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Agriculture and Animal Sciences

1 Crop Resistance to Nematodes (11UMC002)

Parasitic nematodes that attack the roots of plants are estimated to cause an annual worldwide crop damage of over $100 billion. Crops resistant to nematodes are therefore of great economic interest. The current invention developed by researchers at the University of Missouri-Columbia is a genetic approach to make plants resistant to infestation from cyst nematodes attacking soybean, corn and potato. The nematodes secrete effector proteins in order to connect with the plant's root cells, and plants lacking the receptors these effector proteins interact with have increased nematode resistance. Disruption of the plant receptors did not result in obvious changes to root growth in the plant and can be employed to develop a novel management tactic to reduce cyst nematode parasitism of crop plants. PATENT STATUS: Patent application submitted. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

2 Crop Yield Loss Prediction from Aerial Images (06UMC025)

Crop production is increasingly becoming dependent on technology to maximize crop yield at minimum cost and labor. The current invention developed by researchers at the University of Missouri-Columbia is a technology that will predict crop yield loss potential due to N deficiency at mid-season. Predictions are provided in actual yield units to allow corn, wheat, rice, cotton, and potato producers to assess economic loss and make sound business decisions about mid-season fertilizer application. This technology can also be used to produce applicator-ready N rate maps, with higher rates where more stress is seen and more yield response is expected. Producers will be able to maximize the crop's yield potential with minimum labor and fertilizer inputs. PATENT STATUS: Patent application submitted. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

3 Engineered Minichromosomes in Plants (06UMC042)

The use of genetically modified crops is constantly finding new areas of application, including the production of compounds with therapeutic value. Current technology for producing transgenic crops relies on random integrations that can have variable expression and could potentially disrupt the endogenous genes. The current invention developed by researchers at the University of Missouri-Columbia is a technology that will allow continued addition of transgenes as the need arises using engineered plant minichromosomes. Artificial chromosome platforms were produced by telomere-mediated truncation while simultaneously adding DNA sequences that will permit amendments to the chromosome indefinitely. These minichromosomes can be used as a vector for efficient stacking of multiple genes for insect, bacterial and fungal resistances together with herbicide tolerance and crop quality traits unlinked to endogenous genes in a circumstance that would foster faithful expression. PATENT STATUS: Patent application submitted. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553

4 Enhancing Plant Water-Use Efficiency an Drought Tolerance (08UMS003)

Terrestrial plants experience water deficits under different growth conditions, such as drought and high salinity. Researchers at the University of Missouri-St. Louis and the Danforth Plant Science Center (Wang et al) found that membrane lipid-metabolizing enzymes and lipid mediators play pivotal roles in plant water usage and drought tolerance. We have discovered a bifurcating signaling pathway that mediates stomatal movement and water loss. Fine-tuning the approach has the potential to increase water-use efficiency, as measured by the marketable crop, such as seeds or biomass, produced per unit volume of water. We have also identified genes that promote root growth in response to water deficits. Manipulation of these genes improves plant growth under drought and high salinity. Also, alteration of these genes results in changes in flowering time under drought. Our studies indicate that some membrane-based regulatory processes are a key integrator of stresses for optimal plant growth in response to drought/nutrient stresses. Manipulation of these processes can increase biomass production via improved water-use efficiency/drought tolerance. CONTACT INFO: Tamara Wilgers; wilgerst@umsl.edu; 314-516-6884.

Genetic Modifications Causing Phenotypic Sex Reversal (08UMC074) 5

The practice of achieving improvements in animal production through breeding selection has been used in the swine industry for many years. The current invention developed by researchers at the University of Missouri-Columbia provides a more advantageous and faster method than line breeding to produce animals with general combining ability to be used for outcross. The utilization of this invention will allow the production of fertile sex-reversed male or female mammals that are nearly genetically identical to the founder animal. Additionally, the technique can be utilized to propagate an individual whose genetic traits are so unique or rare that they cannot be easily line-bred without compromising the trait combinations present or absent in the founder. PATENT STATUS: Patent application planned. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

Inhibitor Suppresses Foot-and-Mouth Disease (FMD) (10UMC015) 6

Foot-and-mouth Disease Virus (FMDV) is a positive stranded picorm avirus which can infect cloven-hoofed animals, such as cattle, pigs and sheep, and lead to severe losses in livestock production. The delay in eradication or control of FMD is associated with billions of dollars in potential economic losses. The current invention, developed by researchers at the University of Missouri-Columbia is a small molecule that inhibits the RNA polymerase activity of the FMDV 3Dpol. The molecule has demonstrated the suppression of virus production in FMDV-infected cells and is a strong candidate for the development of alternatives or supplementary options to contain future outbreaks of Foot-and-Mouth Disease. PATENT STATUS: Patent application filed. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

A method and apparatus for plant drought stress measurement (10UMC013) 7

Physiologically based drought stress evaluation is necessary for optimal, sustainable plant production. However, effective measures and technologies are lacking in the current market. In this invention, a method and an apparatus are provided to measure water deficiency (drought) by assessing the primary physiological function of water, electron donation in photosystem II. Delayed fluorescence is measured and its dependence on the availability of electron donors (water) is modeled and analyzed. The methodwas validated experimentally with drought-stressed plants. The method and apparatus developed at the University of Missouri-Columbia does not require so many inputs because it does not estimate the amount of water – it measures the availability or deficiency of water by analyzing the primary function of water directly. PATENT STATUS: Patent application submitted. CONTACT INFO: Wayne McDaniel; mcdanielwc@missouri.edu; 573-884-3302.

