

FCR 9

Office of the President
June 11, 2013

Members, Board of Trustees:

PATENT ASSIGNMENT REPORT

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

Background: The March 4, 1997 meeting of 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
QUARTERLY FOR THE PERIOD THROUGH March 31, 2013

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: 13/740,828**
Filed: January 15, 2013
Title: Protection of Cells from Degeneration and Treatment of Geographic Atrophy
Inventor: Jayakrishna Ambati (Ophthalmology and Visual Science)
Technical Description: This invention relates to therapeutic uses of inflammasome inhibition, P2X₇ inhibition, and inhibition of IRAK1 and/or IRAK4, methods of protecting a cell, and methods for identifying inhibitors.
Summary:
Age-related macular degeneration (AMD) is characterized by dysfunction and degeneration of the retinal pigmented epithelium (RPE). The advanced form of atrophic AMD, called GA, is characterized by degeneration and death of the RPE, and it is the leading cause of untreatable vision loss. It has been shown that a dramatic and specific reduction of the RNase DICER 1 results in accumulation of *Alu* RNA transcripts in the RPE of human eyes with GA and induces RPE cell death and RPE degeneration in mice. This invention shows that *Alu* transcripts can hijack innate immune system machinery to induce RPE cell death. The findings show a previously known role for DICER 1 as a guardian against the aberrant overexpression of toxic retrotransposon genetic elements. The findings present a novel self-recognition immune response, whereby endogenous non-coding RNA-induced NLRP3 inflammasome activation results from *DICER 1* deficiency in a non-immune cell. The invention also proposes unique targets for protecting RPE cells against death, including P2X₇ activation and IRK-1/4.

2. **U.S. Patent Application Serial Number: 13/741,458**
Filed: January 15, 2013
Title: Low Voltage Electrowetting Device and Method for Making Same
Inventors: Yuguang Cai (Chemistry) and Xiaoning Zhang
Technical Description: The invention relates generally to the field of electrowetting and, more particularly, to a low-voltage electrowetting device and a method of making the same.
Summary: Electrowetting involves modifying the surface tension of liquids on a solid surface using a voltage. By applying a voltage, the wetting properties of a hydrophobic surface can be modified and the surface becomes increasingly hydrophilic (wetable). Electrowetting is a microfluidic phenomena that is currently enjoying explosive growth as a driving mechanism for a wide range of fluidic and electro-optic applications. There are two parallel approaches to reduce the driving voltage. One way is to increase capacitance. The other way is to minimize the interfacial energies of the solid and the liquid, usually through using an immiscible oil bath. This invention discloses a low-voltage electrowetting device incorporating an ionic liquid dielectric layer of ultra-high

capacitance. Such a device is capable of electrowetting effects using driving voltages of must 70mV and 5V in AC and DC modes of operation. Further, such device is compatible with digital micro-fluidics applications.

3. **U.S. Patent Application Serial Number: 13/741,439**

Filed: January 16, 2013

Title: Fossil-Fuel-Fired Power Plant

Inventors: Kunlei Liu (Center for Applied Energy Research) and James K. Neathery (Center for Applied Energy Research)

Technical Description: The invention relates the power plant field and, more particularly, to a new and improved power plant that operates at an improved efficiency with reduced carbon dioxide emissions.

Summary: The invention discloses a power plant comprised of (1) a boiler configured to receive fuel, feed-water, and an air stream to combust fuel, vaporizing the feed-water into steam, and to discharge a flue gas that includes carbon dioxide; (2) a steam turbine configured to receive the steam wherein the steam drives a load that the steam turbine discharges spent steam; and (3) a post-combustion processing system configured to process the flue gas and including (a) a carbon dioxide scrubber for receiving flue gas and contacting the flue gas with a reagent that absorbs carbon dioxide to form a spent absorbent reagent, (b) a primary stripper for receiving the spent absorbent reagent and stripping at least a portion of the carbon dioxide from the spent absorbent reagent to form a first regenerated reagent, and (c) a secondary stripper for receiving the first regenerated reagent and stripping at least a portion of the carbon dioxide from the first regenerated reagent to form a second regenerated reagent, with the stripper having a first line to return the second regenerated reagent to the carbon dioxide scrubber to be recycled as the reagent and a second line to return at least a portion of the carbon dioxide stripped from the first regenerated reagent to the air stream being received by the boiler.

