Advancing USF Innovation

Life Science Technologies
The University of South Florida (USF) Technology Transfer Office (TTO) was ranked in the Top 20 of American Universities for technology transfer by the prestigious Milken Institute. TTO endeavors to educate and promote innovation, the result of which is products, jobs and technologies utilized in the public interest. TTO’s work allows for a sustained focus on transferring cutting-edge research and innovation to the commercial marketplace, generating revenue and diversifying the economy. USF is the nation’s fifth leading public university in generating new United States utility patents and ranks 12th among universities worldwide in this key measure of innovation, according to the National Academy of Inventors (NAI) and the Intellectual Property Owners Association (IPO). With 116 new utility patents issued in CY 2017, USF continues to stand with some of the world’s most prestigious institutions in the highly competitive arena. USF has ranked in the top 10 among public universities for U.S. patents granted for the past eight years.

The TTO negotiated 127 license and option agreements in FY 2018. This ranks USF in the top 12% of all individually reporting institutions, public and private. 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 facilitated the formation of 10 new startup companies in FY 2018, and has facilitated the formation of 51 startup companies in the last 5 years. USF also set a new institutional record with 206 disclosures in FY 2018.

http://www.usf.edu/research-innovation/pl/
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Conditional FKBP51 Over-Expression Transgenic Mouse

- Human FKBP51 is overexpressed in mice to exhibit depressive behavior
- Provides a new screening tool for therapeutic agents
- Can be used to screen for additional psychiatric disorders, including post-traumatic stress disorder and bipolar disorder
- Live Specimens Available

USF Tech ID# 13A006
Patent Pending

Technology Description:
Researchers at USF have developed a transgenic mouse model that causes the mouse to express depressive behavior. This was accomplished by the addition of a nucleotide sequence encoding human FKBP51 which was integrated into the mouse genome. This model is capable of over-expressing human FKBP51 in the forebrain, which causes the transgenic animal to exhibit depressive behavior.

The mouse model provides a method for studying the effect of a possible therapeutic agent on one or more phenotypes of the depressive–like behavior by comparing the effect to an untreated control animal. This technique offers the potential to improve drug development efforts in the pharmaceutical industry for psychiatric disorders.

Ube3a Rat Model for Angelman Syndrome

- A rat model that lacks the entire Ube3a gene, which is known to cause Angelman Syndrome
- All isoforms and alternative promoters of the Ube3a gene are also removed
- The model may be used for research as well pre-clinical testing of potential therapeutics
- Live Specimens Available

USF Tech ID# 16A060
Patent Pending

Technology Description:
Nearly all cases of Angelman Syndrome result from the disruption of a single gene: UBE3A. USF scientists have developed a rat model of Angelman Syndrome that closely mimics the complete deletion of the UBE3A gene containing region of chromosome 15 found in approximately 70% of Angelman cases. The rat model is completely UBE3A deficient with a genome lacking the entire UBE3A gene (including all isoforms and alternative promoters). This rat model may be used for basic research in regards to the disease as well as applied research for pre-clinical testing of potential therapeutics.
Transgenic Foxc2-tdTomato Overexpressing Mice

- Mouse model to overexpress the Foxc2-td gene via Cre recombinase
- Potential application to resolve genetic defects in lymphatic valve development
- Live Specimens Available

USF Tech ID# 17A097
Patent Pending

Technology Description:
USF researchers have designed a mouse model which has a transgenic construct inserted into the genome to overexpress the gene Foxc2. The construct is designed so that a strong ubiquitous promoter drives the cDNA for Foxc2 and is connected by a P2A linker.

Currently, no widely available mouse models exist to overexpress the gene Foxc2 in a Cre-dependent manner. Foxc2 is a necessary transcription factor for the embryonic development of lymphatic valves as well as for lifelong maintenance of the valve structures. This mouse model may help researchers gain insight into genetic defects of the lymphatic valves.