Portable Solar Sanitizer for Human and Animal Waste (11UMC023) 8

Five million individuals, primarily children, die each year from diarrheal diseases transmitted by drinking water that is contaminated with fecal pathogens. The current invention, developed by researchers at the University of Missouri-Columbia, is a solar sanitizer that uses passive solar energy to disinfect human and animal waste and reduce the transmission of diarrheal diseases. The device can be operated with a minimum amount of instruction and can either be constructed locally from recycled materials or manufactured commercially. Once the waste has been disinfected it can be safely disposed of or used as a source or nitrogen rich fertilizer. PATENT STATUS: Patent application planned. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

Predicting and Increasing Feed Efficiency of Livestock (06UMC013) 9

The efficiency that animals convert feed into cellular energy for maintenance and tissue accretion has a major impact on production efficiency and profitability. The more efficiently animals convert ingested feed into cellular energy, the more work the animal would be expected and perform, and the more efficiently feed will be converted into body mass. The current invention developed by researchers at the University of Missouri-Columbia is a simple blood test that ranks an animal within the population as high, mid, or low in feed efficiency. The invention provides a tool to identify animals that are genetically superior in feed efficiency and spur developments that later increase the feed efficiency. PATENT STATUS: US patent allowed. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

10 Production of Transgenic Plants with Increased Seed Yield (03UMC029)

In an increasingly competitive agricultural market, the development of crops with increased seed yield is of great economic interest. The current invention developed by researchers at the University of Missouri-Columbia is a method to make transgenic plants of Arabidopsis thaliana with a 33% increase in the number of seeds per plant. The plants have three carpels instead of two, but are otherwise normal and the seeds are of normal size. We believe that the method can be used to increase the seed yield of commercially valuable crops of the Brassicaceae family, and particularly rapeseed/canola. PATENT STATUS: US patent. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

Life Sciences

11 Breast cancer treatment using RNA binding proteins (10UMC005)

Human breast cancer is broadly divided into two different subtypes: estrogen receptor positive (ER+) and estrogen receptor negative (ER-). The majority of women with breast cancer are ER+ (85%). Patients with ER+ breast cancer can be treated with the drug tamoxifen, but for unknown reasons, many of them develop drug resistance. In contrast, there are no specific treatments for women who are ER-. These patients are usually treated with surgery and chemotherapy, but the tumor eventually recurs resulting in the death of the patient. The current invention, developed by University of Missouri-Columbia researchers, alters the expression of breast cancer genes at the posttranscriptional level which can block tumor growth by over 90% in difficult to treat breast cancers. PATENT STATUS: Patent application has been filed. CONTACT INFO: Paul Hippenmeyer; hippenmeyerp@missouri.edu; 573-882-0470.

12 Cell Lines for the Study of Bone Formation and Regulation (10UMK007)

University of Missouri-Kansas City researchers have developed novel cell lines that are useful in the examination of osteocyte function, biomineralization, SOST/sclerostin, FGF23 and other mechanisms of osteoblast-to-osteocyte differentiation. The two cell lines were isolated from long bone of a mouse that was generated by crossing the Immortomouse® with a mouse where the DMP1 promoter drives expression of the GFP. One of the cell lines, IDG-SW3 (SW3), expresses all of the markers of osteocytes including Dmp1-GFP, Dmp1, E11/gp38, SOST/sclerostin, and FGF23. The second cell line, IDG-TI (T1), mainly expresses the characteristics of the matrix producing osteoblast such as high alkaline phosphatase, with delayed expression of Dmp1-GFP and E11/gp38, but no expression of SOST/sclerostin or FGF23. Both cells will produce new bone *in vivo*. PATENT STATUS: Patent application has been filed. CONTACT INFO: James Brazeal, brazealj@umkc.edu; 816-235-5091.

13 Late Osteoblast/early Osteocyte-like Cell Line for Visualizing Collagen Assembly in Living Cells (11UMK002)

University of Missouri-Kansas City researchers immortal cell lines representing the late osteoblast/early osteocyte phenotype that stably express a collagen-GFP or collagen-mCherry fusion protein to fluorescently label type I collagen fibrils either red or green. These novel cell lines allow visualization of collagen fibril assembly in living cells over time, which is not possible with existing technologies. PATENT STATUS: Patent application has been filed. CONTACT INFO: James Brazeal, brazealj@umkc.edu; 816-235-5091.

14 DNA Methylation Biomarkers for Rare Cancer Cell Detection (08UMC040 and 09UMC073)

University of Missouri-Columbia researchers have developed a universal cancer diagnostic kit for detection of occult circulating tumor cells (ctcs) at early state of cancer development can be generated from our newly developed Multiple Methylation Sensitive Enzyme Restriction-PCR conjugated a panel of tumor-specific DNA methylation biomarkers. Detectible malignancies include hematopoietic tumors, carcinoma and melanoma. This novel invention can not only save lives from early detection and diagnosis, but also improve the quality of life in diagnosed cancer patients during the entire course of medical treatment. PATENT STATUS: Patent application filed. CONTACT INFO: Paul Hippenmeyer; hippenmeyerp@missouri.edu; 573-882-0470.

