

FCR 8

Office of the President
May 9, 2014

Members, Board of Trustees:

PATENT ASSIGNMENT REPORT

Recommendation: that the Board of Trustees accept the patent assignment report for the period October 1, 2013 through March 31, 2014.

Background: At its March 1997 meeting, the Board of Trustees authorized the University of Kentucky Research Foundation to conduct all future copyright and patent filings and prosecutions. Quarterly reports on patent and copyright applications are to be submitted to the Finance Committee of the Board.

Action taken: Approved Disapproved Other _____

PATENT ASSIGNMENT
FOR THE PERIOD OCTOBER 1, 2013 THROUGH MARCH 31, 2014

Patents

The following assignment on behalf of the Board of Trustees of the University of Kentucky Research Foundation has been executed:

1. **U.S. Patent Application Serial Number: 14/028,224**
Filed: September 16, 2013
Title: A Secreted Tumor-Associated Cytochrome as a Blood-Based Biomarker for Cancer
Inventor: Rolf Craven (Molecular and Biomedical Pharmacology)
Technical Description: The invention relates to methods and kits for detecting Pgrmc1 (progesterone receptor membrane component 1) in a bodily fluid sample to facilitate the detection and diagnosis of cancer, determining the stage of cancer, and determining the prognosis for and/or treatment of a subject having a cancer, particularly lung cancer.
Summary: Methods and kits for detecting biomarkers associated with cancer, particularly biomarkers present in a blood or serum sample, are urgently needed to facilitate early detection and treatment of cancer. EGFR (epidermal growth factor receptor) is one of the most promising therapeutic targets in lung cancer, and EGFR inhibitors have produced positive clinical results. Pgrmc1 (progesterone receptor membrane component 1) is a microsomal protein that co-localizes with EGFR in the endoplasmic reticulum or punctuate cytoplasmic sites. Pgrmc1 associates with EGFR in lung cancer cells and increases susceptibility to the EGFR inhibitor erlotinib. Pgrmc1 is also induced in multiple tumor types. Thus, secreted Pgrmc1 is a biomarker for detecting the presence of cancer in a subject and for monitoring cancer progression in a subject by assaying its levels in a bodily fluid. This invention discloses a method for detecting cancer by measuring Pgrmc1 levels in a bodily fluid and the incorporation of this invention into a diagnostic kit.

2. **U.S. Patent Application Serial Number: 14/050,020**
Filed: October 9, 2013
Title: Method and System for Producing Triterpenes
Inventors: Joe Chappell (Pharmaceutical Sciences), Thomas D. Niehaus, Shigeru Okada, Timothy P. Devarenne, and David S. Watt (Molecular and Cellular Biochemistry)
Technical Description: This invention relates to methods and systems for producing triterpenes.
Summary: Studies have been conducted exploring the use of triterpenes as biofuels and petroleum chemicals. *Botryococcus braunii*—a colony-forming, freshwater green algae—accumulates very high levels of methylated triterpenes, compounds that contribute to the buoyancy of the algae and serve as high-value feedstocks for the petrochemical and chemical industries. *B. braunii* race B accumulates 30% or more of its dry weight as triterpenes components, with up to 25% of the dry weight coming from the triterpenes' methylated forms. This invention disclosed a system that allows for more rapid and higher yield production of triterpenes. The invention discloses isolated nucleic

acids encoding triterpenes methyltransferases, genetically modified or engineered triterpenes methyltransferase with a chloroplast tag directing the triterpenes methyltransferase to chloroplasts of plant cells, expression vectors that express a nucleic acid encoding triterpen methyltransferases, genetically modified cells, and methods for transforming cells with an expression vector encoding triterpenes methyltransferases.

3. **U.S. Patent Application Serial Number: 14/067,800**

Filed: October 30, 2013

Title: Soy Products with Reduced Levels of Sulfite, Free Radicals and Methanethiol

Inventor: William L. Boatright (Animal and Food Sciences)

Technical Description: This invention discloses a method of reducing sulfites associated with soy products and compositions containing soy products.

Summary: Soybeans contain a relatively high number of transition metals, including manganese. When sulfites, manganese and oxygen are combined in solution, sulfite-free radicals are generated. Further reaction of the sulfite-free radicals with oxygen can produce sulfate-free radicals. Sulfite and sulfate-free radicals can contribute to the degradation of the essential amino acids in proteins which can alter the function and nutritional characteristics of the protein. Also, because sulfate-free radicals are very reactive toward the oxidation of methionine residues, they may also play a role in the development of Alzheimer's disease and Parkinson's disease. This invention discloses that the addition of iodate or cystine during the processing of isolated soy protein (ISP) inhibits sulfite and the subsequent formation of sulfite-free radicals, and that sulfate-free radicals and other free radicals generated from sulfite-free radicals and methanethiol.

