FCR 24

Office of the President
December 5, 2023

Members, Board of Trustees:

PATENT ASSIGNMENT REPORT

Recommendation: that the Board of Trustees accept the patent assignment report for the period July 1, 2023 to September 30, 2023.

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 ASSIGNMENTS
FOR THE PERIOD July 1, 2023 TO September 30, 2023

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 Number:** 18/224,263
UKRFID: 2564
Filed: July 20, 2023
Title: METHOD FOR RECOVERING VALUABLE MATERIALS FROM BATTERIES
Inventors: Joshua Werner, John Groppo, Lucas Bertucci, Yang-Tse Cheng (College of Engineering) and Matthew Weisenberger (Center for Applied Energy Research)
Description and Application: The invention is a novel method for recycling batteries, including nickel metal hydride and lithium-ion batteries. The method involves shredding the batteries, wetting the shredded material with an ammonia carbonate lixiviant, and separating and processing the wetted material to capture a variety of metal, including rare earth elements. The global market for battery recycling is expected to reach $18 billion by 2030 at a compound annual growth rate (CAGR) of 43%.
License: N/A

2. **U.S. Patent Application Number:** 18/227,192
UKRFID: 2602
Filed: July 27, 2023
Title: IDENTIFYING RISK OF AND TREATING STROKE-INDUCED COGNITIVE IMPAIRMENT FOLLOWING THROMBECTOMY
Inventors: Keith Pennypacker, Justin Fraser, Jacqueline Anne Frank and Sarah Messner (College of Medicine)
Description and Application: The invention is a novel method to identify risk of vascular contributions to cognitive impairment and dementia (VCID) and stroke-induced cognitive impairment. The method includes taking a blood sample from a patient and measuring a series of proteins predicting both negative and positive effects on cognitive recovery. In patients where negative effect on cognitive

recovery is predicted, s-Dipeptidyl Peptidase-4 or a Dipeptidyl Peptidase-4 inhibitor may be administered. The vascular dementia global market is approximately $5.6 billion and is expected to reach $8.9 billion by 2033 with a CAGR of 4.77%.
License: N/A

3. **U.S. Patent Application Number:** 18/277,359
UKRFID: 2559
Filed: August 15, 2023
Title: RECOVERY OF VALUABLE MATERIALS AND GRAPHITE FROM END-OF-LIFE LITHIUM-ION BATTERIES
Inventors: Kunlei Liu, Xin Gao and Neng Huang (Center for Applied Energy Research)
Description and Application: This invention is a novel method of recovery and enrichment of valuable materials, including lithium, nickel, cobalt manganese, copper and aluminum from end-of-life or manufacturer-defect lithium-ion batteries. The method uses thermal reduction in an inert atmosphere to decompose the black mass of processed lithium-ion batteries. A reducing agent is applied to the black mass and the reduced black mass is mixed with water before separation of the lithium salts. The global market for lithium-ion battery recycling is $1.5 billion with an expected CAGR of 8.2%.
License: N/A

4. **U.S. Patent Application Number:** 18/235,142
UKRFID: 2469
Filed: August 17, 2023
Title: OBJECTIVE AND TRAINING-FREE DETECTION OF HIGH FREQUENCY OSCILLATIONS IN THE EPILEPTIC BRAIN
Inventors: Sridhar Sunderam and Amir Al-Bakri (College of Engineering)
Description and Application: The invention is a method of identifying high frequency oscillations (HFOs) in neural signals from the brain. The identification of HFOs provides a method of predicting epilepsy in a patient. HFOs can also be used to identify brain tissue for resection. The global epilepsy diagnosis and treatment market is expected to reach $10 billion by 2032 with a CAGR of 14.9%.
License: N/A

5. **U.S. Patent Application Number:** 18/280,111
UKRFID: 2569
Filed: September 1, 2023
Title: THREE-COORDINATE AU(I) PROBES AND USE IN SELECTIVELY DISRUPTING MITOCHONDRIA IN CANCER CELLS
Inventors: Samuel Awuah and Randall Mertens (College of Arts and Sciences)
Description and Application: The invention includes novel tri-coordinate Au(I) complexes and methods of using tri-coordinate Au(I) complexes to selectively disrupt mitochondrial structure of target cancer cells. The novel compound works by modulating mitochondrial function in a cell. The novel compounds may also be used to increase reactive oxygen species (ROS) in a cell. The global market for cancer therapeutics is $97 billion with an expected CAGR of 7.6%.
License: N/A

