FCR 1

Office of the President
December 2, 2025

Members, Board of Trustees:

PATENT ASSIGNMENT REPORT

Recommendation: that the Board of Trustees accept the patent assignment report for the period July 1, 2025 to September 30, 2025.

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, 2025 TO September 30, 2025

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:** 19/145,270
   UKRFID: 2740
   Filed: July 2, 2025
   Title: 3D MICROFLUIDIC DEVICE AND METHOD OF SEPARATING PARTICLES BY SIZE FROM A SUSPENSION
   Inventors: Guigen Zhang (Pigman College of Engineering)
   Description and Application: This invention is a 3D microfluidic device with a vertically oriented channel, an intermediate spiral section and a four-port outlet system, designed to passively separate particles and cells by size in a single device. As the sample flows through the spiral path, inertial and Dean forces align larger particles into stable positions while smaller particles circulate and exit via different outlets, enabling simultaneous multi-fraction recovery without real-time microscope tuning. The separation thresholds are tunable via geometry (channel height, width, loop radii/number), flow velocity and fluid properties, providing flexibility for diverse applications, from circulating tumor cell (CTC) isolation to extracellular vesicle preparation. Importantly, there is a strong market need for robust, label-free, high-throughput separation technologies in diagnostics, cell therapy and biomanufacturing. Existing microfluidic solutions often require optical tuning or field-based forces and struggle with scalability and reproducibility. The global microfluidics market was valued at approximately $37.5 billion in 2024 and is projected to reach $73.9 billion by 2030, representing an estimated 12% compound annual growth rate (CAGR) from 2025 to 2030.
   License: NA

2. **U.S. Patent Application Number:** 19/145,282
UKRFID: 2752
Filed: July 2, 2025
Title: 3D MICROFLUIDIC TRANSFECTION DEVICES AND METHOD OF TRANSFECTING TARGET CELLS WITH A TRANSFECTION AGENT
Inventors: Guigen Zhang and Sheng Tong (Pigman College of Engineering)
Description and Application: This invention is a 3D microfluidic transfection device that enables efficient, consistent and clog-free delivery of genetic material into living cells in a continuous flow. It integrates a vertically oriented microchannel and dual electrode system that applies synchronized electric and hydro-pressure fields, ensuring uniform exposure and high transfection efficiency while maintaining cell viability. Unlike conventional cuvette-based or high-voltage systems, this device offers high-throughput, gentle and GMP-compatible cell transfection suitable for clinical and industrial scale-up. The technology directly addresses the market need for safer, scalable and more reproducible transfection systems to support the rapidly expanding cell and gene therapy sector, where batch-to-batch variability and low cell survival remain critical bottlenecks. Potential applications include CAR-T cell manufacturing, genetic editing and nanoparticle-mediated delivery in research and therapeutic production. The global cell and gene therapy manufacturing market was valued at approximately $14.8 billion in 2024 and is projected to reach $35 billion by 2030, growing at a CAGR of 15-16%.
License: NA

3. **U.S. Patent Application Number:** 19/265,798
UKRFID: 2279
Filed: July 10, 2025
Title: CONCRETE FORMULATION FOR SEALING AND PLUGGING OIL OR GAS WELLS FOR ABANDONMENT
Inventors: Thomas Robl, Robert Jewell, Anne Oberlink and Tristana Duvallet (Center for Applied Energy Research, CAER)
Description and Application: This invention describes a specialized concrete formulation engineered to seal and plug oil and gas wells during abandonment operations. The formulation combines calcium sulfoaluminate (CSA) cement and Portland cement with a specific aggregate gradation and optional additives — such as foaming agents,

water reducers and set-time retarders — to achieve rapid setting, low viscosity, strong bonding and long-term shrink resistance. Unlike conventional Portland-based well cements that can crack, shrink or fail under high-pressure conditions, this technology enables microcellular foamed concrete applications that can penetrate casings, stabilize under depth pressure and fill entire wellbores in minutes, ensuring durable seals and reducing methane leakage risks. The market urgently needs low-cost, high-performance sealing materials to address the environmental and regulatory challenge of over 3 million abandoned oil and gas wells worldwide, many of which leak methane or groundwater contaminants. Key applications include oil and gas well decommissioning, environmental remediation and carbon sequestration site closure. The global well abandonment and decommissioning market was valued at approximately $6.5 billion in 2024 and is projected to reach $9.8 billion by 2030, growing at a CAGR of 7%.
License: License in negotiations