4. **U.S. Patent Application Serial Number: 14/087,219**

Filed: November 22, 2013

Title: Carbon Particles

Inventors: Stephen M. Lipka and Christopher R. Swartz (Center for Applied Energy Research)

Technical Description: This invention provides methods of preparing carbon nanospheres, carbon nanoparticles, and carbon particles by hydrothermal synthesis.

Summary: Carbon particles are used as electrodes in symmetric and asymmetric electrochemical double layer capacitors, electrodes in lithium ion batteries, conductive additive for active material in lithium ion batteries and other battery chemistries, lubrication, capacitive de-ionization of waste water, electrochemical remediation, water softening, and as a replacement for activated carbon. This invention provides methods of preparing carbon nanospheres, carbon nanoparticles, and carbon particles by hydrothermal synthesis and methods of activating carbon particles.

5. **U.S. Patent Application Serial Number: 14/087,643**

Filed: November 22, 2013

Title: Bis-Quarternary Ammonium Cyclophane Compounds that Interact with Neuronal Nicotinic Acetylcholine Receptors

Inventors: Peter Crooks, Linda Dwoskin, Guangrong Zheng, Sangeetha Sumithran, Zhenfa Zheng (Pharmaceutical Sciences), and Paul Lockman

Technical Description: This invention relates to *bis*-quaternary ammonium cyclophane compounds that interact with neuronal nicotinic receptors and to methods of using the compounds to treat central nervous system diseases and pathologies.

Summary: Neurons affected by nicotine play an important role in the neural circuitry relevant to many neurological diseases, including myasthenia gravis, Parkinson's disease, Alzheimer's disease, schizophrenia, eating disorders, and drug addiction. Blocking the activity of neurons sensitive to nicotine is sometimes therapeutic. The inventors have produced compounds that block the activity of nicotine sensitive neurons. The compounds in this invention should be useful in the treatment of a wide variety of diseases related to the action of nicotine.

6. **U.S. Patent Application Serial Number: 14/090,812**

Filed: November 26, 2013

Title: Tris-Quaternary Ammonium Salts and Methods for Modulating Neuronal Nicotinic Acetylcholine Receptors

Inventors: Peter Crooks, Linda Dwoskin, Roger Papke, Guangrong Zheng, and Sangeetha Sumithran (Pharmaceutical Sciences)

Technical Description: This invention relates to *tris*-quaternary ammonium salts and their use in modulating nicotinic acetylcholine receptors.

Summary: The structure and functional diversity of central nervous system nicotinic receptors has stimulated a great deal of interest in developing novel, subtype-selective agonists and/or antagonists. Some of these agonists are currently being evaluated in clinical trials for cognitive enhancement and neuroprotective effects, potentially beneficial for diseases such as Alzheimer's and Parkinson's. This invention discloses *tris*-quaternary ammonium compounds that are modulators of nicotinic acetylcholine receptors and a method for administering the compounds in therapeutically effective amounts in order to prevent and/or treat a central nervous system associated disorder, substances use and/or abuse disorder, or gastrointestinal tract disorder in mammals.

7. **U.S. Patent Application Serial Number: 14/092,286**

Filed: November 27, 2013

Title: Method and System for Diterpene Production Platforms in Yeast

Inventors: Joe Chappell, Xun Zhuang (Pharmaceutical Sciences), and Wu Shuigin

Technical Description: The invention relates to methods and systems of building terpene production platforms in yeast that have various introduced mutations. These platforms or cell lines can be further modified to produce specific enzymes and/or terpenes, namely diterpenes.

Summary: Terpene family members have commercial value in the flavor and fragrance industries, in pharmaceutical formulations, as lubricants for high-performance machinery. Terpenes are made by plants and microbes in small amounts and in components of complex mixtures that vary with growth and environmental conditions, making it difficult to reproducibly obtain large amounts of any one terpene constituent. The invention discloses the generation of yeast lines that have utility for the production of diverse and high-value diterpenes.