6. **U.S. Patent Application Number:** 18/243,312
UKRFID: 2183
Filed: September 7, 2023
Title: bZIP TRANSCRIPTION FACTORS REGULATE CONVERSION OF NICOTINE TO NORNICOTINE
Inventors: Ling Yuan, Sanjay Singh, Sitakanta Pattanaik (College of Agriculture, Food and Environment) and Darlene Lawson (R.J. Reynolds Tobacco Company)
Description and Application: The invention is a method to decrease conversion of nicotine to nornicotine. Nornicotine, a precursor to *N*-nitrosonornicotine (NNN), is produced during the curing and processing of tobaccos materials. Specifically, during post-harvest processing, nornicotine chemically reacts with nitrosating agents to form NNN. As NNNs belong to a class of smoking-related carcinogens called tobacco specific nitrosamines (TSNA), it is highly desirable to reduce TSNA in tobacco products. The method involves administering a basic region/leucine zipper (bZIP) type transcription factor inhibitor to an organism. The method also includes mutating a bZIP type transcription factor binding site on a promoter of a nicotine N-demethylase (NND). In other methods, the plant genome may be mutated to knock out at least one bZIP type transcription factor. The global tobacco market is expected to reach $1.1 trillion by 2027 with an expected CAGR of 3.1%.

License: N/A

7. **U.S. Patent Application Number:** 18/244,136
UKRFID: 2509
Filed: September 8, 2023
Title: METHOD FOR SPRAY DRYING D-TAGATOSE
Inventors: Heather Campbell (formerly College of Pharmacy)
Description and Application: This is a D-tagatose spray-drying feed formulation with a mixture of D-tagatose and a functional polymer excipient co-dissolved in a solvent to produce a composite with a glass transition temperature of greater than 30°C. The composite is then atomized in a drying chamber containing a hot inert processing gas and the droplets evaporate to produce solid particles of D-tagatose. D-tagatose has been shown to be a safe and efficacious treatment for type 2 diabetes. Specifically, D-tagatose has been shown to lower fasting food glucose levels and total cholesterol. D-tagatose may provide the desired sweet taste while avoiding the issues associated with more bioavailable sugars. The global food sweetener market was approximately $86 billion in 2020 and is expected to grow at a CAGR of 2.5% until 2026.
License: N/A

8. **U.S. Patent Application Number:** 18/281,743
UKRFID: 2468
Filed: September 12, 2023
Title: APPARATUS FOR PLACING A NEEDLE AT A SPECIFIC LOCATION AND DEPTH USING AN ULTRASOUND PROBE
Inventors: Kyle Murphy (College of Medicine)
Description and Application: This invention is a novel apparatus to place a needle at a specific location and depth using an ultrasound probe. The device allows a physician to consistently find and place the tip of a needle at a desired location, such as in a vessel of a patient or in an abscess cavity in a relatively quick and efficient manner. The device has a needle guide aperture that can maintain a desired angle between 1°-89° relative to the longitudinal axis of the needle guide. The needle guide market is expected to exceed $4 billion by 2024 with a CAGR of 6.2%.
License: Optioned to AVA Surgical Technologies, LLC

9. **U.S. Patent Application Number:** 18/282,788
UKRFID: 2552
Filed: September 19, 2023
Title: MORTAR MIX AND CONCRETE MIX INCORPORATING A STILLAGE LIQUID
Inventors: Rodney Andrews, Robert Jewell and Anne Oberlink (Center for Applied Energy Research)
Description and Application: This is a method of using stillage liquid as an admixture in mortar and concrete to improve the workability of fresh concrete and to modify the properties of the hardened mortar or concrete. Stillage is the liquid waste that remains after ethanol distillation. The distillery industry produces a significant amount of stillage each year thereby creating a waste disposal concern. The global market for cement production is $312 billion with an expected CAGR of 5.2%.
License: Option to Carbon Science Solutions, LLC

