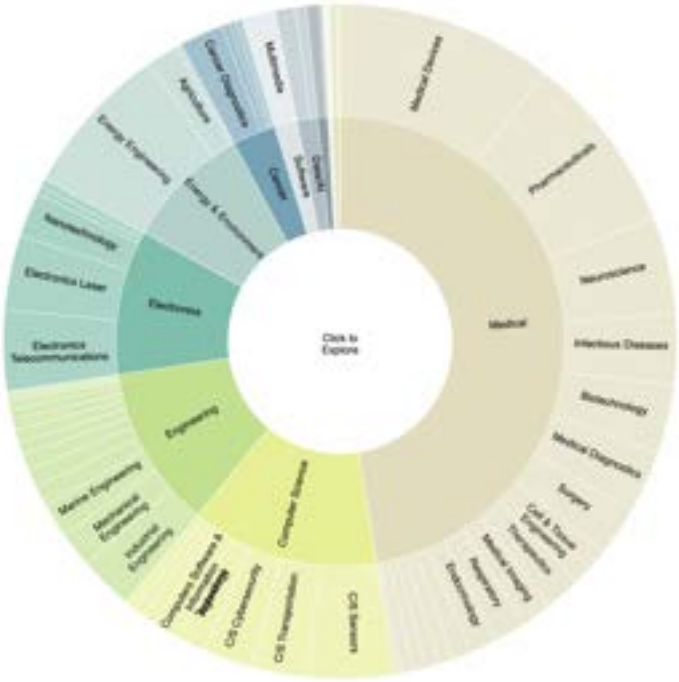
Why Work With USF and the Technology Transfer Office?

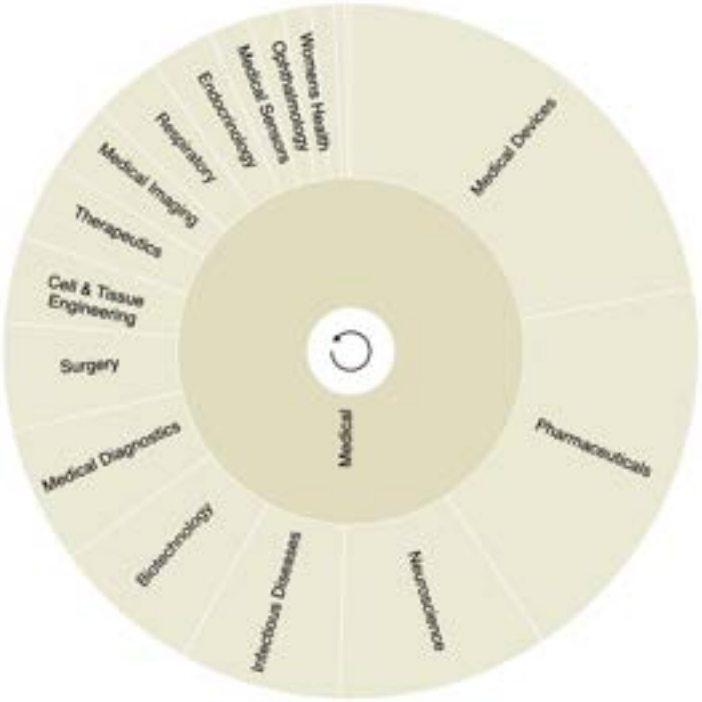
USF Technology Transfer is committed to being the office of choice for our industry partners and envisions a future where every technology is given the opportunity to make a global impact.

- USF ranked 11th among American public universities and 23rd among all universities worldwide in generating new US Patents in CY 2021, according to the National Academy of Inventors (NAI) and Intellectual Property Owners Association (IPO). On a global scale, this is the 10th year USF has ranked in the top 25.
- USF facilitated the formation of 11 new startup companies in FY 2022 (ranking USF in the top 15 percent nationally for facilitating University startups).
- USF executed 99 options & licenses in FY 22 (ranking USF in the top 12 percent for executed agreements). These agreements represent companies that have contracted with USF to further develop research into commercial products and to help bring USF's innovation into the marketplace.
- USF Tampa was ranked #19 among the "Best Universities for Technology Transfer, 2017" by the prestigious Milken Institute.
- USF's innovation and economic development efforts generate more than $582 million in statewide impact.

USF TECHNOLOGY TRANSFER™

USF Technology Wheel





Categories

- Advance Materials 37
- Arts and Humanities 3
- Cancer 44
- Chemistry 10
- Computer Science 116
- Data/AI 13
- Electronics 148
- Energy & Environment 90
- Engineering 77
- ✔ Medical 279
  - Biotechnology 26
  - Cell & Tissue Engineering 15
  - Endocrinology 11
  - Infectious Diseases 28
  - Medical Devices 83
  - Medical Diagnostics 24
  - Medical Imaging 12
  - Medical Sensors 7
  - Neuroscience 37
  - Oncology 4
  - Ophthalmology 6
  - Pharmaceuticals 70
  - Respiratory 12
  - Surgery 19
  - Therapeutics 14
  - Womens Health 5
- Research Tools/Copyright 2
- Software 56

USF Tech Transfer has over 250 technologies in the medical space. To learn more about how we can partner, please contact: ttoinfo@usf.edu

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