Sensitively Studying Gene-Gene Interactions Over a Wide Genetic Background

- Uses the CRISPR method to generate novel mouse models
- Allows first-generation mice to be used, which greatly expedites modeling of gene-gene interaction over a wide genetic background
- Eliminates genetic, epigenetic and environmental variations
- Product in Development

USF Tech ID# 14B153
US Patent# 9,974,290

Preclinical Model of Neonatal Necrotizing Enterocolitis

- An animal model to investigate red blood cell transfusions and NEC-like bowel injuries in mouse pups with severe anemia
- Is consistent with the typical course of transfusion-associated NEC in human infants
- Supports the idea that the incidence of NEC in premature infants peaks at a postmenstrual age

USF Tech ID# 17A053
Patent Pending
Sporozoite Cryopreservation Compositions and Methods

- Retains significantly high viability of cryopreserved infective malaria cells
- Applicable towards a whole-parasite vaccine
- Plays a key role in liver stage research
- Is effective for plasmodium research

**USF Tech ID# 18A008**
**Patent Pending**

**Technology Description:**
Researchers at the University of South Florida have developed a novel method to allow harvested sporozoites to be cryopreserved and thawed effectively. This method will allow the sporozoites to retain a significantly high viability and infectivity at 70% or greater, which is a substantial improvement when compared to the current standard. Retaining such a high viability and sporozoite functionality overcomes the limitations presented previously in Plasmodium sporozoite and liver stage research. Sporozoites and other parasitic cells prepared aseptically in this manner are suitable for clinical use as a whole-parasite vaccine and pre-clinical discovery research studies.

Direct Conversion of Human Skin Fibroblast into Neurons Using a Faster and Cheaper Alternative

- A modified protocol to convert human skin fibroblasts into neurons using a readily available medium
- Neurons are directly converted without transition into iPSCs and without the use of neurotrophic factors
- Lower cost and faster conversion method

**USF Tech ID# 15A014**
**US Patent# 9,481,864**

**Technology Description:**
Researchers at the University of South Florida have developed a novel method to obtain neurons from human skin fibroblasts in half the time previously reported. This method uses readily available medium to convert the cells without the complicated and lengthy generation of induced pluripotent stem cells (iPSCs). This method lowers costs and increases time efficiency.

This newly discovered method will be a crucial component in the advancements of ex-vivo assays. It will also expedite personalized medicine approaches for the treatment of Alzheimer’s disease and other neurodegenerative diseases.
Methods and Systems of Detecting Exocytosis of a Target Molecule from a Population of Cells

- A method used to monitor insulin exocytosis at the whole islet level in response to an insulin secretagogue
- High throughput screening
- A less expensive, simple and more sensitive method

USF Tech ID# 15A096
US Patent# 9,739,734

Technology Description:
USF researchers have developed a simple yet sensitive method for high throughput analysis of single pancreatic islet viability and potency using impedance analysis. Impedance analysis of electrical circuits enables separation of resistance and capacitances and characterization of the actual values in the circuit. This method has been successfully utilized to monitor insulin exocytosis at the whole islet level in response to an insulin secretagogue.

This approach could not only be used as an industry standard for assessing and sorting human islets prior to transplantation, but will also advance islet transplantation procedures and explorations for treatments of diabetes by monitoring functional release of insulin from single islets.

Harmful Algal Bloom Mitigation by Induction of Programmed Cell Death

- A method for controlling algal blooms via induced apoptosis
- Suitable for any type of aquatic medium (marine, freshwater, brackish & artificial)
- May be used as a preventative measure for harmful algal blooms

USF Tech ID# 09A050
US Patent# 8,476,196

Technology Description:
University of South Florida inventors have developed compositions and methods for controlling harmful algal blooms. These compositions induce apoptosis in the harmful algae blooms, ultimately terminating them. The invention comprises of nitric oxide donating compounds, other algaecidal agents, and PCD inducers which can be an agent or treatment that induces the apoptosis pathway in the algae. This invention is applicable as a preventative measure or treatment option. It can be used for any type of aquatic medium (marine, freshwater or brackish) and it is also applicable to an artificial environment such as an aquaculture system, aquarium, field sample, filter media, pool etc.

