

# FCR 8

Office of the President  
February 19, 2021

Members, Board of Trustees:

## PATENT ASSIGNMENT REPORT

Recommendation: that the Board of Trustees accept the patent assignment report for the period October 1, 2020 to December 31, 2020.

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.

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Action taken:  Approved     Disapproved     Other \_\_\_\_\_

PATENT ASSIGNMENTS  
FOR THE PERIOD October 1, 2020 TO December 31, 2020

Patents

The following assignments on behalf of the Board of Trustees of the University of Kentucky Research Foundation have been executed:

- 1. U.S. Patent Application Serial Number:** 16/943,196<sup>1</sup>  
**UKRFID:** 2024  
**Filed:** July 21, 2020  
**Title:** POTENTIAL OF ZERO CHARGE-BASED CAPACITIVE DEIONIZATION  
**Inventors:** Kunlei Liu, Xin Gao, Ayokunle Omosebi (Center for Applied Energy Research) and James Landon (formerly Center for Applied Energy Research)  
**Description and Application:** The invention is a capacitive, electrostatic deionization apparatus that solves the problem of short lifetime of conventional capacitive deionization (CDI) and membrane capacitive deionization (MCDI) devices in the separation of salts and water. The device shifts the potential of zero charge of electrode surfaces through surface modifications increasing the lifetime of capacitive deionization devices. Unlike prior art devices, the electrode surfaces of this novel device are restored after each desorption to minimum ion conditions. The global water treatment market is valued at approximately \$60 billion in 2019 and is expected to grow at a compound annual growth rate (CAGR) of 3.7% from 2020 to 2027.  
**License:** Licensed to PowerTech Water LLC
  
- 2. U.S. Patent Application Serial Number:** 17/063,498  
**UKRFID:** 2393  
**Filed:** October 5, 2020  
**Title:** PREPARATION OF PYRAZOLO[3,4-B]PYRIDINES AS ANTIMALARIALS  
**Inventors:** Scott Eagon (Cal Poly), Rodney Guy and Jared Hamill (College of Pharmacy)  
**Description and Application:** The invention is a method of treating malaria and other Plasmodium parasites using novel pyrazolo[3,4-b]pyridines. The amount of pyrazolo[3,4-b]pyridines suitable for

inhibiting the growth of Plasmodium will generally be about 1 nM to about 100  $\mu$ M. The global market for antimalarial drugs is approximately \$660 million with an expected CAGR of 5.6%.

**License:** N/A – Inter-institutional Agreement in place with Cal Poly

**3. U.S. Patent Application Serial Number: 17/068,459**

**UKRFID:** 2326

**Filed:** October 12, 2020

**Title:** METHODS AND SYSTEMS FOR RAPID ANALYSIS OF CANNABINOIDS

**Inventors:** David Hildebrand (College of Agriculture, Food and Environment), Ju-Young Yoon (Visiting Scholar College of Agriculture, Food and Environment) and Julia Wallin (formerly College of Agriculture, Food and Environment)

**Description and Application:** The invention is a novel method and system for the rapid analysis of cannabinoids from crude cannabis extracts. The method involves measuring an amount of cannabinoids in a sample using optical density and/or absorbance of the sample at a selected wavelength. Previous methods of measurement were directed to dry samples while other methods were directed to wet samples, and many traditional methods could not be used with crude extracts. This novel method attempts to solve the shortcomings of the prior art by allowing testing of both wet and dry samples, as well as crude extracts. The cannabinoid testing market is expected reach \$1.4 billion by 2021, and the CBD industry is expected to reach \$22 billion by 2022 at a 132% CAGR.

**License:** N/A

**4. U.S. Patent Application Serial Number: 17/074,344**

**UKRFID:** 2356

**Filed:** October 19, 2020

**Title:** CERAMIDE MIMICS FOR TREATMENT OF ALZHEIMER'S DISEASE

**Inventors:** Erhard Bieberich (College of Medicine)

**Description and Application:** The invention is a method of diagnosing Alzheimer's disease in a patient as well as a method of treatment. The invention proposes inhibiting protein binding to exosomes by administering ceramide analogue to a patient. Additionally, the size of the exosomes is reduced through the introduction of ceramide analogues. One example of the invention

method and treatment: 1) obtain a blood sample from a subject; 2) purify exosomes from the blood; 3) detect the size of the exosomes in the blood; 4) diagnose the subject with Alzheimer's disease when exosomes over 100nm in size comprise at least 30% of the total population of exosomes; and 5) administer an effective amount of ceramide analogue to the subject. One such ceramide analogue contemplated is N-oleoyl serinol. The North American Alzheimer's disease drug market is expected to reach \$3 billion by 2025.