Method for Producing Biocompatible Glasses that React to Form Biologically Useful Materials (10MST026) 15

Missouri University of Science and Technology researchers have developed a method for controlling the calcium compounds that form when a bioactive glass reacts with bodily fluids.In this process, biocompatible glasses can form biologically useful materials by chemically reacting with either body fluids or simulated body fluids to form materials in the body that are useful in regenerating mammalian hard and soft tissue. These glasses react with the body fluids in several weeks to form materials that are osteogenic and resorbable by osteoclasts. The glasses may be made into desirable shapes such as microspheres, or they may be pulled into fibers that can be made into wound dressings or rigid scaffolds. PATENT STATUS: Patent application filed. CONTACT INFO: Keith Strassner, kdstrass@mst.edu; 573 341-6725.

Nanopore-Facilitated Single Molecule Detection of MicroRNAs (10UMC022) 16

MicroRNAs (miRNAs) are a class of short non-coding RNAs molecules that regulate gene expression at the post-transcriptional level. Traditionally, miRNAs have been detected using techniques like Northern blotting, microarrays, or RT-PCR. The nanopore sensor has demonstrated the ability to differentiate miRNA levels in blood from lung cancer patients and healthy people. Aberrant expression of miRNAs has been found in all types of tumors. Thus miRNAs have been recognized as potential cancer biomarkers. Most notably, specific miRNAs are released from the primary tumor into blood circulation, making the detection of circulating miRNAs profile a powerful tool for noninvasive cancer detection, diagnosis, staging, and monitoring. PATENT STATUS: Provisional patent filed. CONTACT INFO: Paul Hippenmeyer; hippenmeyerp@missouri.edu; 573-882-0470.

Nanotechnology-Based Electrochemical DNA Sensing (07UMC034) 17

DNA sensing and recognition devices are essential for accurate detection of bacteria and other microbes, as well as for detection and identification of viruses, and there is a critical need to develop better methods and devices for DNA detection. The current invention developed by researchers at the University of Missouri-Columbia is a new technology that will increase the DNA sensor sensitivity, specificity, and sensing speed over current methods. This novel invention consists of an electrolyte cell, an electrochemical measurement device, and a nanostructured ceramic base electrode. The device is so sensitive that it does not require amplification of the DNA by PCR and it is advantageous due to its reusability, its increased detection speed, and its specificity. PATENT STATUS: Patent application filed. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

Plant Product Improves Obesity-Associated Health Risks (10UMC067) 18

Obesity is associated with a variety of metabolic complications including insulin resistance, type 2 diabetes and cardiovascular disease and is one of the leading causes of death worldwide. The current invention developed by researchers at the University of Missouri-Columbia is a novel plant product with a composition that alleviates multiple conditions associated with obesity. Animals treated with the new product showed improved glucose/insulin homeostasis, which was associated with improved adipose tissue and liver metabolism. PATENT STATUS: Patent application filed. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

Medical

Anti-Microbial Peptide against *H. influenzae* and *S. aureus* (02UMC041) 19

The discovery of penicillin in 1928 initiated a revolution in the treatment of a variety of diseases. However, extensive use of antibiotics has led to a world-wide emergence of bacterial pathogens that are resistant to current anti-microbial compounds. The current invention developed by researchers at the University of Missouri-Columbia is a novel anti-microbial peptide that kills *Haemophilus influenzae* and that also inhibits the growth of *Staphylococcus aureus*. The peptide described in this invention may have therapeutic value in the treatment of human and animal infections. PATENT STATUS: US Patent filed. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

20 Antiviral Compounds for the Treatment of Eye Infections (02UMK012)

A need exists for antiviral compounds that are sufficiently hydrophilic to be formulated into solutions such as eye drops and are efficacious when applied topically to the eye. A need also exists for antiviral compounds that reach both the anterior segment and the vitreo-retinal segment or the retina of the eye when administered systemically. UMKC professor Dr. Ashim K. Mitra has developed esters with sufficient hydrophilicity to be formulated into pharmacologi-cally active compositions, such as aqueous solutions (e.g., eye drops). Compounds of the invention can be effectively transported into the ocular tissues. Specifically, such compounds effectively reach the anterior segment and/or the vitreo-retinal segment when administered either topically or systemically. The compounds formulated have been shown to be effective against viral infections, particularly the herpes group of viruses (e.g., herpes simplex types 1 and 2, varicellazoster virus (VZV) and human cytomegalovirus (HCMV)). PATENT STATUS: US Patent filed. CONTACT INFO: James Brazeal, brazealj@umkc.edu; 816-235-5091.

21 Bioactive materials to accelerate Wound healing (10MST002)

The invention developed by researchers at Missouri University of Science and Technology can be used as a wound care material for treating both hard and soft tissues in mammals. Wounds such as diabetic ulcers or other open wounds can be covered with this bioactive and biodegradable material to form a temporary and resorbable barrier while providing useful materials to promote the wound healing process. This bioactive material can be made into a variety of shapes and forms for applications ranging from wound covering to implant fixation. PATENT STATUS: US Patent Utility Application Filed. CONTACT INFO: Keith Strassner, kdstrass@mst.edu; 573 341-6725.