The results of a Karenia brevis culture with 100 mM of nitric oxide.
Molecule that Inhibits STAT3 Activation: Development of a Phospho STAT3 Cytoblot High Throughput Assay
- A method for the treatment of tumors and cancerous tissues
- Prevents tumorigenesis and malignant transformation through the modulation of STAT3 intracellular signaling
- Anti-tumor activity demonstrated in-vitro and in-vivo

USF Tech ID# 01A026
US Patent# 7,998,947 & 8,691,799

Novel Methods for the Staining of Fungi and Protozoa: Development of Staining Kit
- Methods are applicable to fungal and protozoan detection in both environmental and biological samples
- Techniques are rapid, specific and sensitive methods
- Applicable as a routine detection test

USF Tech ID# 02A034
US Patent# 7,745,168; 7,157,242 & 8,609,365

Detection of Florida Red Tide Organisms by Nucleic Acid Amplification
- Quick identification via real time PCR
- Reliable bloom prediction
- Potential adaptation to a mobile design

USF Tech ID# 02B088
US Patent# 7,700,278 & 8,003,778

A Method for the Detection of Polyketide Synthetase Gene Expression in Karenia brevis (Red Tide)
- A rapid and specific detection of the existing toxin-producing genes of the Florida Red Tide Organism
- Ability to predict fish kills
- Determination of relative virulence

USF Tech ID# 05B070
US Patent# 7,422,857 & 7,888,031

Column based collection, enrichment, and detection of microsporidia from 100μL of blood
### Method for Controlling Microbial Cells for Separation
- May improve the performance of bioreactors by removing contaminants or enriching microbes
- Unlike antibody based separation, this technology has an unlimited shelf life and is reusable
- May be used with a variety of environmental samples

USF Tech ID# 06A014  
US Patent# 8,795,498

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### Molecular Detection and Quantification of Enterococci
- A method for rapid detection and quantification of fecal bacteria responsible for human recreational water illnesses (RWIs)
- Uses acid sequence based amplification (NASBA) to amplify ribonucleic acid (RNA)
- Rapid detection with high sensitivity and precision
- Reduction in false negatives

USF Tech ID# 06A039  
US Patent# 7,947,441

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### Barrier-Permeable Proxy Reporter Analysis
- Utilizes molecular tags that target a desired molecule, cell or particle and can then report the presence of the target without interferences from the environmental media
- Gives the detector the ability to remain in its preferred configuration
- Keeps the environmental media isolated

USF Tech ID# 06A054  
US Patent# 7,879,622

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### Enantioselective Bronsted Acid-Catalyzed Ring-Opening of Aziridines
- Excellent enantioselectivity
- Can be completed in an environmentally benign set of conditions
- Potential application in preparation of pharmaceuticals

USF Tech ID# 07A029  
US Patent# 7,799,934
Enhanced Formation of Extracellular Matrix by Overlayering Cultured Cells with a Volume Exclusion Agent
- Increases the formation of collagen fibrils and extracellular matrix
- Allows for higher tensile strength and better structural integrity of the cells in culture
- Yields a more normal cell topography in the bioengineered tissue

USF Tech ID# 08A052
US Patent# 8,623,646

ATP Bioluminescence Immunoassay
- Can determine viability of specific bacterial contaminants in food products, beverages, and public water sources
- A reliable procedure that can be completed in one hour
- Minimal or no sample pre-treatment involved
- Plate or dipstick formats

USF Tech ID# 09A010
US Patent# 8,518,658 & 9,116,151

Capture Antibody Targeted Fluorescent In-Situ Hybridization (CAT-FISH)
- Accommodates various fluorescence requirements
- Allows multiple combinations of probes and antibodies
- Is an inexpensive kit that utilizes inexpensive and commercially available reagents

USF Tech ID# 10B092
US Patent# 9,714,943

QmiR, A Computer Program for Designing PCR Primers for UQmiR miRNA RT-qPCR Assay
- Primers can be designed for specific miRNAs and for miRNA amplification
- Can handle thousands of miRNA sequences at once
- Ensures specificity when using miRNAs in a research setting

USF Tech ID# 11A031
Patent Pending
Blue Collagenase Assay
- Measures both soluble and insoluble cell or tissue-associated collagenase activity
- Stains lyophilized collagen in its native state without solubilization by acid and/or gelling by heat
- Allows for qualitative observation of collagenase activity and quantitative activity via a spectrophotometer
- Can also be used to analyze metallo-proteinases in humans and other animals