**License:** N/A

**5. U.S. Patent Application Serial Number: 17/049,613**

**UKRFID:** 2136

**Filed:** October 22, 2020

**Title:** DEVELOPMENT OF LOW-COST ACTIVATED CARBON FOR REMOVAL OF VOCS AND PHARMACEUTICALS FROM RESIDENTIAL DRINKING WATER

**Inventors:** Stephen Lipka (formerly Center for Applied Energy Research)

**Description and Application:** The invention is a system incorporating hydrothermally dehydrated carbonaceous products, particularly from waste sources, that when activated provide for effective filters of water. The activated particles have high microporosity and provide an improved and affordable approach to decontamination of water sources. Advantageously, the filtering material is prepared using hydrothermally dehydrated waste material such as bourdon stillage. The water and wastewater global market is expected to reach \$211 billion by 2025.

**License:** Exclusive License to Carbon Science Solutions LLC in negotiations

**6. U.S Patent Application Serial Number: 17/084,073**

**UKRFID:** 2390

**Filed:** October 29, 2020

**Title:** AN EFFICIENT NON-CLOGGING INERTIAL VORTEX TYPE PARTICLE SCRUBBER

**Inventors:** Steven Schafrik, Allison Taylor (College of Engineering) and Ashish Kumar (formerly College of Engineering)

**Description and Application:** The invention is a new and improved efficient, non-clogging inertial vortex type particle scrubber. That novel scrubber includes a housing with an inlet guide, twin vortex chambers

and an outlet. A particle-laden air stream passes through the inlet guide into the twin vortex chambers, and particles are displaced by centrifugal forces toward a wall and then relatively particle free air is discharged from the outlet. This inventive scrubber technology is applicable to mining and other industrial applications dealing with aerosols and other particulate matter. The global air purification market was approximately \$10 billion as of 2019 with an expected growth of 12.6% through 2027.

**License:** N/A

**7. U.S. Patent Application Serial Number: 17/095,260**

**UKRFID:** 2238

**Filed:** November 11, 2020

**Title:** SINGLE STAGE CLARIFIER AND MIXING ASSEMBLY

**Inventors:** Joshua Werner (College of Engineering)

**Description and Application:** The invention is a novel single stage clarifier and mixing assembly. Traditionally clarifiers rely on gravity sedimentation to remove particles from a slurry. The novel clarifier and mixing assembly includes: 1) a housing, 2) a mixing section with the housing, that includes a mixing chamber with an inlet, adapted to deliver an inlet stream to the mixing chamber, 3) a clarifier section within the housing and extending concentrically around the mixing section and 4) an agitator adapted for mixing the inlet stream in the mixing chamber. This invention eliminates the need of thickeners for solid-liquid separation and consolidates two-unit processes into a single operation. The global separation machine market is expected to reach \$100 billion by 2024.

**License:** License option with Lexmark International Inc.

**8. U.S. Patent Application Serial Number: 16/953,027**

**UKRFID:** 2427

**Filed:** November 19, 2020

**Title:** SYSTEM AND METHOD FOR ANATOMIC CLASSIFICATION OF AORTIC ANATOMY IN ANEURYSMS

**Inventors:** David Minion (College of Medicine)

**Description and Application:** The invention is a system and method of defining and classifying aneurysm morphology that can be used for evaluation of various treatment options and established guidelines and indications for repair. The disclosed system utilizes objective and easily identifiable points of reference. In this system, the diameter and

relative location of the points of reference are then used in a formulaic manner to define and characterize sealing segments and other anatomic variables. The pattern or anatomic order of multiple points of reference established phenotypes for grouping and comparing individual morphologies. This ease of classification will assist with outcomes research and improve overall treatment plans. The global aneurysm treatment market is \$800 million and is expected to grow at a CAGR of 8.6%.