22 Chemically Initiated Bone Cement (11UMK005)

A biocompatible polymer bone cement with numerous advantages over the currently used polymethyl methacrylates. Currently available commercial bone cements are based on polymethyl methacrylates and have several disadvantages including toxicity, lack of bioactivity, volumetric shrinkage, tissue necrosis, and the generation of heat upon polymerization. Researchers at the University of Missouri-Kansas City have developed a chemically initiated cement composed primarily of a monomer that has already proven very effective in commercial dental composites. Our extensive testing of this new cement has found that this system is biocompatible, has a peak exotherm that is below 45 degrees C, low shrinkage, and excellent mechanical properties. This system provides a biocompatible alternative to PMMA-based bone cements while maintaining good mechanical properties. PATENT STATUS: Provisional patent filed. CONTACT INFO: James Brazeal, brazealj@umkc.edu; 816-235-5091.

23 Fast Biclustering Algorithm (11MST001)

An algorithm that performs biclustering quickly and efficiently. Biclustering performs simultaneous clustering on features and data. It automatically integrates feature selection to clustering without any prior information, so that the relations of clusters of unsupervised labels (for example, genes) and clusters of data (for example, samples or conditions) are established. However, typical approaches have NP-complete computational complexity, which raises a great challenge to computational methods when identifying such local relations. This invention developed by researchers at Missouri University of Science and Technology demonstrates that a neural-based classifier can be modified to perform biclustering in an efficient way. Experimental results on multiple human cancer data sets show that the algorithm can achieve clustering structures with higher qualities than those with other commonly used biclustering or clustering algorithms. CONTACT INFO: Keith Strassner, kdstrass@mst.edu; 573 341-6725.

24 Highly Effective Gene Therapy to Treat Duchene Muscular Dystrophy (07UMC002)

Duchenne muscular dystrophy (DMD) is the most common form of the childhood muscular dystrophies, affecting 1 in 3,500 newborn males worldwide. DMD is caused by mutations in the dystrophin gene. Gene therapy holds promise for treating DMD. However, the large size of the dystrophin gene has been one of the major obstacles in gene therapy for DMD. Minimized genes used in current clinical trials do not retain all functions of wild type dystrophin. The present invention demonstrates the development of a novel synthetic mini gene accomplishing all the biological functions of the full-length gene. PATENT STATUS: US patent allowed and PCT applications filed. CONTACT INFO: Paul Hippenmeyer; hippenmeyerp@missouri.edu; 573-882-0470.

Genistein and Analogues for Treatment of Cystic Fibrosis (96UMC047) 25

Cystic fibrosis is a devastating disease characterized by progressive disability and is one of the most common fatal genetic disorders among Caucasians in USA and Europe. It is caused by mutations in a channel protein on the cell surface called the cystic fibrosis transmembrane conductance regulator (CFTR). The current invention developed by researchers at the University of Missouri-Columbia is a method for the treatment of cystic fibrosis by restoring the chloride channel function in cells with mutant CFTR protein using genistein, and derivatives and analogues thereof. Genistein is assumed to function as a potentiator by enhancing the chloride transport of mutant CFTR protein found in the plasma membrane. PATENT STATUS: US patent granted. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

Kinase Inhibitors as Potential Therapeutics in Neurological Disorders (10MST019) 26

A series of novel fluorinated kinase inhibitors that can be used in cell cycle suppression in vulnerable neurons. The invention , developed by researchers at the Missouri University of Science and Technology, describes a compound that has inhibitory effects comparable to state of the art cell cycle suppressing agents. The amyloid beta-induced toxicity that results in cell cycle re-entry in Alzheimer's disease neurons is ameliorated significantly in the presence of this inhibitor. The effect is comparable to that of Roscovitine and Flavopiridinol. This compound is expected to be relatively nontoxic and may be a potential alternative to the existing drugs for treating neurological disorders. It may also be useful, along with related versions, in the treatment of cancer and related pathologies. PATENT STATUS: Provisional Patent Filed. CONTACT INFO: Keith Strassner, kdstrass@mst.edu; 573 341-6725.

Material for Controlling Tissue Growth in Mammals (09MST031) 27

A biocompatible and biodegradable material that directs vessel growth in mammals by surface and subsurface implantation into mammalian hosts. This material, developed by researchers at the Missouri University of Science and Technology, is a biologically compatible inorganic material that, when placed in a mammal, chemically reacts with body fluids in a way that promotes growth of soft and hard tissue by increasing the number and diameter of blood vessels. The material reacts to form a biologically useful material and will ideally be resorbed by the body and eventually be replaced by new tissue. This method of increasing vascularity can be used to treat blood deficient sites in mammals (wounds, ulcers, sores, severe burns) that require additional blood flow for healing. PATENT STATUS: US patent allowed and PCT applications filed. CONTACT INFO: Keith Strassner, kdstrass@mst.edu; 573 341-6725.

Materials that Promote Vascular Growth in Mammals (10MST003) 28

A group of materials that react with body fluids in mammals to promote vascular growth. This invention, developed by researchers at the Missouri University of Science and Technology, encompasses a family of materials that react in a controllable manner with mammalian tissue to promote blood vessel growth when implanted in a mammal. Subcutaneous implantation studies in rodents indicate that a 300 percent increase in vascular growth is possible at six weeks. This material is biocompatible and bonds readily to living issue. Porous three dimensional tissue scaffolds have also been fabricated from the material. PATENT STATUS: US and PCT Applications Filed. CONTACT INFO: Keith Strassner, kdstrass@mst.edu; 573 341-6725.