**USF Tech ID# 13A062**
Patent Pending

Fragment Evolution via Kinetic Target-Guided Synthesis for the Identification of Potent Bcl-2 Modulators
- Rapid identification of modulators of protein-protein interactions
- Applicable to any undruggable targets such as protein-protein interaction targets or protein-DNA/RNA interactions
- Applicable to the pharmaceutical, biotechnology, and drug design industries

**USF Tech ID# 13B140**
Patent Pending

Universal qPCR Duplex Detection of mRNAs and miRNAs
- A multiplexed RNA Quantitative PCR Assay
- Simultaneous detection of one or more microRNA species and/or one or more messenger RNA species from one or more samples
- Four PCR reactions can be performed in one well
- Reduction in cost, time and experimental errors

**USF Tech ID# 13B164**
US Patent# 10,030,263

CRISPR Cloning Technique
- A CRISPR/Cas9 technique combined with the homologous recombination technique
- Can be used to modify an existing construct into a large vector seamlessly
- Efficiently shortens cloning time

**USF Tech ID# 14B124**
Patent Pending
Efficient CRISPR Knock-in
- High knock-in efficiency of HDR without NHEJ inhibitors
- Ability to knock-in large fragments with the absence of undesirable bi-allelic knock-ins
- High survival rate of zygotes
- Low toxicity and cost

USF Tech ID# 15B127
Patent Pending

Site-Directed Mutagenesis without Polymerase Chain Reaction
- Small DNA fragments can be cloned seamlessly into a vector without using the PCR technique
- Allows for simple and seamless mutagenesis with high efficiency
- Could be combined with the CRISPR/Cas9 technique

USF Tech ID# 16A036
Patent Pending

A System and Method for Nonlinear Time-to-Event Statistical Data Analysis
- An innovative nonlinear hybrid dynamic model for survival data analysis
- Determines both the size and location of changes in hazard rate with certain degree of confidence
- Applicable to a multitude of fields

USF Tech ID# 17B124
Patent Pending

Conversion of Octolig ® to a Lithium-Ion Control Agent
- Significant lithium ion removal of greater than 99% using column chromatography, Octolig®, and Tetrahydrofuran (THF)
- Possible lithium extraction from various materials
- Effective in multiple research methods

USF Tech ID# 17B178
Patent Pending
Sensor Apparatus for In Situ Analysis of Chemical and Biological Species

- A submersible, self propelled apparatus
- Provides an improved method to analyze a component contained in a liquid or fluid medium in situ or in an on-site situation
- Capable of measuring large volumes of fluids without a pumping system and utilizes a highly-sensitive contaminant assay system

USF Tech ID# 02B081
US Patent# 8,557,183 & 8,603,395

Magnetic Metabolite Transfer Disks and Diagnostic Transfer Disks

- Used for the transfer and identification of microbial species and their metabolites
- Could be adapted as a bandage or wound dressing
- Has the potential to be automated for industrial use

USF Tech ID# 07B144
US Patent# 8,697,437

Two Stage Acoustic Microfluidic Microparticle and Cell Separation System

- Continuous microparticle and cell separation using surface acoustic waves
- Biological samples are handled gently with no physical contact between the ultrasonic transducer and the medium
- The use of the sheath flow for positioning is not required

USF Tech ID# 10B132
Patent Pending

Development and Testing of Hyperbaric Atomic Force Microscopy (AFM) and Fluorescence Microscopy for Biological Applications

- A custom-designed hyperbaric chamber tested with AFM and fluorescence microscopy allows researchers to study the effects of hyperbaric gases on biological preparations
- Enables remote operation of instrumentation under hyperbaric conditions
- Allows for vibrational isolation and temperature regulation

USF Tech ID# 11A076
Patent Pending
Membrane-Integrated Microfluidic Device for High-Resolution Live Cell Imaging Fabricated via a Novel Substrate Transfer Technique

- Allows for high resolution images on either side of the membrane in a tissue mimetic environment
- Continuous perfusion of necessary nutrients and gasses
- Can be adapted to any membrane-based cell culture which requires high resolution imaging screening methods

**USF Tech ID# 12A045**
**Patent Pending**

Microfluidic Device for Generating Neural Cells to Simulate Post-Stroke Conditions

- Generates normoxic, anoxic, and hypoxic environments *in vitro* to replicate the *in vivo* conditions that occur during an ischemic stroke
- Allows for precise control over input parameters (drug candidates, cytokines, etc.)