10. **U.S. Patent Application Number:** 18/370,760
UKRFID: 2370
Filed: September 20, 2023
Title: ANTEGRADE RETROGRADE RECON FEMORAL INTRAMEDULLARY NAIL SYSTEM
Inventors: Arun Aneja, Shea Comadoll, Boshen Liu (formerly College of Medicine) and Lorenzo Deveza (Baylor University)
Description and Application: This invention is an improved intramedullary nail configured for antegrade or retrograde insertion into a femur to stabilize the neck of the femur. Unlike traditional intermedullary nails, this invention may be inserted in a retrograde manner and still stabilize/protect the femoral neck. The invention may also be used with a variety of femoral fractures. The global orthopedic device market is more than $36 billion and will continue to grow as the population increases.
License: N/A

11. **U.S. Patent Application Number:** 18/370,558
UKRFID: 2696
Filed: September 20, 2023
Title: TREATMENTS FOR BLOOD-BRAIN BARRIER DYSFUNCTION AND RECURRENT SEIZURES USING NOX/LOX/COX INHIBITORS

Inventors: Bjoern Bauer (College of Pharmacy) and Anika Hartz (College of Medicine)
Description and Application: This invention is a treatment for epilepsy in Alzheimer disease (AD) patients. New evidence indicates that early-stage AD patients experience seizures and that 65% of AD patients have seizures/epilepsy. The treatment is the combination of N-acetylcystein (NAC), zileuton (ZLT) and celecoxib (CEL). The global AD therapeutic market was valued at $4 billion in 2022 with an expected CAGR of 20% until 2030.
License: N/A

12. **U.S. Patent Application Number:** 18/283,410
UKRFID: 2444
Filed: September 21, 2023
Title: CRADLE AND FEEDBACK MECHANISM FOR AUTOMATED DEVICE ALIGNMENT IN RADIATION THERAPY QUALITY ASSURANCE
Inventors: Janelle Molloy (formerly College of Medicine)
Description and Application: This is a novel apparatus adapted for automated quality assurance device alignment for radiation therapy quality assurance. The novel apparatus is designed to automatically reposition and change the angular orientation of a quality assurance device. The apparatus includes a base and a translation stage. The translation stage includes a cradle, a rotation adjustment assembly, a tile adjustment assembly and a position sensor. The radiation therapy quality assurance market is expected to reach $36 million by 2028 with a CAGR of 4.5%.
License: Licensed to Iridesce Solutions, Inc.

13. **U.S. Patent Application Number:** 18/473,051
UKRFID: 2497
Filed: September 22, 2023
Title: MULTI-WAVELENGTH TIME-RESOLVED LASER SPECKLE CONTRAST IMAGING (MTR-LSCI) OF TISSUE HEMODYNAMICS AND METABOLISM
Inventors: Guoqiang Yu, Lei Chen, Chong Huang, Siavash Mazdeyasna, Mingjun Zhao and Faraneh Fathi (College of Engineering)

Description and Application: This invention is a multi-wavelength time-resolved laser speckle contrast imaging (MTR-LSCI) apparatus. This MTR-LSCI device is used to determine hemodynamics in a subject. The device uses a time-gated camera and widefield illumination to produce images through layered head tissue (scalp, skull and brain). This eliminates the need for reconstruction of 3D images. The global hemodynamic monitoring market is $1.1 billion and is expected to grow by a CAGR of 6.4%.
License: Optioned to Bioptics Technology LLC

14. **U.S. Patent Application Number:** 18/283,871
UKRFID: 2534
Filed: September 25, 2023
Title: PRODUCTION OF ACTIVATED-BELITE-CSA CLINKERS AT EXTREMELY LOW FIRING TEMPERATURE
Inventors: Thomas Robl, Robert Jewell, Anne Oberlink and Tristana Duvallet (Center for Applied Energy Research)
Description and Application: The invention is a novel hydraulically active α'_H-belite-calcium sulfoaluminate clinker that is produced at extremely low firing temperatures when compared to current commercial binders. This lower firing temperature greatly reduces carbon emissions. The global market for cement production is $312 billion with an expected CAGR of 5.2%.
License: N/A

