

**PATENT ASSIGNMENTS
FOR THE PERIOD October 1, 2023 TO December 31, 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: 18/377,044**
UKRFID: 2156
Filed: October 5, 2023
Title: LOUPE-BASED INTRAOPERATIVE FLUORESCENCE IMAGING DEVICE FOR THE GUIDANCE OF TUMOR RESECTION
Inventors: Guoqiang Yu, Chong Huang (College of Engineering) and Thomas Pittman (College of Medicine)
Description and Application: The invention is a hands-free, wearable, magnifying eye-loupe-based imaging device, using fluorescence imaging to identify tumor margins. This invention provides superior fluorescence excitation, specificity and economy. The technology has the potential to be used in surgical settings beyond tumor resection surgeries. Approximately 700,000 people in the United States are currently living with a brain tumor. Brain tumor patients have the highest per-patient initial cost of care for any cancer group, with an annualized mean net cost of care well over \$100,000.
License: Optioned to Bioptics Technology LLC
- 2. U.S. Patent Application Number: 18/286,937**
UKRFID: 2555
Filed: October 13, 2023
Title: INTELLIGENT MACHINE VISION SYSTEM FOR IN-PROCESS TOOL WEAR MONITORING
Inventors: Julius Schoop (College of Engineering)
Description and Application: This is a novel tool-wear monitoring system using an intelligent machine vision system. The system monitors a cutting tool while mounted in the spindle of a CNC cutting machine. The system includes a machine vision camera, an environmentally protected microscope, and a light source for lighting the cutting tool to obtain cutting tool images with the machine vision

camera. The global machine condition monitoring market is currently \$2.6 billion with a 7% compound annual growth rate (CAGR).
License: Optioned to Hill Engineering, LLC

- 3. U.S. Patent Application Number:** 18/498,834
UKRFID: 2669
Filed: October 31, 2023
Title: USING siRNAs AGAINST TAU CIRCULAR RNAs AS A RATIONAL THERAPY FOR ALZHEIMER'S DISEASE
Inventors: Stefan Stamm and Justin Welden (College of Medicine)
Description and Application: This invention is novel treatment for Alzheimer's disease. The treatment targets the backsplice junction between exons 12 and 7 in the microtubule-associated protein tau (MAPT) gene. Targeting the junction ensures only circular RNA produced by the backsplicing while allowing normal MAPT gene expression. The global Alzheimer's disease therapeutic market was \$4 billion in 2022 with an expected CAGR of 20% through 2030.
License: Optioned to CircCure Corporation
- 4. U.S. Patent Application Number:** 18/389,398
UKRFID: 2738
Filed: November 14, 2023
Title: CARBON CAPTURE SYSTEM WITH TEMPERATURE CONTROLLED ABSORBER BOTTOM
Inventors: Kunlei Liu, Zhen Fan, Heather Nokolic, Reynolds Frimpong and Chin Ng (Center for Applied Energy Research)
Description and Application: This invention is a novel system to capture carbon dioxide from a flue gas stream. The system includes an absorber, a stripper, a cooling system, and a control module. The system is adapted to independently cool (a) flue gas upstream from an absorber flue gas inlet and (b) carbon dioxide-lean carbon capture solution delivered to each carbon capture inlet at different levels of the absorber. The global carbon capture market was valued at \$3 billion with an expected CAGR of 21.5%.
License: N/A