**License:** N/A

**9. U.S. Patent Application Serial Number: 17/116,755**

**UKRFID:** 1935

**Filed:** December 9, 2020

**Title:** COMPOSITIONS AND METHODS FOR TREATING RETINAL DEGRADATION

**Inventors:** Jayakrishna Ambati and Benjamin Fowler (formerly College of Medicine)

**Description and Application:** The invention is methods for treating degradation of the retinal pigment epithelium (RPE) by administering compositions comprising a nucleoside and/or a nucleoside reverse transcriptase inhibitor (NRTI). Geographic atrophy, an advanced form of age-related macular degeneration, causes blindness in millions of people worldwide. There are no approved treatments, and it results from death of RPE cells. The inventive treatment to reduce RPE cell death includes: 1) inhibiting inflammasome activation; 2) reducing permeability of a cell; 3) reducing the amount of mitochondrial reactive oxygen species in the cell and/or 4) inhibiting activation of at least one inflammasome in a subject's eye. The global pharmaceutical market for age-related macular degeneration was worth \$8.6 billion in 2018 and is expected to reach \$18.7 billion in 2028.

**License:** Licensed to Inflammasome Therapeutics Inc.

**10. U.S. Patent Application Serial Number: 17/118,328**

**UKRFID:** 2434

**Filed:** December 10, 2020

**Title:** DISTORTED GOLD (I)-PHOSPHINE COMPLEXES AND METHODS FOR USE AS ANTIFUNGAL AGENTS

**Inventors:** Sylvie Garneau-Tsodikova (College of Pharmacy), Emily Dennis (formerly College of Pharmacy), Jong Kim and Samuel Awuah (College of Arts and Sciences)

**Description and Application:** The invention is distorted gold (I) phosphines used as an antifungal and treatment of fungal infections. Fungal infections are deadly for patients with conditions that weaken the immune system. These systemic fungal infections are primarily caused by only a few fungal genera, specifically *Candida* and *Aspergillus*. The novel distorted gold (I) phosphines may be used to kill these fungal varieties by contacting the fungus with an effective amount of the novel compound. The novel compound can also be used to prevent or disrupt a fungal biofilm. The global antifungal market is \$19 billion with an expected CAGR of 4.6%.

**License:** N/A

**11. U.S. Patent Application Serial Number:** 17/129,736

**UKRFID:** 2396

**Filed:** December 21, 2020

**Title:** INCREASED POLYPEPTIDE PRODUCTION YIELDS OF BUTYRYLCHOLINESTERASE POLYPEPTIDES FOR THERAPEUTIC USE

**Inventors:** Chang-Guo Zhan, Fang Zheng (College of Pharmacy) and Xiabin Chen (formerly College of Pharmacy)

**Description and Application:** The invention is novel fusion proteins including butyrylcholinesterase (BChE) with improved yield and biological half-life. BChE has a long history of clinical application without any adverse events reported, and it is well known that BChE can intercept and destroy the organophosphorus (OP) nerve poisons before they reach their target. Thus, administration of BChE is recognized as an effective and safe medication for the prevention of OP nerve agent toxicity. The novel composition includes an Fc polypeptide joined to the N-terminal or C-Terminal end of a BChE polypeptide. The global market for organophosphate poisoning treatment was \$550 million but is expected to decrease by -1.6% CAGR until 2024.

**License:** N/A

**12. International Application Number: PCT/US20/53787**

**UKRFID: 2025**

**Filed: October 1, 2020**

**Title: METHOD FOR TREATING ALZHEIMER'S DISEASE**

**Inventors: Florin Despa (College of Medicine)**

**Description and Application:** The invention is a method for treating a patient with Alzheimer's disease, microhemorrhages and neurological deficits. The method includes the administration of an agent that increases vascular low-density lipoprotein receptor-related protein 1 (LRP1) expression and reduces the amount of systemic amylin. One such method is administering an effective amount of a composition that increases epoxyeicosatrienoic acids. The composition that increases epoxyeicosatrienoic acids is a soluble epoxide hydrolase inhibitor such as 1-(1-propanoylpiperidin-4-yl)-3-[4-(trifluoromethoxy)phenyl]urea (TPPU). The TPPU is administered orally or intravenously in a dose of about 20 micrograms per kilogram TPPU. The North American Alzheimer's disease drug market is expected to reach \$3 billion by 2025.