15. **International Application Number:** PCT/US2023/27667
UKRFID: 2660
Filed: July 13, 2023
Title: TRIAZINE LIPIDS, LIPID SYNTHESIS, AND METHODS FOR INHIBITING CANONICAL NF_KB TRANSCRIPTIONAL ACTIVITY
Inventors: Vincent Venditto, Julian Mory (College of Pharmacy), Abdullah Masud (College of Arts and Sciences) and David Nardo (formerly College of Pharmacy)
Description and Application: This invention is a novel triazine lipid and a method of synthesis. These novel lipids are used as a method of inhibiting canonical NF_kB transcriptional activity during an immune response to an immunostimulatory antigen within a subject. This includes administering a non-viral triazine lipid-based vector including a plurality of triazine lipids to a subject at the same time as an immunostimulatory peptide. This invention is applicable to MRNA

vaccines. The global vaccine market is expected to reach $67 billion by 2026 with a CAGR of 10%.
License: N/A

16. **International Application Number:** PCT/US2023/30494
UKRFID: 2728
Filed: August 17, 2023
Title: EXTRACTION OF COPPER FROM A FEED MATERIAL FOR THE PRODUCTION OF METALLIC COPPER
Inventors: Joshua Werner, Lucas Bertucci (College of Engineering) and Kevin Hubert
Description and Application: This invention is a new method for enhanced recovery of copper and other valuable metals and materials from waste materials. The new method contacts a waste material stream with an ammonia-based lixiviant adapted to leach copper and other base metals from the waste material feed stream. At this stage copper may be recovered. The stream is then treated with a second lixiviant to leach noble metals from the stream allowing for recovery of the noble metals. Some embodiments of the novel method include a precipitation reaction to recover gold following the second lixiviant addition. This novel process may be used in combination with the novel electrowinning cell in UKRF 2455. The global metal recovery market is $91 billion with an expected CAGR of 5% until 2024. The global market for e-waste recycling is $15 billion with an expected CAGR of 9%.
License: N/A

17. **International Application Number:** PCT/US2023/30535
UKRFID: 2654
Filed: August 18, 2023
Title: THIOL ISOMERASES INHIBITORS; PREPARATION THEREOF; AND METHODS OF USE THEREOF
Inventors: Sylvie Garneau-Tsodikova (College of Pharmacy) and Daniel Kennedy (Western New England University)
Description and Application: This invention is novel thiol isomerase inhibitor compounds to treat cancer or treat or prevent cancer-induced thrombosis. The global cancer therapeutics market size is expected to reach $335 billion by 2029 with a CAGR of 9%.
License: N/A

18. **International Application Number:** PCT/US2023/32508
UKRFID: 2709
Filed: September 12, 2023
Title: METHOD FOR RECYCLING THE CRITICAL METALS FROM LITHIUM-ION BATTERIES
Inventors: Jian Shi, Xin Gao, Yuxuan Zhang, Qing Shao and Ahmed Ullah (College of Engineering)
Description and Application: This invention is a novel method for recycling metal from a spent lithium-ion battery using hydrophobic deep eutectic solvent (DES) systems. Novel hydrophobic DESs have shown great potential to extract lithium, cobalt and nickel at near 100% efficiency. The metal ions can then be extracted from the solution by chemical precipitation. The global lithium-ion battery recycling market is expected to reach $35 billion by 2031 with an expected CAGR of 20%.
License: N/A

19. **International Application Number:** PCT/US2023/74792
UKRFID: 2433
Filed: September 21, 2023
Title: SUBSTITUTED 2-CINNAMOYLPHENYL BENZOATES AND RELATED HETEROCYCLES AS WNT INHIBITORS FOR THE TREATMENT OF CANCER
Inventors: Chunming Liu (College of Medicine), Xifu Liu, Mykhaylo Frasinyuk, and David Watt (formerly College of Medicine)
Description and Application: The invention is a novel treatment for colon, liver and lung cancer. The compounds work by inhibiting Wnt signaling. The treatment includes a substituted 2-cinnamoylphenyl benzoate. The global cancer therapeutics market is expected to reach $335 billion by 2029 with a CAGR of 9%.
License: N/A

20. **Foreign Application Number:** AU 2021232790
UKRFID: 1935
Filed: September 13, 2023
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 patient's eye. The global pharmaceutical market for age-related macular degeneration was $8.6 billion in 2018 and is expected to reach $18.7 billion in 2028.
License: Licensed to Inflammasome Therapeutics Inc.