8. **U.S. Patent Application Serial Number: 14/092,495**
Filed: November 27, 2013
Title: Method and System for Terpene Production Platforms in Yeast
Inventors: Joe Chappell, Xun Zhuang (Pharmaceutical Sciences), and Wu Shuigin
Technical Description: The invention relates to methods and systems of building terpene production platforms in yeast that have various introduced mutations. These platforms or cell lines can be further modified to produce specific terpenes.
Summary: Terpene family members have commercial value in the flavor and fragrance industries, in pharmaceutical formulations, as lubricants for high-performance machinery. Terpenes are made by plants and microbes in small amounts and in components of complex mixtures that vary with growth and environmental conditions, making it difficult to reproducibly obtain large amounts of any one terpene constituent. This invention discloses the method for conducting mutagenesis on yeast and selecting the mutagenic yeast for the production of specific terpenes.
9. **U.S. Patent Application Serial Number: 14/102,977**
Filed: December 11, 2013
Title: Cocaine Hydrolast-FC Fusion Proteins for Cocaine and Methods for Utilizing the Same
Inventors: Chang-Guo Zhan, Fang Zheng, Hsin-Hsiung Tai, Xiabin Chen, Liu Xue, and Shurong Hou (Pharmaceutical Sciences)
Technical Description: This invention relates to polypeptides comprising butyrylcholinesterase (BChE) and one or more other polypeptides.
Summary: Cocaine mediates its reinforcing and toxic effects by blocking neurotransmitter reuptake, and the classical pharmacodynamic approach has failed to yield small-molecule receptor antagonists due to the difficulties inherent in blocking a blocker. An alternative to receptor-based approaches is to interfere with the delivery of cocaine to its receptors and accelerate its metabolism in the body. The dominant pathway for cocaine metabolism in primates is butyrylcholinesterase (BChE)-catalyzed hydrolysis at the benzoyl ester group. The enhancement of cocaine metabolism by administration of BChE has been recognized to be a promising pharmacokinetic approach for the treatment of cocaine abuse and dependence. Thus, BChE mutant with high activity against (-)-cocaine are highly desired for use in humans. This invention discloses an isolated polypeptide comprising a BChE polypeptide and a second polypeptide and the nucleic acid molecules that encode them. The invention also discloses the coupling of this isolated polypeptide with a pharmaceutical carrier and a method for administering the combination in order to lower blood cocaine concentration in humans.
10. **U.S. Patent Application Serial Number: 14/109,735**
Filed: December 13, 2013
Title: Lightweight Thermal Management Material for Enhancement of Through-Thickness Thermal Conductivity
Inventor: Matthew C. Weisenberger (Center for Applied Energy Research)
Technical Description: The invention relates generally to thermal management materials and, more particularly, to thermal management materials incorporating carbon nanotubes held in a polymer matrix and methods for producing such materials.

Summary: Aligned carbon nanotubes embedded in a polymer matrix are known for their usefulness in transferring heat. The inventors have developed a new nanotube/polymer material showing improved heat transfer, increasing its usefulness over prior materials for situations where heat transfer is critical. The invention discloses improved composite materials made from carbon nanotubes and a polymer matrix including continuous tapes of such material, as well as methods of their production. The method comprises the steps of preparing strips of aligned carbon nanotube arrays and splicing those strips together end-to-end on a flexible support to form a tape. The method includes covering the tape with a non-permanently adhered film. In addition, the invention relates to a method of increasing unidirectional heat conduction from a work piece.

11. **U.S. Patent Application Serial Number: 14/153,844**

Filed: January 13, 2014

Title: Amidated Dopamine Neuron Stimulating Peptides for CNS Dopaminergic Upregulation

Inventors: Luke Bradley, Don Gash and Greg Gerhardt (Anatomy and Neurobiology)

Technical Description: This invention relates to amidated glial cell line-derived neurotrophic factor peptides that are useful for treating brain diseases and injuries that result in dopaminergic deficiencies.

Summary: Neurotrophic factors are endogenous proteins that modulate cell signaling pathways regulating stem cell proliferation, neuronal differentiation, differentiation, growth, and regeneration. Neurotrophic factors are useful in treating the degeneration of nerve cells and the loss of differentiated function that occurs in a variety of neurodegenerative diseases. Many neurotrophic factors are both neuroprotective and neurorestorative, and identifying neurotrophic factors with the right combination of protective and restorative actions and developing effective strategies for drug delivery have profound therapeutic functions for Parkinson's, Alzheimer's, Huntington's, and other degenerative processes in the brain. Successful trophic factor therapy requires site-specific delivery, distribution of the trophic factor through the target tissue, and tightly-regulated dose delivery. Glial cell line-derived neurotrophic factor (GDNF) is the most potent dopaminergic trophic factor found to date. This invention discloses a composition of an Amidated Dopamine Neuron Stimulating peptide (ADNS peptide) of varying amino acid sequences and a method of treating brain injury or disease using a pharmaceutically effective amount of the composition.