**License: Optioned to AMDx Prognostx Inc.**

**13. International Application Number: PCT/US20/54315**

**UKRFID: 2393**

**Filed: October 5, 2020**

**Title: PREPARATION OF PYRAZOLO[3,4-B]PYRIDINES AS ANTIMALARIALS**

**Inventors: Scott Eagon (Cal Poly), Rodney Guy and Jared Hamill (College of Pharmacy)**

**Description and Application:** The invention is a method of treating malaria and other Plasmodium parasites using novel pyrazolo[3,4-b]pyridines. The amount of pyrazolo[3,4-b]pyridines suitable for inhibiting the growth of Plasmodium will generally be about 1 nM to about 100  $\mu$ M. The global market for antimalarial drugs is approximately \$660 million with an expected CAGR of 5.6%.

**License: N/A – Inter-institutional Agreement in place with Cal Poly**



**14. International Application Number: PCT/US20/55407**

**UKRFID:** 2383

**Filed:** October 13, 2020

**Title:** A MACHINE LEARNING ALGORITHM FOR PREDICTING CLINICAL OUTCOMES AND IDENTIFYING DRUG TARGETS IN ISCHEMIC STROKE

**Inventors:** Keith Pennypacker, Justin Fraser (College of Medicine) and Qiang Cheng (College of Engineering)

**Description and Application:** The invention is a method of identifying and analyzing biomarkers, genes and proteins that increase or decrease in response to ischemic stroke damage and predicting edema and infarct volume in a patient using machine learning. Ischemic stroke is the fifth leading cause of death in the United States, accounting for 87% of all strokes. Approximately 800,000 individuals are affected each year and ischemic stroke is the primary cause of severe long-term disability. The invention incorporates patient characteristics, imaging, genetic and proteomic data into algorithms that can predict new therapeutic targets. The global market for stroke diagnostics and treatment is \$21 billion with an expected 7% CAGR through 2022.

**License:** N/A

**15. International Application Number: PCT/US20/58922**

**UKRFID:** 2403

**Filed:** November 4, 2020

**Title:** NOVEL SUPEREBASTINE AGAINST THERAPY RESISTANT PROSTATE CANCER

**Inventors:** Vivek Rangnekar, Ravshan Burikhanov, Vitaliy Sviripa (College of Medicine) and David Watt (formerly College of Medicine)

**Description and Application:** The invention is novel compounds for the treatment of Abiraterone (ABT)- and Enzalutamide (ENZ)-resistant prostate cancer cells. Prostate cancer is one of the leading causes of cancer-related deaths in men in the United States. Androgen deprivation therapy (ADT) is the mainstay treatment of prostate cancer; however, about 30% of patients show relapse of the disease within 3 years of this treatment developing castration-resistant prostate cancer (CRPC). CRPC is treated with Abiraterone (ABT) and Enzalutamide (ENZ). Although ABT and ENZ increase the lifespan of patients with CRPC, these patients quickly develop resistance to this treatment. The novel compounds include ebastine (4-[4-(Diphenylmethoxy)-1-

piperidiny]l]-1-[4-(2-methyl-2-propanyl)phenyl]-1-butanone (EBS). The treatment involves administering compounds including EBS to a patient with Abiraterone (ABT)- and Enzalutamide (ENZ)-resistant prostate cancer cells. The global market for CRPC is \$6 billion with an expected CAGR of 10.3%.

**License:** N/A

**16. International Application Number:** PCT/US20/61537

**UKRFID:** 2368/2371

**Filed:** November 20, 2020

**Title:** ANTI-CANCER COMPOSITIONS AND METHODS

**Inventors:** Chengfeng Yang, Zhishan Wang and Yunfei Li (College of Medicine)

**Description and Application:** The invention is a method for inhibiting and killing cancer cells using platinum (II) and/or lomitapide, which can be encapsulated in a nanoparticle. The invention is a unique strategy for synthesizing ultras-small platinum (II) dots (uPTDs) with a diameter of approximately 1 nm. The transformation from free molecules to quantum dot-like structure facilitates nanoparticle (NP) encapsulation of miriplatin, via a nanoprecipitation method disclosed herein, and has the additional benefit of potentiating extra DNA-damaging capability of miriplatin. The invention also contemplates the repurposing of lomitapide for the treatment of triple negative breast, lung and colorectal cancers. The global markets for breast, lung and colorectal cancer will reach approximately \$64 billion by 2022.