21. Foreign Application Number: EP22776491.7
UKRFID: 2468
Filed: September 21, 2023
Title: APPARATUS FOR PLACING A NEEDLE AT A SPECIFIC LOCATION AND DEPTH USING AN ULTRASOUND PROBE
Inventors: Kyle Murphy (College of Medicine)
Description and Application: This invention is a novel apparatus to place a needle at a specific location and depth using an ultrasound probe. The device allows a physician to consistently find and place the tip of a needle at a desired location, such as in a vessel of a patient or in an abscess cavity in a relatively quick and efficient manner. The device has a needle guide aperture that can maintain a desired angle between 1°-89° relative to the longitudinal axis of the needle guide. The needle guide market is expected to exceed $4 billion by 2024 with a CAGR of 6.2%.
License: Optioned to AVA Surgical Technologies, LLC

Patent Activities
Fiscal Year to Date as of September 30, 2023

Total FY2023-24					
	FY24Q1	FY24Q2	FY24Q3	FY24Q4	Total FY24
Invention Disclosures[i]	24	0	0	0	24
Full Patent Applications[ii]	21	0	0	0	21
Provisional Patent Applications[iii]	18	0	0	0	18
Patents Issued	10	0	0	0	10
License Income	$446,360.22	$0	$0	$0	$446,360.22
New Licenses and Options Executed	9	0	0	0	9
New UK Startups Formed	1	0	0	0	1

Patent Activities
FY2022-23

Total FY2022-23					
	FY23Q1	FY23Q2	FY23Q3	FY23Q4	Total FY23
Invention Disclosures[iv]	24	34	31	25	114
Full Patent Applications[v]	25	15	16	11	67
Provisional Patent Applications[vi]	24	20	23	27	94
Patents Issued	8	6	12	6	32
License Income	$317,370.67	$172,263.56	$103,698.50	$214,573.50	$807,906.23
New Licenses and Options Executed	7	5	14	11	37
New UK Startups Formed	3	0	1	1	5

Patent Application Summary Table

Inventors	College(s)	Title	Brief description
Biomedical			
Keith Pennypacker, Justin Fraser, Jacqueline Anne Frank and Sarah Messner	College of Medicine	Identifying risk of and treating stroke-induced cognitive impairment following thrombectomy	A novel method to identify risk of vascular contributions to cognitive impairment and dementia (VCID) and stroke-induced cognitive impairment.
Heather Campbell	College of Pharmacy	Method for spray drying d-tagatose	A D-tagatose spray-drying feed formulation as a sugar substitute for diabetics.
Kyle Murphy	College of Medicine	Apparatus for placing a needle at a specific location and depth using an ultrasound probe	A novel apparatus to place a needle at a specific location and depth using an ultrasound probe.
Arun Aneja, Shea Comadoll, Boshen Liu and Lorenzo Deveza	College of Medicine	Antegrade retrograde recon femoral intramedullary nail system	An improved intramedullary nail configured for antegrade or retrograde insertion into a femur to stabilize the neck of the femur.

Inventors	College(s)	Title	Brief description
Bjoern Bauer and Anika Hartz	College of Pharmacy, College of Medicine	Treatments for blood-brain barrier dysfunction and recurrent seizures using nox/lox/cox inhibitors	A treatment for epilepsy in Alzheimer's patients.
Janelle Molloy	College of Medicine	Cradle and feedback mechanism for automated device alignment in radiation therapy quality assurance	A novel apparatus adapted for automated quality assurance device alignment for radiation therapy quality assurance.
Vincent Venditto, Julian Mory, Abdullah Masud and David Nardo	College of Pharmacy	Triazine lipids, lipid synthesis, and methods for inhibiting canonical NF_KB transcriptional activity	A novel triazine lipid and a method of synthesis for vaccine adjuvants.
Sylvie Garneau-Tsodikova and Daniel Kennedy	College of Pharmacy	Thiol isomerases inhibitors; preparation thereof; and methods of use thereof	Novel thiol isomerase inhibitor compounds for the treatment of cancer.
Chunming Liu, Xifu Liu, Mykhaylo Frasinyuk and David Watt	College of Medicine	Substituted 2-cinnamoylphenyl benzoates and related heterocycles as wnt inhibitors for the treatment of cancer	A novel treatment for colon, liver and lung cancer.