4. **U.S. Patent Application Serial Number: 13/763,057**

Filed: February 8, 2013

Title: Aromatic Compounds with Sulfur Containing Ligands

Inventor: Boyd E. Haley (Chemistry)

Technical Description: The invention relates to novel aromatic compounds useful as nutritional supplements, antioxidants, heavy metal chelators, and/or as intermediaries for producing other useful compounds of this type.

Summary: Free radicals are unstable oxygen-containing molecules that negatively interact with other molecules in the body in a process called oxidation. High levels of free radicals and oxidation can lead to oxidative stress. Moderate oxidative stress can trigger apoptosis, while more intensive oxidative stress may cause widespread necrosis or cell death. The body naturally fights oxidation by producing glutathione (GSH), a tripeptide comprised of glutamic acid, cystine, and glycine. GSH is found in all cells of the body, and without GSH, the body would have little resistance to metabolic acids and the liver would shrivel up from the eventual accumulation of acidic toxins. Once GSH stabilizes a free radical, it becomes oxidized and is usually excreted from the body. Thus, the body must replace GSH as it is used. This invention relates to novel compounds useful as antioxidant dietary supplements that help maintain healthy GSH levels. This invention

discloses the structures of several aromatic compounds incorporating sulfur-containing ligands.

5. **U.S. Patent Application Serial Number: 13/767,418**

Filed: February 14, 2013

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

Inventor: Chang-Guo Zhan (Pharmaceutical Sciences)

Technical Description: The invention relates to butyrylcholinesterase variant polypeptides and, in particular, butyrylcholinesterase mutants with amino acid substitutions.

Summary: Cocaine mediates its reinforcing and toxic effects by blocking neurotransmitter reuptake, and the classical pharmacodynamic approach has failed to yield small-molecule receptor/transporter antagonists due to the difficulties inherent in blocking a blocker. An alternative to a pharmacodynamic approach is to interfere with the delivery of cocaine to its receptors/transporters and accelerate its metabolism in the body. The dominant pathway for cocaine metabolism in humans is butyrylcholinesterase (BChE)-catalyzed hydrolysis at the benzoyl ester group. Human experiments have shown that enhancement of BChE activity by the administration of exogenous enzyme substantially decreases cocaine half-life. Administering BChE to enhance cocaine metabolism works three orders-of-magnitude lower against the naturally occurring (-)-cocaine than against the biologically inactive (+)-cocaine, and so there exists a need for mutant BChE with higher catalytic activity against (-)-cocaine. This invention discloses five novel BChE mutants that have unexpected increased catalytic efficiency for (-)-cocaine hydrolysis. These mutants have various unique amino acid residue substitutions, which provide the surprising enhanced catalytic activity. In addition, the invention discloses a novel method for developing additional mutants, which have enhanced catalytic efficiency.

6. **U.S. Patent Application Serial Number: 13/803,939**

Filed: March 14, 2013

Title: Axial-Centrifugal Flow Catheter Pump for Cavopulmonary Assistance

Inventors: Dongfang Wang (Cardiothoracic Surgery) and Joseph B. Zwischenberger (Surgery)

Technical Description: The invention relates to the field of medical devices, in particular, to cardiac medical devices and systems for use in remediating or alleviating failing circulation subsequent to a Fontan procedure.

Summary: The Fontan procedure is a palliative surgical procedure used to ameliorate complex congenital heart defects such as heart valve defects and abnormalities in pumping ability. The procedure has disadvantages and post-surgical complications, including pleural effusions, atrial scarring, atrial flutter, and atrial fibrillation, all of which require additional surgical interventions. Other long-term risks include protein-losing enteropathy and chronic renal insufficiency. Additionally, immediately or even 2 to 5 years after the procedure, it is known that the surgically created Fontan circulation often fails. Attempts have been made to improve failing Fontan circulation by implanting a right ventricular assist device, but this requires a traumatic surgical intervention and a

takedown of the Fontan connection to install the pump. Usage of dual pumps or smaller single pumps has been evaluated, and there remains a need for improvements to pumps. This invention discloses an improvement featuring a rotor having elements providing both an axial fluid flow and a centrifugal fluid flow and a motor operatively connected to the motor.