12. **U.S. Patent Application Serial Number: 14/158,357**

Filed: January 17, 2014

Title: Protection of Cells from Alu-Rna-Induced Degeneration and Inhibitors for Protecting Cells

Inventors: Jayakrishna Ambati (Ophthalmology and Visual Science) and Valeria Tarallo

Technical Description: This invention relates to methods for identifying inflammasome, MyD88, IL-18, VDAC1, VDAC2, Caspase-8, and NF κ B; inhibitors of said inflammasome, methods of protecting cells, and screening methods for identifying inhibitors.

Summary: The atrophic form of age-related macular degeneration (AMD) remains poorly understood and without effective clinical intervention. Extensive atrophy of the retinal pigment epithelium (RPE) leads to severe vision loss and is termed geographic atrophy. The pathogenesis of geographic atrophy is unclear, but it is known to cause blindness in millions of people worldwide and has no known cure. RNase DICER 1 is dramatically reduced in the RPE of human eyes with geographic atrophy, and DICER 1 deficiency leads to an accumulation of *Alu* RNA transcripts. *Alu* RNA transcripts induce cell death of human RPE cells and RPE degeneration in mice. This invention shows that DICER 1 deficient or *Alu* RNA exposure activates the NLRP3 inflammasome and triggers toll-like receptor-independent MyD88 signaling via IL-18 both in the RPE of mice and in mice and human RPE cells.

13. **U.S. Patent Application Serial Number: 14/161,277**

Filed: January 22, 2014

Title: Health Monitoring System

Inventors: Craig Carter (Veterinary Diagnostic Laboratory), Eric Vanzant (Animal and Food Sciences), Jacqueline Smith, Cris Anderson, and Agricola Odoi

Technical Description: This invention relates to methods and systems for monitoring the health of a subject, specifically utilizing movement data to identify whether a subject is healthy.

Summary: This invention uses a sensor secured to a subject to monitor its movement and a transponder that transmits the movement data to a receiver. Averaging movement data can provide quantitative data that is representative of a subject's general movement behavior. A subject will be determined to be morbid (i.e., unhealthy) if the movement data is lower than reference movement data by a statistically measurable difference. Reference movement data is collected about a subject before a prolonged (two- or three-day) period of decreased movement. This system can be used with either human or animal subjects, and particular interest is in using it with cattle because approximately 1 to 1.3 million cattle die and 8 million cattle are sick in the U.S. each year.

14. **U.S. Patent Application Serial Number: 14/163,376**

Filed: January 24, 2014

Title: High-Activity Mutants of Butyrylcholinesterase for Cocaine Hydrolysis and Methods of Generating the Same

Inventors: Chang-Guo Zhan, Hoon Cho and Hsin-Hsiung Tai (Pharmaceutical Sciences)

Technical Description: This invention relates to the use of butyrylcholinesterase (BChE) mutants in the treatment of cocaine abuse and dependence.

Summary: The dominant pathway for cocaine metabolism in primates is butyrylcholinesterase (BChE)-catalyzed hydrolysis at the benzoyl ester group. Enhancement of BChE activity by administration of exogenous enzyme substantially decreases cocaine half-life and is a promising pharmacokinetic approach for treatment of cocaine abuse and dependence. BChE mutants with high activity against (-)-cocaine are highly desired for use in humans, and there existed a need to determine which amino acid mutations would result in a BChE with a higher catalytic activity for (-)-cocaine. This invention discloses five novel human BChE mutants that have unexpected increased

catalytic efficiency for cocaine hydrolysis and a method for developing other mutants with this increased efficiency. This invention also discloses a novel pharmaceutical composition that combines a BChE variant with a pharmaceutical carrier, which can be administered to a human to decrease his cocaine blood concentration and in particular (-)-cocaine blood concentration.

15. **U.S. Patent Application Serial Number: 14/166,201**

Filed: January 28, 2014

Title: A Method for Energy Storage to Utilize Intermittent Renewable Energy and Low-Value Electricity for CO₂ Capture and Utilization

Inventors: Kunlei Liu (Center for Applied Energy Research), James Neathery, Joseph Remias, Cameron Lippert, and Nick Holubowitch

Technical Description: This invention relates to power plant energy production and, more specifically, to an apparatus and method for the capture of carbon dioxide produced during energy production by coal-fired power plants.