**USF Tech ID# 12A047**
**US Patent# 8,912,006 & 9,632,076**

Auto-Regulation System for Intraocular Pressure

- A wireless device for continuous pressure monitoring
- Eliminates manual sampling of pressure
- Allows complete control of the specific input parameters
- Reduced time and increased sample rate

**USF Tech ID# 12A082**
**US Patent# 9,022,968 & 9,314,375**

High-Throughput Platform for Bioprinting Tissue Modules

- Versatile platform for complex tissue formation
- Maintains cell morphology in tissue modules during assembly of 3D structures
- Integrates into existing 3D printing systems

**USF Tech ID# 14B171**
**Patent Pending**

A diagram of the high-throughput bioprinting platform.
Continuous Wireless Powering of Moving Biological Sensors
- Can deliver a constant power supply
- Eliminates power related drifts and their corresponding recalibration procedures
- Increased data resolution and decreased size

USF Tech ID# 15A052
US Patent# 10,027,179

A Mouse Dissection Device Expediting Sample Collection
- The simplified multilayer structure accommodates a wide range of animal sizes
- Durable structure and easy clean-up design
- Allows for expedited sample collection from small animals

USF Tech ID# 15B170
US Patent# 9,622,842

Polymer Gradient Creation System
- Allows the creation of complex gradients of multiple polymer or liquid components
- Components such as nanoparticles or cells can also be imbedded into the polymer matrix
- Allows for high accuracy and control

USF Tech ID# 17A019
Patent Pending

Single-Cell Develop-and-Capture Microfluidic Devices and Methods of Use
- Performs a single cell omic analysis on a chip
- Is able to track a single stem cell’s development and lineage
- Sequences three generations of progeny cells
- Applicable towards cancer and regenerative medicine research

USF Tech ID# 17A074
Patent Pending
Supramolecular Assemblies and Building Blocks

- Simple and highly modifiable materials
- Greater potential for the prediction, design, and synthesis of the network topology of a framework based on a singular network topology
- Potential application in areas focused on carbon dioxide capture, methane storage, gas separations and drug delivery

USF Tech ID# 07B130
US Patent# 8,034,952

Technology Description:
Researchers at USF have invented a novel approach to unequivocally design functional porous materials based on hierarchical bottom-up assembly utilizing targeted supermolecular building blocks (SBBs). These building blocks provide a greater potential for the prediction, design, and synthesis of the resultant network topology of the constructed metal-organic, or covalent-organic frameworks.

This invention also provides corresponding designed ligands that can be used as monomers in the preparation of SBBs and the triangular molecular building blocks (MBBs). The dual composition of these materials and their extra-large cavities offer great potential for their use in areas such as separation, controlled release and/or sequestration of gases, chemosensors and drug delivery.

Polypeptide Electrospun Nanofibrils of Defined Composition

- Homogeneous nanofibers made of pure synthetic polypeptides
- Have increased stability through crosslinking
- Are biodegradable by enzymes over time
- Possible applications include surgical sutures, wound dressings, tissue engineering scaffolds, medical textile materials and drug delivery depots

USF Tech ID# 09B135
US Patent# 9,428,849

Technology Description:
University of South Florida researchers have developed homogeneous nanofibers made of pure synthetic polypeptides. These materials have physical, chemical and biological properties that make them advantageous for replacing traditional materials in medicine and tissue engineering. Biocompatible and bio-absorbable materials are needed to help minimize the foreign-body response that often occurs during surgical procedures. These biomaterials are also biodegradable by enzymes over time.
3-Trifluoromethyl-3-Aryldiazirine Photolabels with Enhanced Ambient Light Stability

- A successfully synthesized ambient-light stable photolabel
- Enhanced ambient light stability and aqueous solubility
- Enhanced photo-affinity labeling could help to introduce chemical probes into drug discovery, identifying new drug targets and molecular interactions

**USF Tech ID# 16A024**
**US Patent# 10,067,136**

**Technology Description:**
Researchers at USF have successfully synthesized an ambient-light stable photolabel without compromising the photoactivated insertion reactivity. The photolabels, synthesized with 3-trifluoromethyl-3-aryldiazirine, have allowed researchers to overcome the many obstacles of traditional photolabel techniques, including cumbersome synthesis, instability to ambient light conditions, and limited aqueous solubility.