Novel Compounds with Potential to Treat Septic Shock and Alzheimer's (11UMS002) 29

Septicemia is a serious world-wide health problem associated with mortality rates of 40-60%. It is well established that septic shock is initiated by introduction of bacterial endotoxin (or lipopolysaccharide, LPS) into the blood stream. Researchers at the University of Missouri-St. Louis (Demchenko et al) have discovered a new and simplified series of Lipid-A analogs to block the pro-inflammatory response to LPS. This work has potential commercial application in research investigations to elucidate LPS signaling pathways, as a therapeutic for treatment of septic shock, and as a drug to treat the inflammatory component of Alzheimer's disease. Synthesis is very simple and scalable. PATENT STATUS: A provisional application is currently being filed. CONTACT INFO: Tamara Wilgers; wilgerst@umsl.edu; 314-516-6884.

30 Novel Compounds for Powerful, Safe Analgesics (00UMS044)

Among classes of opioid receptors, the delta (δ)-selective opioids have the potential to provide powerful analgesics without the numerous negative side effects associated with narcotics such as morphine (e.g., dependence, respiratory depression, gastrointestinal problems, insomnia, etc.). Researchers at the University of Missouri-St. Louis (Welsh et al) discovered that certain triazole compounds (e.g., di- and tri-substituted triazole ring compounds) exhibit high binding affinity and high selectivity for opioid receptors and exhibit excellent bioavailability. These (δ)-selective opioids offer great potential across a wide range of pharmaceutical applications, including: powerful, yet safe, analgesics; treatment or prevention of opioid receptor related diseases and conditions such as pain, anxiety, obesity, depression or stress-related diseases; agents for treating immune disorders; new treatments for addition to drugs (e.g., cocaine). PATENT STATUS: US Patent #7,045,520; US Divisional Patent #7,294,720; US Divisional Patent application #7,776,898. CONTACT INFO: Tamara Wilgers; wilgerst@umsl.edu; 314-516-6884.

31 A Novel Protein Target for Anti-Cancer Therapeutics (10UMC001)

Targeted therapies are transforming the way people treat cancer. With help from cancer biochemistry and computational modeling technologies, it is now possible to discover new therapeutic targets within cancer cells and then design small molecule drug candidates that selectively interfere with their role in cancer. The current invention, developed by researchers at the University of Missouri-Columbia, is a novel protein target for anticancer therapeutics. It also includes pharmaceutical compositions and a method of treating cancer using such compositions. Known inhibitors of this target have been used in other therapeutic areas and supply proof of principle for chemotherapeutic use. PATENT STATUS: Provisional US Patent application filed. CONTACT INFO: Paul Hippenmeyer; hippenmeyerp@missouri.edu; 573-882-0470.

32 Pentablock Polymers for Improved Drug Delivery (08UMK008)

Drug delivery using biodegradable and biocompatible thermosensitive polymers can be a valuable strategy for the treatment of various conditions, especially ocular diseases. University of Missouri-Kansas City researchers have developed a pentablock copolymer for diagnostic use or the administration of biologically active agents. These polymers are ideal for hydrophilic compounds such as peptides and proteins. Also, the drug delivery and degradation characteristics of the novel polymers can be optimized by adjusting the block ratio and molecular weight of the polymer. These optimizations are a significant improvement over the existing triblock polymer which has very limited options for modification and optimization. PATENT STATUS: Non- Provisional US Patent application filed. CONTACT INFO: James Brazeal, brazealj@umkc.edu; 816-235-5091.

33 Small Molecule Therapeutics for HPV16 (10UMS008)

A researcher at the University of Missouri-St. Louis (James K. Bashkin) in collaboration with NanoVir, LLC, a pharmaceutical discovery and development company founded in 2003, has broken new ground in cancer prevention therapies. There are no drugs currently approved in the United States for the specific treatment of HPV infection. NanoVir's therapeutic agent would be the first, offering non-surgical treatment options to women affected by this virus, which causes positive Pap smears and can lead to cervical cancer. PATENT STATUS: Non- Provisional US Patent application filed. CONTACT INFO: Tamara Wilgers; wilgerst@umsl.edu; 314-516-6884.

34 Targeted Antisense Radiotherapy (10UMC069)

The current invention developed by researchers at the University of Missouri-Columbia is a novel agent for simultaneous, targeted gene and radiation therapy of blood cancers. The agent binds selectively to non-Hodgkin's lymphoma (NHL) cells and contains an antisense module that reduces the activity of a cancer gene to sensitize tumors to radiation. Simultaneously, the agent delivers radiation that is highly efficient at killing these sensitized cancer cells. Our invention is superior to conventional targeted radiotherapy because its two simultaneous mechanisms of action work together to ensure better cancer cell killing, potentially giving it more efficacy than existing approaches and with less side effects. PATENT STATUS: Patent application filed. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374 Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

Treatment of Type 1 Diabetes Before and After Expression of Predisposition Markers (03UMC017 and 06UMC044) 35