Summary: This invention discloses a power plant comprised of a boiler that receives fuel, feed-water, and air in stream to produce steam and flue gas; a steam turbine that receives steam to drive a generator to produce electricity and discharges spent steam; a condenser that receives the spent steam and converts steam to condensed feed-water; a post-combustion processing system that processes that flue gas; and an energy storage system including at least one electrochemical cell to store excess electrical energy, produced by the generator during period valley demand, and release thermal energy for power plant operations. In one embodiment, the post-combustion processing system includes a flue gas scrubber, a CO₂ absorbent reagent for removing CO₂ from the flue gas in the scrubber, and a primary stripper for regenerating spent CO₂ absorbent reagent. This invention also discloses a method for improving power plant efficiency comprised of six steps: combusting fuel in an air stream to convert feed-water into steam, driving a steam turbine to produce electricity, removing CO₂ from the flue gas using a CO₂ absorbent reagent, storing excess electricity produced during period valley demand in an electrochemical cell, converting the stored electrical energy to thermal energy, and using thermal energy to aid in regenerating the CO₂ absorbent reagent.

16. **U.S. Patent Application Serial Number: 14/180,619**

Filed: February 14, 2014

Title: Hybrid Cement Clinker and Cement Made from that Clinker

Inventors: Thomas Robl (Center for Applied Energy Research), Tristana Duvall, Robert Rathbone, and Yongmin Zhou

Technical Description: This invention relates to a new hybrid cement clinker and cement that utilizes waste and byproducts of other industrial processes while providing enhanced performance and environmental characteristics.

Summary: This invention discloses the specifications for a hybrid cement clinker, as well as a new cement. The new cement is a ferrite-alite-calcium sulfonaluminate (CSA) cement that is less expensive to produce than conventional CDA cements and is much more energy efficient than ordinary Portland cement (OPC) with greatly reduced carbon emissions and similar performance.

17. **U.S. Patent Application Serial Number: 14/186,207**
Filed: February 21, 2014
Title: A Flow-Through Filter to Remove Aluminum from Medical Solutions
Inventors: Robert Yokel (Pharmaceutical Sciences), Wesley Harris, Christopher Spilling, Robert Kuhn (Pharmacy Practice and Science), Vasilii Abramov, and Jason Lone
Technical Description: This invention relates to filter assemblies for removing metal ions from a solution and, more particularly, to a filter assembly capable of removing trivalent ions, such as aluminum, and tetravalent metal ions from medical solutions.
Summary: Aluminum (Al) is a common contaminant in many medical solutions as a result of the widespread distribution of Al in the environment. Healthy adults are generally protected against oral Al toxicity, but there is a special concern regarding aluminum exposure to premature infants. These infants routinely require several days of parenteral nutrition (PN) until they can tolerate oral feeding, and it is well known that some of the small volume parenteral solutions used to prepare the final PN solutions are heavily contaminated with Al. This invention discloses a single-use filter to remove Al from a solution as it passes through the filter. The body of the filter is filled with a specialized chelators, and the filter is designed to produce a controlled fluid flow rate, using a partially evacuated vial and flow restriction/flow controller tube with a specified internal diameter and length which establish a controlled rate of flow.
18. **U.S. Patent Application Serial Number: 14/200,360**
Filed: March 7, 2014
Title: Enhancement of Binding Characteristics for Production of an Agglomerated Product
Inventor: Darrell Taulbee (Center for Applied Energy Research)
Technical Description: This invention discloses a method of mixing a particulate material and a binder to form a precursor material and irradiating the precursor material with microwave radiation to activate the binder to form the product.
Summary: Approximately 2 billion tons of recoverable coal fines have been discarded in impoundments in the U.S., with about 50 million more tons added each year. This is a substantial resource that cannot yet be economically cleaned and separated into low-ash product. Drying and forming this coal into agglomerates yields a product that can be transported, stored, and handled in conventional coal-processing equipment. Extrusion is the most common technology for forming biomass into pelletized fuel, but it is an energy intensive process that is limited in capacity, problematic to maintain a consistent production rate, and leads to excessive equipment erosion. Briquetting is lower-energy, higher-throughput, and lower-equipment erosion technology compared to extrusion. Two economic obstacles to producing briquettes are the cost of drying the fine coal and/or biomass and binder costs. This invention discloses a method of preparing a precursor material for briquetting by mixing a particulate material and a binder. The precursor material is then irradiated with microwave radiation to dry the precursor material and activate the binder, resulting in the formation of an agglomerated product. This invention discloses several possible embodiments for both the particulate material

and the binder used to make the precursor material, as well as ranges for the moisture content of the precursor material.

Patent Activities

Fiscal year to date as of March 31, 2014

Number of Patent Applications	21
Number of Patents Issued	20
Patent Gross Revenue	\$3,102,726.19