- 5. U.S. Patent Application Number:** 18/520,159
UKRFID: 2425
Filed: November 27, 2023
Title: ANTIBODIES FOR BINDING PATHOLOGIC FORMS OF CALCINEURIN
Inventors: Christopher Norris, Susan Kraner, Jenna Leigh Gollihue (College of Medicine) and Rodney Guttman (University of West Florida)
Description and Application: This invention involves novel monoclonal antibodies to label pathologic delta calcineurin (CN) fragments, but that do not label full-length CN. In conjunction with immunohistochemistry, these antibodies can pinpoint where delta-CN is generated in relation to different cell types and developing neuropathology. Methods can then be used to identify which genes and proteins are mechanistically associated with delta-CN. In ELISA applications, delta-CN may be specifically identified and quantified in biofluids using these novel antibodies. This detection can be used in a clinical setting as a relatively noninvasive method of predicting the presence of an insidious pathology in the central nervous system. The global neurogenerative disease therapeutics market is expected to exceed \$55.1 billion by 2024 with an expected CAGR of 7.14%.
License: N/A
- 6. U.S. Patent Application Number:** 18/567,315
UKRFID: 2475
Filed: December 5, 2023
Title: TREATMENT FOR AORTOPATHY
Inventors: Alan Daugherty, Zhenyu Li, Hong Lu, Conqing Wu and Dien Ye (College of Medicine)
Description and Application: This invention is a method to treat aortopathy by reducing the expression of gasdermin D (GSDMD). Antisense oligonucleotide (ASO), miRNA, siRNA, locked nucleic acid (LNA) nucleotides inhibit GSDMD. Aortopathies target the largest artery in the body and cause more than 10,000 deaths in the United States per year. No current medications have been approved to treat disease progression. The global market for aortopathies is currently \$760 million with an expected CAGR of 10%.
License: N/A

- 7. U.S. Patent Application Number:** 18/567,275
UKRFID: 2545
Filed: December 5, 2023
Title: INDOLE-SUBSTITUTED QUINOLINES AND THEIR COMBINATION WITH PLK1 INHIBITORS FOR THE TREATMENT OF CANCER
Inventors: Chunming Liu (College of Medicine) and David Watt (formerly College of Medicine)
Description and Application: This invention is a novel treatment for cancer by administering indole-substituted quinolines alone or in combination with polo-like kinase-1 (Plk1) inhibitors. This treatment may be particularly effective against colorectal cancer. The global colorectal cancer therapeutics market was \$8.6 billion in 2018 with a projected CAGR of 6.1% until 2023.
License: Exclusive License to Epionc, Inc.
- 8. U.S. Patent Application Number:** 18/539,217
UKRFID: 2209
Filed: December 13, 2023
Title: QUALITY ASSURANCE DEVICE FOR A MEDICAL ACCELERATOR
Inventors: Janelle Molloy (formerly College of Medicine), Dennis Cheek and Quan Chen (College of Medicine and Wild Dog Physics, LLC)
Description and Application: This invention is a quality assurance device for calibrating and verifying proper operation of a medical accelerator. The invention combines a novel phantom with a shell consisting of a scintillating material that converts X-ray radiation into visible light. This light is detected using optical imaging that can acquire a near 360-degree panoramic field. The images can be transmitted to a digital imaging system. The inventive device allows for the performance of several tasks with a single device.
License: Licensed to Iridesce Solutions, Inc.

- 9. U.S. Patent Application Number: 18/540,795**
UKRFID: 2765
Filed: December 14, 2023
Title: ELECTRICALLY-CONDUCTING POLYMER YARN AND METHOD OF MAKING SAME
Inventors: Matthew Weisenberger (Center for Applied Energy Research) and Ruben Sarabia Riquelme (formerly Center for Applied Energy Research)
Description and Application: The invention is a method for making electrically conductive yarn by simultaneously drawing and axially twisting a starting material. The starting materials include nonwoven fibers. The global market for conductive fibers was \$1.8 billion in 2022 with an expected CAGR of 11.66% until 2033.
License: NA
- 10. U.S. Patent Application Number: 18/541,729**
UKRFID: 2742
Filed: December 15, 2023
Title: CARBON FIBER DERIVED FROM PEDOT:PSS FIBER
Inventors: Matthew Weisenberger (Center for Applied Energy Research) and Ruben Sarabia Riquelme (formerly Center for Applied Energy Research)
Description and Application: The invention is a method of making carbon fibers by direct carbonization of poly (3,4-ethylenedioxythiophene): poly (styrene sulfonate). This direct carbonization method eliminates the need for oxidizing the precursor fibers. The global carbon fiber market was \$7.1 billion in 2023 with an expected CAGR of 12.6% until 2033.
License: N/A
- 11. U.S. Patent Application Number: 18/545,717**
UKRFID: 2690
Filed: December 19, 2023
Title: TARGETING AND TREATMENT OF CANCEROUS CELLS USING RADIOLABELED GRP78-BINDING AGENTS
Inventors: Vivek Rangnekar (College of Medicine)
Description and Application: The invention is a novel method to treat cancer by administering a radiolabeled 78-kDa glucose-regulated protein (GRP78) binding agent (GRP78-binding agent). The method is

effective against prostate cancer, but the treatment may also be effective against other forms of cancer. The global prostate cancer treatment market was \$12 billion in 2022 with an expected CAGR of 8.7%.