7. **U.S. Patent Application Serial Number: 13/850,746**

Filed: March 26, 2013

Title: Method of Ameliorating Oxidative Stress and Supplementing the Diet

Inventor: Boyd E. Haley (Chemistry)

Technical Description: The invention relates to the field of dietary supplements for mammals and, more particularly, to methods of supplementing a diet, removing heavy metals and other toxins, and ameliorating oxidative stress.

Summary: Heavy metals such as mercury, lead, cadmium and silver have numerous deleterious effects within cells. Heavy metals can bind proteins and inhibit or activate their biological properties. When heavy metals bind specific proteins, it triggers a series of events that can lead to unhealthy cells that may die or be unable to defend themselves from stress factors such as viral infection. Glutathione (GSH) provides protection against heavy metal toxicity, organic toxins, and hydroxyl free radical damage, but exposure to excess heavy metals causes reduced GSH to convert to oxidized glutathione (GSSG) and decreases the cell's ability to remove toxins. An ideal way to recover GSH levels would be to develop a non-toxic compound that mimics GSH function. This invention discloses a molecule with cell membrane-penetrating abilities, heavy metal chelation and oxygen radical scavenging properties, and a non-toxic character. The molecule can be delivered in the diet of mammals.

8. **U.S. Patent Application Serial Number: 13/853,186**

Filed: March 29, 2013

Title: Solvent and Method for Removal of an Acid Gas from a Fluid Stream

Inventor: Joseph E. Remias (Center for Applied Energy Research)

Technical Description: The invention relates to the removal of CO₂ and other acid gases from a fluid stream and, more particularly, to a solvent of promoter and tertiary amines used for separating an acid gas from that fluid stream.

Summary: The cleanup of acid gases from natural gas and in oil reefing has been practiced since the 1930s, and post-combustion CO₂ emissions continue to be a topic of widespread interest. Aqueous amines are frequently used to remove acid gasses. In broad terms, the described method seeks to add a promoter amine in the form of a substituted primary and/or secondary amine to a tertiary amine to form a solvent. The promoters serve to increase the overall mass transfer of the acid gas into the absorption solvent. The promoters are designed to have particularly low volatility without contributing significant viscosity to the solution. The described promoters achieve this attribute without being an ionic compound, which can negatively impact mass transfer. The low volatility and low viscosity are achieved by using alternate functional groups in addition to the amine functional group that reacts with the CO₂ molecule. Low volatility is important to reduce amine loss in the CO₂ capture process. This property is often achieved by using alcohol

subgroups in addition to the amine group; however, the alcohol groups are hydrogen bond donors, which add more solution viscosity due to intermolecular bonding.

9. **U.S. Patent Application Serial Number: 13/853,234**

Filed: March 29, 2013

Title: Catalysts and Methods of Increasing Mass Transfer Rate of Acid Gas Scrubbing Solvents

Inventor: Joseph E. Remias (Center for Applied Energy Research)

Technical Description: The invention relates generally to catalysts and methods of increasing the overall mass transfer rate of acid gas scrubbing solvents utilizing those catalysts.

Summary: Several methods are in use for post-combustion CO₂ capture, and regardless of the method used, the mass transfer rate in the absorber column dictates the size of the column (capital cost) used and, consequently, has a substantial impact on the overall process cost. In order to minimize absorber costs, it is important to maximize the overall mass transfer rate for the scrubber system, as there is a direct correlation between the two. This invention relates to compounds/catalysts and related methods for this purpose. The invention discloses the chemical formula for a catalyst compound that is added to a fluid stream including an acid gas and an acid gas scrubbing solvent. The acid gas scrubbing solvent includes an amine ammonia or a carbonate/bicarbonate solution.

Patent Activities

Fiscal year to date as of March 31, 2013

Number of Patent Applications	16
Number of Patents Issued	22
Patent Gross Revenue	\$4,656,540.59