A novel technology to treat Type 1 Diabetes has been developed. This technology, developed by researchers at the University of Missouri-Columbia, uses the unique approach of antigen specific therapy mediated by an efficient Fc-directed delivery for robust antigen presentation. A peptide from glutamic acid decarboxylase (GAD) autoantigen was genetically expressed on an immunoglobulin molecule and the resulting Ig-GAD was able to restore normoglycemia in hyperglycemic, non-obese diabetic (NOD) mice. This regimen triggered regeneration of endogenous beta cells without assistance of exogenous insulin or stem cells. Current Phase III clinical trials with rhGAD65 point to the safety and efficacy of this autoantigen. Recent licensing of the rhGAD therapeutic by JNJ from Diamyd reinforces the commercial potential. Coupled with a superior antigen presentation, the Ig-GAD approach may offer patients the option they need to control their disease. PATENT STATUS: Granted in EU and allowed in US. Divisionals pending. CONTACT INFO: Paul Hippenmeyer; hippenmeyerp@missouri.edu; 573-882-0470.

Medical Devices

A Fast and Cost-Effective Spore-Based Vaccine Platform (07UMC085) 36

The current invention developed by researchers at the University of Missouri-Columbia is a new vaccine platform utilizing inactivated spores that is easy to customize to a disease of interest. The time between identification of an emerging pathogen to vaccine creation can be shortened to as little as 3 weeks. By utilizing bacterial cells that to high titers in simple growth medium, large batches of vaccine can be made in little time with immunogenic proteins surface displayed on the spores. Cost and time savings are achieved because no protein purification steps are required. The spores are easily inactivated and stable in the absence of refrigeration. Bacterial spores are recognized by the immune system as foreign and have the natural ability to stimulate the immune system and lead to effective immune responses. Thus our platform system should not need the use of adjuvants to produce a robust immune response. Lastly, we have the ability to express proteins from different antigen sources to create a multivalent vaccine against multiple pathogens. PATENT STATUS: US Patent application filed. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

Bionanocomposite for Soft Tissue Repair (07UMC092) 37

Implanted biomaterials utilized for soft tissue repair suffer from poor tissue integration, which permits sliding and rubbing of the material on the cells and tissues. The current invention developed by researchers at the University of Missouri-Columbia is a mesh that achieves a higher level of control at the interface between the tissue and the implant, which translates into improved tissue integration and overall biocompatibility. The fabrication from novel bionanocomposite is relatively inexpensive, faster than conventional methods, and utilizes non-toxic, water soluble cross-linking agents. PATENT STATUS: Patent application filed. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374
Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

Closed Loop Respiratory Device with Dynamic Adaptability (09UMC023) 38

This invention, developed by researchers at the University of Missouri-Columbia, describes a device for automatically controlling SpO2 concentrations in the blood of premature infants and other patients in need of respiratory support. This dynamically adaptable device will respond to changing patient conditions where tight O2 control is desired or in situations of reduced staff monitoring capabilities. PATENT STATUS: Provisional patent application on file. CONTACT INFO: Paul Hippenmeyer; hippenmeyerp@missouri.edu; 573-882-0470.

39 Continuously Tunable Lens for Vision Correction (09UMS007)

Correction of age-related optical changes in the eye, such as presbyopia, has been increasingly important. A researcher at the University of Missouri-St. Louis (Guoqiang Li) has conceived of a new and improved adaptive liquid crystal lens employing the hybrid diffractive lens structure. The inventive lens allows large aperture, high light efficiency, fast switching time, low driving voltage, power-failure-safe configuration, and continuous adjustment of the focusing power. The low-cost, electro-optic lenses will be continuously tunable and offer high optical performance for near, intermediate and distance vision. The invention also provides a new fabrication method for the inventive liquid crystal lens. PATENT STATUS: US Publication # 2010/0225834. CONTACT INFO: Tamara Wilgers; wilgerst@umsl.edu; 314-516-6884.

40 Helical Conservative Shoulder Prosthesis (10UMC034)

Shoulder replacement surgery is required to supply function to joints damaged by traumatic injury, use injuries or disease. Over 60,000 replacements are performed in the US annually. Presently, the "ball" (or head) of the replacement joint rests on top of the humerus and is connected to a long shaft (or stem) that penetrated down into the intramedullary canal of the bone. This invention, developed by researchers at the University of Missouri-Columbia, does not require the stem insertion into the intramedullary canal for stabilizing the ball thus the device does not require reaming into the intramedullary canal. One size stem will fit multiple patient geometries decreasing the need for precise sizing and leading to decreased need for variable manufacturing and inventory. PATENT STATUS: US and PCT applications filed. CONTACT INFO: Paul Hippenmeyer; hippenmeyerp@missouri.edu; 573-882-0470.

41 Method for Joining Hydrogels to Porous Materials for Human Joint Repair (08UMR001)

A method of joining a hydrogel and substrate to form a composite structure that can be seeded with tissue-forming cells for the repair of joint defects. This invention, developed by researchers at the Missouri University for Science and Technology, is a method of joining a soft, water-filled polymer, known as a hydrogel, to a porous substrate consisting of a metal, ceramic, or organic material to form a composite structure. The method involves capillary infiltration of the porous substrate, followed by curing of the hydrogel by ultraviolet radiation to form a mechanically interlocking interface with the substrate. The hydrogel and the substrate can be seeded with tissue-forming cells and signaling factors for the production of tissue-engineered composites for the repair of joint defects. PATENT STATUS: Patent Pending – Published Application US 2009/0076624. CONTACT INFO: Keith Strassner, kdstrass@mst.edu; 573 341-6725.