License: N/A

12. International Application Number: PCT/US2023/76536

UKRFID: 2319

Filed: October 11, 2023

Title: MITHRAMYCIN OXIME DERIVATIVES HAVING INCREASED SELECTIVITY AND ANTI-CANCER ACTIVITY

Inventors: Jon Thorson, Jurgen Rohr, Khaled Shaaban, Joseph Eckenrode, Yang Liu (College of Pharmacy), Markos Leggas, Jianjun Zhang and Yinan Zhang (formerly College of Pharmacy)

Description and Application: The invention is a treatment for cancer using derivatives of mithramycin (MTM). The relevant compounds are MTM Oxime (MTM-OX) and MTM hydrazine (MTM-HY). The use of these derivatives allows for selective modulation of the activity of a target erythroblast transformation-specific transcription factor in a patient by administering a therapeutically effective amount of the derivative or a related pharmaceutically acceptable salt. This treatment may be effective for prostate, colon and lung cancers, as well as the treatment of leukemia, lymphoma and Ewing sarcoma. The global oncology market is expected to reach \$581 billion by 2030.

License: N/A

13. International Application Number: PCT/US2023/78639

UKRFID: 2711

Filed: November 3, 2023

Title: COMPOUNDS WITH ANTI-ACINETOBACTER BAUMANNII ACTIVITY

Inventors: Sylvie Garneau-Tsodikova (College of Pharmacy)

Description and Application: A novel compound for controlling *Acinetobacter baumannii*. This bacteria is resistant to many antibiotics and causes infections in the blood, urinary tract and lungs. The global antibiotic resistance market was \$10.1 billion in 2022 with an expected CAGR of 5.3% until 2033.

License: N/A

- 14. International Application Number:** PCT/US2023/79268
UKRFID: 2526
Filed: November 9, 2023
Title: RNA INTERFERENCE (RNAI) FOR CONTROL OF JAPANESE BEETLE
Inventors: Subba Reddy Palli (College of Agriculture, Food and Environment) and Ramesh Dhadapani (formerly College of Agriculture, Food and Environment)
Description and Application: This invention is a novel compound for the control of the Japanese beetle. The compound includes dsRNA targeting a lethal gene through RNA interference (RNAi) mechanism. Targeting can be achieved by applying an inactive bacterium containing expressed dsRNA to a plant. The global pest control market was \$22.6 billion in 2022 with an expected CAGR of 5.4% until 2032.
License: N/A
- 15. International Application Number:** PCT/US2023/85188
UKRFID: 2694
Filed: December 20, 2023
Title: BACTERIAL TYPE IV SECRETION SYSTEMS, METHODS OF USE FOR IN VIVO DNA DELIVERY, AND METHOD OF ENGINEERING
Inventors: Carrie Shaffer (College of Pharmacy) and Prashant Damke (College of Agriculture, Food and Environment)
Description and Application: This invention includes novel devices for the delivery of polynucleotides. Specifically, the novel devices include a *Helicobacter pylori* cag type IV secretion system (cagT4SS) as a DNA-delivery device capable of transferring large fragments of DNA from the bacterial cell to target host cells. The global gene therapy market was \$9 billion in 2023 with an expected CAGR of 21.4% until 2028.
License: N/A

Patent Activities
Fiscal Year to Date as of December 31, 2023

Total FY2023-24					
	FY24Q1	FY24Q2	FY24Q3	FY24Q4	Total FY24
Invention Disclosures ⁱ	24	34	0	0	58
Full Patent Applications ⁱⁱ	21	15	0	0	36
Provisional Patent Applications ⁱⁱⁱ	18	15	0	0	33
Patents Issued	10	9	0	0	19
License Income	\$446,360.22	\$3,380,740.08	\$0	\$0	\$3,827,100.30
New Licenses and Options Executed	13 ¹	17	0	0	30
New UK Startups Formed	2	3	0	0	5

¹ Four additional Options/Licenses were returned to OTC with a Q1 execution date.