**License:** N/A

**17. International Application Number:** PCT/US20/62431

**UKRFID:** 2401

**Filed:** November 25, 2020

**Title:** LOBINALINE N-OXIDES AS POSITIVE ALLOSTERIC MODULATORS OF THE DOPAMINE TRANSPORTER WITH POTENTIAL VALUE IN THE TREATMENT OF SUBSTANCE ABUSE DISORDERS

**Inventors:** John Littleton (formerly College of Arts and Sciences), Bert Lynn (College of Arts and Sciences), Dennis Rogers (Naprogenix) and Greg Gerhardt (College of Medicine)

**Description and Application:** The invention is the treatment of substance abuse disorders. The treatment involves administering a pharmaceutically effective amount of lobinaline N-oxide to a subject

diagnosed with a substance abuse disorder. The effective amount is about 25 mg/kg and may be administered subcutaneously. The lobinaline N-oxide may be either lobinaline mono-N-oxide and/or lobinaline bi-N-oxide. The global substance abuse market treatment is \$4.4 billion with an expected CAGR of 12.4% through 2024.

**License:** N/A

Patent Activities  
Fiscal Year to date as of December 31, 2020

<b>Total FY2020-21</b>					
	FY21Q1	FY21Q2	FY21Q3	FY21Q4	Total FY21
Invention <sup>2</sup> Disclosures	26	18	0	0	44
Full Patent Applications <sup>3</sup>	23 <sup>4</sup>	16	0	0	39
Provisional Patent Applications <sup>5</sup>	26	17	0	0	43
Patents Issued	8	8	0	0	16
License Income	\$810,900.86	\$209,591.78	\$0	\$0	\$1,020,492.64
New Licenses & Options Executed	6	3			9
New UK Startups Formed	0	0			0

<b>Total FY2019-20</b>					
	<b>FY20Q1</b>	<b>FY20Q2</b>	<b>FY20Q3</b>	<b>FY20Q4</b>	<b>Total FY20</b>
<b>Invention Disclosures</b>	22	32	33	33	120
<b>Full Patent Applications</b>	11	16	13	21	61
<b>Provisional Patent Applications</b>	28	14	25	32	99
<b>Patents Issued</b>	7	11	7	8	33
<b>License Income</b>	\$1,365,221.64	\$66,754.90	\$1,478,971.84	\$32,673.12	\$2,943,621.50
<b>New Licenses &amp; Options Executed</b>	12	4	7	6	29
<b>New UK Startups Formed</b>	1	0	2	3	6

Patent Application Summary Table

Inventors	College(s)	Title	Brief description
<b>Biomedical</b>			
Scott Eagon, Rodney Guy and Jared Hammill	Pharmacy	Preparation of pyrazolo[3,4-B]pyridines as antimalarials	Novel pyrazolo[3,4-B]pyridines for the treatment of malaria and other Plasmodium parasites.
Erhard Bieberich	Medicine	Ceramide mimics for treatment of Alzheimer's disease	The treatment of Alzheimer's disease by administering ceramide analogues.
David Minion	Medicine	System and method for anatomic classification or aortic anatomy in aneurysms	A system to define and classify aneurysm morphology that can be used to evaluate various treatment options.
Jayakrishna Ambati and Benjamin Fowler	Medicine	Compositions and methods for treating retinal degradation	A treatment for retinal pigment degradation by administering nucleosides and/or nucleoside reverse transcriptase inhibitors.
Sylvie Garneau-Tsodikova, Emily Dennis, Jong Kim, and Samuel Awuah	Pharmacy, Arts and Sciences	Distorted gold (I)-phosphine complexes and methods for use as antifungal agents	The use of novel distorted gold (I)-phosphine compounds for the treatment of fungal infections.
Chang-Guo Zhan, Fang Zheng, and Xiabin Chen	Pharmacy	Increased polypeptide production yields of butyrylcholinesterase polypeptides for therapeutic use	Novel fusion proteins including butyrylcholinesterase with improved yield and half-life to intercept and destroy organophosphorus nerve poisons.