42 Nanosecond pulsed TIRPAS: Improved Photoacoustic Detection (11UMC020)

The development of specialized methods that allow for rapid inexpensive detection, identification, and quantification of biologically and chemically relevant compounds has the potential to both revolutionize the detection and treatment of disease and result in quantum leaps in scientific knowledge. The current invention developed by researchers at the University of Missouri-Columbia is an improvement to photoacoustic detection with the potential to revolutionize the detection of small and large absorbing molecules, including environmental pollutions and disease indicators. The combination of Total Internal Reflection Photoacoustic Spectroscopy (TIRPAS) with the use of a nanosecond pulsed laser increases the sensitivity and selectivity of chemical detection over current methods like UV-VIS spectroscopy, and has many of the characteristics of being a disruptive technology. PATENT STATUS: Patent application filed. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

43 Photoacoustic Detection of Metastatic Melanoma (10UMC072)

Researchers at the University of Missouri-Columbia have developed photoacoustic technology that will detect and isolate melanoma cells circulating in the blood in a more effective and efficient manner without the use of staining. The technology enables high throughput screening of low levels of metastasis in a potential melanoma patient. Furthermore, the cells can be isolated for further characterization using a proprietary flow cell. This invention will be useful for rapid diagnosis of melanoma as well as for monitoring melanoma patients. PATENT STATUS: Patent applications filed. CONTACT INFO: Harriet F. Francis, MS, JD; francish@missouri.edu; 573-884-0374. Per Stromhaug, PhD, MBA; stromhaugpe@missouri.edu; 573-884-3553.

Quantitatively Measuring Visual Suppression (05UMS031) 44

Vision disorders are the 4th most prevalent class of disability in the United States and the most prevalent handicapping condition in childhood. Researchers at the University of Missouri-St. Louis (Bassi et al) have developed the Q3D, a handheld, portable device that quantitatively measures the amount of visual suppression in patients. Able to detect very small impairments and changes in suppression (0.1 log unit steps up to 3 log units), the Q3D can detect suppression earlier than current methods, and quantified measurement allows for tracking intervention progress over time. The Q3D is the only device that quantifies the depth of visual suppression. The Q3D is a fast (<1 min.) and easily administered test, is self-calibrating, can be manufactured as a stand-alone device or adapted fit to rechargeable power handles (e.g., Welch Allyn, Keeler), is inexpensive to manufacture, and has low power requirements. PATENT STATUS: US Patent # 7,686,452. CONTACT INFO: Tamara Wilgers; wilgerst@umsl.edu; 314-516-6884..

Scaffold for Tissue Regeneration in Mammals (09MST023) 45

Borate glass compositions that are biocompatible and bioactive in mammals have been developed by researchers at the Missouri University of Science and Technology, for biological applications. These glasses react substantially faster with body fluids than silicate based bioactive glasses, forming an initial amorphous calcium-rich phosphate material which eventually becomes hydroxyapatite (HA). PATENT STATUS: US and PCT applications filed. CONTACT INFO: Keith Strassner, kdstrass@mst.edu; 573 341-6725.

Steerable Epidural Catheter (10UMC037) 46

Injecting pain medication around a specific nerve root in the cervical vertebrae can be a challenging procedure for anesthesiologists, challenging due to the devastating consequences of a misstep. The invention, developed by researchers at the University of Missouri-Columbia, describes a catheter design for a modified interlaminar approach capable of being threaded into the epidural space via the lumbar region up to the thoracic and cervical levels and directs pain medication into a precise space more safely and more reliably than current methods. This device is designed to have a structural integrity that will allow the catheter to be threaded through blockages but a shape that minimizes the risk of trauma. Medical literature has paved the way for this device. However, the market does not yet offer a readily available product for the procedure. PATENT STATUS: Provisional patent application on file. CONTACT INFO: Wayne McDaniel; mcdanielwc@missouri.edu; 573-884-3302. CONTACT INFO: Wayne McDaniel; mcdanielwc@missouri.edu; 573-884-3302.

Intermammary Injection Device (11UMC037) 47

Mastitis, an inflammation of the cow's udder usually caused by a bacterial intramammary infection, is the most costly (over $2 billion per year to US dairy industry) and common infectious disease of dairy cattle (about 33% of dairy cows develop mastitis). Likewise, mastitis is the most common reason dairy cows are treated with antibiotics and second only to reproductive failure as the cause for culling a dairy cow. According to the 2007 data by USDA, about 16.4% of dairy cows (over 1.5 million) in the US were treated with antibiotics for mastitis in 2007; about 90% of dairy operations (over 62,000) used intramammary antibiotics at the beginning of the dry (non-lactating) period. Furthermore, sealants to prevent intramammary infections are in prevalent use. Current intramammary treatment involves use of a syringe-type injection device to infuse products. A new device has been developed that makes intramammary injection more efficient and ergonomically safe while producing less waste than the current practice. PATENT STATUS: Provisional US application on file. CONTACT INFO: Paul Hippenmeyer; hippenmeyerp@missouri.edu; 573-882-0470.