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			
Stefan Stamm and Justin Welden	College of Medicine	Using siRNAs against tau circular RNAs as a rational therapy for Alzheimer's disease	Novel treatment for Alzheimer's disease targeting backsplice junction.
Christopher Norris, Susan Kraner, Jenna Leigh Gollihue and Rodney Guttman	College of Medicine	Antibodies for binding pathologic forms of calcineurin	Novel monoclonal antibodies to label pathologic delta calcineurin (CN) fragments, but that do not label full-length CN.
Alan Daugherty, Zhenyu Li, Hong Lu, Conqing Wu and Dien Ye	College of Medicine	Treatment for aortopathy	A method to treat aortopathy by reducing the expression of gasdermin D.
Chunming Liu and David Watt	College of Medicine	Indole-substituted quinolines and their combination with PLK1 inhibitors for the treatment of cancer	A novel treatment for cancer by administering indole-substituted quinolines alone or in combination with polo-like kinase-1 (Plk1) inhibitors.

Inventors	College(s)	Title	Brief description
Janelle Molloy, Dennis Cheek and Quan Chen	College of Medicine	Quality assurance device for a medical accelerator	Quality assurance device for calibrating and verifying proper operation of a medical accelerator.
Vivek Rangnekar	College of Medicine	Targeting and treatment of cancerous cells using radiolabeled GRP78- binding agents	A novel method to treat cancer by administering a radiolabeled 78-kDa glucose-regulated protein (GRP78) binding agent (GRP78-binding agent).
Jon Thorson, Jurgen Rohr, Khaled Shaaban, Joseph Eckenrode, Yang Liu, Markos Leggas, Jianjun Zhang and Yinan Zhang	College of Pharmacy	Mithramycin oxime derivatives having increased selectivity and anti-cancer activity	A cancer treatment using derivates of mithramycin.
Sylvie Garneau- Tsodikova	College of Pharmacy	Compounds with anti- <i>Acinetobacter baumannii</i> activity	A novel compound for controlling <i>Acinetobacter baumannii</i> .
Carrie Shaffer and Prashant Damke	College of Pharmacy	Bacterial type iv secretion systems, methods of use for in vivo DNA delivery, and method of engineering	Novel devices to deliver polynucleotides.

Inventors	College(s)	Title	Brief description
Engineering			
Guoqiang Yu, Chong Huang and Thomas Pittman	College of Engineering	Loupe-based intraoperative fluorescence imaging device for the guidance of tumor resection	A hands-free, wearable, magnifying eye-loupe-based imaging device, using fluorescence imaging to identify tumor margins.
Julius Schoop	College of Engineering	Intelligent machine vision system for in-process tool wear monitoring	A tool-wear monitoring system using an intelligent machine vision system.
Center of Applied Energy Research			
Kunlei Liu, Zhen Fan, Heather Nokolic, Reynolds Frimpong and Chin Ng	CAER	Carbon capture system with temperature-controlled absorber bottom	System for capturing carbon dioxide from a flue gas stream.
Matthew Weisenberger and Ruben Sarabia Riquelme	CAER	Electrically conducting polymer yarn and method of making same	A method for making electrically conductive yarn by simultaneously drawing and axially twisting a starting material.
Matthew Weisenberger and Ruben Sarabia Riquelme	CAER	Carbon fiber derived from PEDOT:PSS fiber	A method to make carbon fibers by direct carbonization of poly (3,4-ethylenedioxythiophene):poly (styrene sulfonate).

Inventors	College(s)	Title	Brief description
College of Agriculture, Food and Environment			
Subba Reddy Palli and Ramesh Dhadapani	College of Agriculture, Food and Environment	RNA interference (RNAi) for control of Japanese beetle	A novel compound for Japanese beetle control.

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.