This invention will enhance photoaffinity labeling thereby furthering its applications. Such applications may include drug discovery and the identification of new drug targets and molecular interactions.

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**Imparting Amphiphobicity on Single-Crystalline Porous Materials**

- The amphiphobic porous materials resist all kinds of liquids but allow the adsorption/permeation of gases
- Exhibits superhydrophobicity, oleophobicity, high crystallinity and intact porosity
- Applications in a variety of fields such as microelectronics, medicine and military

**USF Tech ID# 16B177**
**Patent Pending**

**Technology Description:**
Researchers at the University of South Florida have developed a method to impart superhydrophobicity or amphiphobicity on porous materials while still maintaining gas permeability. This property is a pioneering invention to protect crystalline porous materials under various chemical environments. The treated porous materials resist all kinds of liquids, but allow the adsorption/permeation of gases. These materials may have many important applications in a variety of fields such as microelectronics, medicine and military.
Polyhedral Cage-Containing Mesoporous Metal-Organic Frameworks as Platform for Biocatalysis
- Enhanced activity and greater stability of the immobilized enzyme in comparison to current technologies
- High surface area, structural versatility and solvent adaptability
- Various biocatalysis applications in chemical, pharmaceutical and food industries

USF Tech ID# 11A083
US Patent# 9,404,105

- Simple and highly tunable
- Made-to-order Metal-Organic Frameworks with potential in carbon dioxide capture, methane storage, and gas separation
- Wide range of applications in catalysis, magnetic materials, semi-conducting materials, chemosensors, and biosensors

USF Tech ID# 11B117
US Patent# 9,139,599

Nano-Scale Faceted Polyhedra
- Chemical robustness and diversity allow the technology to be made from magnetically and catalytically active metals
- Contains internal and external cavities suitable for encapsulating organic or other chemical species
- Applications include areas of liquid crystal technology, magnetic devices or applications, and drug delivery as adjuvant or carriers

USF Tech ID# 01A012
US Patent# 6,965,026

Synthetic Elastic Polymer/Collagen Fibril Biocomposite for Artificial Tissue Design
- Combines biotic and abiotic material for artificial tissue replacement surgeries
- Decreases the risk of an autoimmune response
- Decreases the risks of post-operative infection at the site of implant

USF Tech ID# 06B095
US Patent# 8,093,027

Polyhedral Cage-Containing Mesoporous Metal-Organic Frameworks as Platform for Biocatalysis
- Enhanced activity and greater stability of the immobilized enzyme in comparison to current technologies
- High surface area, structural versatility and solvent adaptability
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- Wide range of applications in catalysis, magnetic materials, semi-conducting materials, chemosensors, and biosensors

USF Tech ID# 11B117
US Patent# 9,139,599

The prototypal nanoscale faceted polyhedron that is based upon a small rhombiheaxahedron.

Control collagen fiber
Nanoparticle treated fiber

3.9 nm and 4.9 diameter cages in Tb-meso Metal-Organic Framework.

A scheme representing the various layered MOF (side view) pillaring techniques using exemplary ligands.
Peptide-Based Materials
- Novel bio-inspired polymeric materials made of random polypeptides of known amino acid composition
- Cost efficient and highly practical
- Potential application in the materials manufacturing niche
- Eliminates unnecessary consumption of non-renewable resources, therefore reducing non-biodegradable waste

**USF Tech ID# 12B157**
**US Patent# 9,932,443**

Tantala-Based Sorbent for Online/Offline Extraction and Preconcentration of Catecholamine Neurotransmitters as Well as Other Chemical Species
- Provides excellent pH stability (pH 0-14)
- Could be used to investigate a wide range of analytes including catecholamine neurotransmitters, nucleotides and nucleosides
- Allows for a desorption efficiency of > 95%

**USF Tech ID# 17A100**
**Patent Pending**

Kate Bishop, J.D.
kbishop6@usf.edu

Terri B. Hunter, Ph.D.
tbhunter@usf.edu

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