Engineering

48 Recrystallized laser deposited materials for remanufacturing of parts (09MST027)

This technology is a direct metal deposit with friction. It is a friction stir process that results in a finished aggregated piece with comparable full structural quality to a wholly forged piece. This means that a broken part may be repaired with excellent bonding and strength or a piece may be constructed using rapid prototyping to result in a fully formed piece with completely bonded layers. The inventors showed a Ti-6Al-4V direct metal deposition layer could be formed with forged like characteristics. PATENT STATUS: US Utility Patent Application No. 12/787,075. CONTACT INFO: Keith Strassner, kdstrass@mst.edu; 573 341-6725.

49 Long Carbon Fibers for Blast Resistant Concrete (10MST005)

A very promising but barely explored change to conventional reinforced concrete construction is the addition of "long" carbon fiber (fiber measuring more than 2 inches long) to the concrete mixture to improve the blast and impact resistance. The longer fiber absorbs more energy as they pull out during the pressure wave or impact, reducing the potential for failing during the explosion or earthquake. The fiber will also significantly diminish secondary fragmentation, reducing one of the leading causes of damage to surrounding personnel and materials. The research involved the development of a coating that allows the use of long carbon fibers within conventional reinforced concrete, resulting in significantly improved blast and impact resistance. These fibers measure between 3 and 6 inches long and consist of a carbon graphite yarn. Potential applications of this technology include fiber-reinforced concrete barriers, façade panels, bridge piers, building columns, blast walls, and components for field-cast housing/barracks in locations without access to specialized construction equipment. The fibers are light weight and can be used at low percentages that are added directly to local concrete mixtures. PATENT STATUS: Lab testing is complete. CONTACT INFO: Keith Strassner, kdstrass@mst.edu; 573 341-6725.

50 Smart rocks for integrated monitoring and mitigation of bridge scour ready for triage (10MST012)

Scour is a process in which a fluid erodes material supporting a structure. When scour occurs near a bridge, the associated erosion can cause that bridge to collapse. Bridge collapses occur in hours or days. To prevent them, scour must be monitored and its mitigation strategy must be developed in real time. This invention introduces magnetic embodiments with sensors, a smart rock system, to tackle the grand challenge of scour monitoring and mitigation in real time. The smart rock system can facilitate an evaluation of the critical scour condition of bridges and reduce damage and loss of life from bridge failures caused by scour. PATENT STATUS: Provisional Patent Application Filed. CONTACT INFO: Keith Strassner, kdstrass@mst.edu; 573 341-6725.

51 Portable Instrument for Measuring Luminous Output from Traffic Light (10MST030)

This instrument provides a cheap, portable method for measuring luminous output from LED traffic signals. Design of the devise allows minimizing disturbance to traffic as it can be operated from inside a moving vehicle. There is NO need to setup traffic control or remote the signal and test in the lab. Luminous readings can be recorded, stored and observed over a period of time to determine the rate of degradation. PATENT STATUS: Provisional Patent Application Filed. CONTACT INFO: Keith Strassner, kdstrass@mst.edu; 573 341-6725.

52 Nanoporus Carbon (07UMC033)

This invention teaches a method of manufacture and associated composition of nanoporous carbon with extremely high surface area. The nanoporous structure enables the carbon to adsorb large amounts of gas at low pressures. The large surface area of the carbon adsorbs gas molecules by the nature of surface attraction forces, which is what makes adsorbed natural gas (ANG) possible. This invention has multiple viable applications. The largest market is in motor vehicles, and this research team at the University of Missouri was the first to reach the Department of Energy's target of holding 150 V/V storage capacity at 500 psig and have since achieved storage capacities above 190 V/V. CONTACT INFO: Wayne McDaniel; mcdanielwc@missouri.edu; 573-884-3302.

Aluminum Nitride (AlN) Vacuum Ultraviolet Photodiode (07UMC015) 53

This invention teaches a method of thin film doping of aluminum nitride. Doping is a critical step in the development of a semiconductor, which gives the semiconductor desired qualities. By using this novel method, co-doping with silicon creates a p-n junction which is elementary to all semiconductor devices. Doping with aluminum nitride is specifically valuable because of the compound's impressive physical properties and its high energy band gap. These are of particular interest since III-V nitrides with a direct band gap has the potential, especially in optoelectronics, to produce emissions over a wide spectral range from the visible to the UV. Recently, blue diodes developed from III-V nitrides became a significant commercial force with more applications being developed all the time. The ultimate development of similar III-V UV diodes would be expected to have a similar number of important commercial applications. CONTACT INFO: Wayne McDaniel; mcdanielwc@missouri.edu; 573-884-3302.

SiCON 54

SiCON harnesses the beneficial characteristics of silicon dioxide and silicon carbide by employing nanotechnology and materials science to combine these characteristics into a coating that is high strength, scratch resistant, crack free, and has favorable optical and electrical properties. Quartz, glass, silicon, stainless steel and plastic substrates were coated with the dielectric film using plasma enhanced chemical vapor deposition. The coating can be performed at various deposition temperatures from ambient to 400 C without sacrificing the beneficial properties. The films were prepared by varying different parameters like gas flow and deposition temperature. Fourier transform infra red analysis confirmed the material and fluorescent measurement confirmed that the sample fluoresces in green color when excited with UV light. Finally, I-V measurement confirms that the coating has very high breakdown strength. CONTACT INFO: Wayne McDaniel; mcdanielwc@missouri.edu; 573-884-3302.

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