Inventors	College(s)	Title	Brief description
Jayakrishna Ambati and Benjamin Fowler	College of Medicine	Compositions and methods for treating retinal degradation	Methods to treat degradation of the retinal pigment epithelium (RPE) in age-related macular degeneration.
Kyle Murphy	College of Medicine	Apparatus for placing a needle at a specific location and depth using an ultrasound probe	A novel apparatus to place a needle at a specific location and depth using an ultrasound probe.
Engineering			
Joshua Werner, John Groppo, Lucas Bertucci, Yang-Tse Cheng and Matthew Weisenberger	College of Engineering	Method for recovering valuable materials from batteries	Novel method for recycling batteries, including nickel metal hydride and lithium-ion batteries.
Sridhar Sunderam and Amir Al-Bakri	College of Engineering	Objective and training-free detection of high frequency oscillations in the epileptic brain	A method of identifying high frequency oscillations (HFOs) in neural signals from a brain.
Guoqiang Yu, Lei Chen, Chong Huang, Siavash Mazdeyasna, Mingjun Zhao, and Faraneh Fathi	College of Engineering	Multi-wavelength time-resolved laser speckle contrast imaging (MTR-LSCI) of tissue hemodynamics and metabolism	A multi-wavelength time-resolved laser speckle contrast imaging (MTR-LSCI) apparatus which eliminates the need for 3D reconstruction.

Inventors	College(s)	Title	Brief description
Joshua Werner, Lucas Bertucci and Kevin Hubert	College of Engineering	Extraction of copper from a feed material for the production of metallic copper	A new method for enhanced recovery of copper and other valuable metals from waste materials.
Jian Shi, Xin Gao, Yuxuan Zhang, Qing Shao and Ahmed Ullah	College of Engineering	Method for recycling the critical metals from lithium-ion batteries	A novel method for recycling metal from a spent lithium-ion battery using hydrophobic deep eutectic solvent (DES) systems.
Center of Applied Energy Research			
Kunlei Liu, Xin Gao and Neng Huang	CAER	Recovery of valuable materials and graphite from end-of-life lithium-ion batteries	A novel method of recovery and enrichment of valuable materials (lithium, nickel, cobalt manganese, copper and aluminum) from lithium-ion batteries.
Rodney Andrews, Robert Jewell and Anne Oberlink	CAER	Mortar mix and concrete mix incorporating a stillage liquid	A method of using stillage liquid as an admixture in mortar and concrete to improve the workability of fresh concrete.
Thomas Robl, Robert Jewell, Anne Oberlink and Tristana Duvallet	CAER	Production of activated-belite-csa clinkers at extremely low firing temperature	A novel hydraulically active α'_H-belite-calcium sulfoaluminate clinker.

Inventors	College(s)	Title	Brief description
College of Arts and Sciences			
Samuel Awuah and Randall Mertens	College of Arts and Sciences	Three-coordinate Au(i) probes and use in selectively disrupting mitochondria in cancer cells	Novel tri-coordinate Au(I) complexes and methods of using these complexes to selectively disrupt mitochondrial structure of target cancer cells.
College of Agriculture, Food and Environment			
Ling Yuan, Sanjay Singh, Sitakanta Pattanaik and Darlene Lawson	College of Agriculture, Food and Environment	bZip transcription factors regulate conversion of nicotine to nornicotine	A method to decrease conversion of nicotine to nornicotine.

[i] 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.

[ii] Full patent applications, as used by OTC, include nonprovisional patent application 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.

[iii] 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.

[iv] 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.

[v] Full patent applications, as used by OTC, include nonprovisional patent application 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.

[vi] 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.