Florin Despa	Medicine	Method for treating Alzheimer's disease	The treatment of Alzheimer's disease by administering an agent to increase vascular low-density lipoprotein receptor related protein 1 expression and reduce the amount of systemic amylin.
Scott Eagon, Rodney Guy, and Jared Hammill	Pharmacy	Preparation of pyrazolo[3,4-B]pyridines as antimalarials	Novel pyrazolo[3,4-B]pyridines for the treatment of malaria and other Plasmodium parasites.
Keith Pennypacker, Justin Fraser, and Qiang Cheng	Medicine, Engineering	A machine learning algorithm for predicting clinical outcomes and identifying drug targets in ischemic stroke	The use of machine learning in analyzing biomarkers, genes and proteins to predict new therapeutics targets for the treatment of ischemic stroke.
Vivek Rangnekar, Ravshan Burikhanov, Vitaliy Sviripa, and David Watt	Medicine	Novel superebastine against therapy resistant prostate cancer	Novel compounds that include ebastine (4-[4-(Diphenylmethoxy)-1-piperidinyl]-1-[4-(2-methyl-2-propanyl)phenyl]-1-butanone for the treatment of resistant cancer cells.
Chengfeng Yang, Zhishan Wang, and Yunfei Li	Medicine	Anti-cancer compositions and methods	The use of ultrasmall platinum (II) dots encapsulating miriplatin to treat triple negative cancer.
John Littleton, Bert Lynn, Dennis Rogers, and Greg Gerhardt	Arts and Sciences, Medicine	Lobinaline N-oxides as positive allosteric modulators of the dopamine transporter with potential value in the treatment of substance abuse disorders	Administering lobinaline N-oxide for the treatment of substance abuse disorder.

<b>Engineering</b>			
Kunlei Liu, Xin Gao, James Landon, and Ayokunle Omosebi	Center for Applied Energy Research	Potential of Zero Charge-Based Capacitive Deionization	A capacitive electrostatic deionization device that has increased operating life over conventional water and salt separation devices.
Stephen Lipka	Center for Applied Energy Research	Development of low-cost activated carbon for removal of VOCs and pharmaceuticals from residential drinking water	Using hydrothermally dehydrated waste material as an effective filter for water.
Steven Schafrik, Allison Taylor, and Ashish Kumar	Engineering	An efficient non-clogging inertial vortex type particle scrubber	An improved non-clogging inertial vortex particle scrubber that removes particles from air by centrifugal forces.
Joshua Werner	Engineering	Single Stage Clarifier and Mixing Assembly	A novel clarifier with internal chambers eliminating the need for a two-step process.
<b>Agriculture, Food and Environment</b>			
David Hildebrand, Ju-Young Yoon, and Julia Wallin	Agriculture, Food and Environment	Method and system for rapid analysis of cannabinoids	A novel method for the rapid analysis of cannabinoids in a sample using optical density and/or absorbance at specific wavelengths.

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<sup>1</sup> This application was filed by a previous licensee without notice, records of the filing were received in November 2020.



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<sup>2</sup> Invention disclosures include new technologies and intellectual property disclosed to the Office of Technology Commercialization (OTC) that do not fall under an existing technology number. This number captures the potential new intellectual property disclosed to OTC.

<sup>3</sup> Full patent applications, as used by OTC, include nonprovisional patent applications filings at the United States Patent and Trademark Office (USPTO), Patent Cooperation Treaty filings, and foreign patent application filings. These are technologies that are assigned to the University of Kentucky that OTC has identified to invest further into in an effort to obtain patent protection, and are described in more detail in the patent assignment section above.

<sup>4</sup> Number of Full Patent Applications changed from fiscal year Q1 report to capture undisclosed first quarter licensee applications discovered in November 2020.

<sup>5</sup> Provisional patent applications are legal documents filed at the USPTO that establish a filing date and protect the owner from anticipated publication of the technology, but do not mature into an issued patent unless the applicant files a full patent application within one year. Although owned by the University of Kentucky, the provisional patent applications are not included in the patent assignment descriptions as they will not mature into full patent applications without further action and investment.