4. **U.S. Patent Application Number:** 19/267,120
UKRFID: 2552
Filed: July 11, 2025
Title: TEQUILA STILLAGE MORTAR AND CONCRETE
Inventors: Rodney Andrews, Robert Jewell and Anne Oberlink (CAER)
Description and Application: This invention leverages stillage's natural organic composition to enhance workability, rheology and compressive strength while simultaneously reducing the total water demand and reusing an abundant industrial waste stream. Unlike conventional formulations, the tequila stillage admixture can be used as-received without solids removal or refrigeration, and it naturally resists mold growth, providing shelf-life and cost advantages over prior distillery waste-based admixtures. This innovation addresses a growing market need for green construction materials that lower embodied carbon, reduce freshwater usage and align with circular-economy goals. Key applications include infrastructure, residential and commercial concrete production, and sustainable construction in arid or resource-limited regions. The global green concrete market was valued at approximately $31 billion in 2024 and is projected to reach $78 billion by 2030, growing at an estimated 16% CAGR from 2025 to 2030.

License: Optioned to Carbon Science Solutions LLC

5. **U.S. Patent Application Number:** 19/267,088
UKRFID: 2935
Filed: July 11, 2025
Title: METHOD OF SPINNING CONDUCTIVE POLY(3,4-ETHYLENEDIOXYTHIOPHENE): POLYSTYRENE SULFONATE FIBERS
Inventors: Matthew Weisenberger, Elizabeth Morris, Leah Noble (CAER) and Ruben Riquelme (formerly CAER)
Description and Application: This invention describes a novel method for spinning conductive polymer fibers made from poly(3,4-ethylenedioxythiophene): polystyrene sulfonate (PEDOT:PSS) for use in smart and functional textiles. The process employs upward solution spinning of a PEDOT:PSS dope into a formic acid-based coagulation bath, which causes the fibers to solidify and float to the surface, where they are dried individually before being combined into a non-fused multifilament tow. This approach eliminates filament fusion, a major issue in conductive polymer fiber production, and allows continuous, scalable fabrication of highly conductive, flexible fibers suitable for weaving or knitting. This technology meets a growing market demand for durable, lightweight and conductive fibers that can integrate electronics directly into fabrics for sensing, power transfer and communication. Key applications include wearable electronics, flexible sensors, e-textiles and energy-harvesting fabrics. The global smart textiles market was valued at approximately $6.2 billion in 2024 and is projected to reach $18.5 billion by 2030, reflecting a CAGR of 19% from 2025 to 2030.
License: NA

6. **U.S. Patent Application Number:** 19/149,784
UKRFID: 2718
Filed: July 21, 2025
Title: A STAGED-FEED POST-COMBUSTION CO2 CAPTURE TECHNOLOGY FOR FLUE GAS STREAM
Inventors: Kunlei Liu, Zhen Fan, Reynolds Frimpong (Pigman College of Engineering) and Heather Nikolic (formerly Pigman College of Engineering)

Description and Application: This invention describes a novel carbon capture system that efficiently removes and converts carbon dioxide (CO_2) from gas streams using an integrated solid sorbent and electrochemical regeneration process. The technology employs a proprietary sorbent composition and modular reactor design that captures CO_2 under ambient or low-pressure conditions and then regenerates the sorbent electrochemically, eliminating the high-temperature or caustic chemical steps common in conventional systems. Unlike amine-based or cryogenic methods, this approach offers lower energy consumption, reduced material degradation and scalability for continuous industrial operation. This technology addresses an urgent market demand for cost-effective, low-carbon capture solutions to meet global decarbonization and emission-reduction targets. Key applications include flue-gas treatment, direct air capture and integration with bioenergy or hydrogen production systems. The global carbon capture, utilization and storage (CCUS) market was valued at $5.9 billion in 2024 and is projected to reach $18.2 billion by 2030, representing a CAGR of 20% from 2025 to 2030.
License: NA

7. **U.S. Patent Application Number:** 19/280,815
UKRFID: 2300
Filed: July 25, 2025
Title: HIGH SPEED MULTI-AXIS MACHINE TOOL
Inventors: Julius Schoop (Pigman College of Engineering)
Description and Application: This invention is a high-speed, multi-axis machine tool designed to cut complex three-dimensional features — such as curved surfaces, slots, and pockets — into hard-to-machine materials with unprecedented precision and efficiency. The technology replaces conventional milling with a non-rotational, single-point shaping process driven by six synchronized servo-actuated axes, enabling precise multi-axis linear motion and advanced “jerk-controlled” acceleration for smooth, chatter-free machining. Unlike traditional milling systems limited by rotational symmetry and tool deflection, this design allows greater tool stiffness, improved surface integrity and 10 times faster material removal rates while accommodating external cryogenic or minimal-lubrication cooling. The innovation addresses a major market need for higher-performance machining systems in aerospace, biomedical and defense manufacturing, where complex geometries and high-strength alloys

drive production costs and limits. Key applications include aerospace turbine components, biomedical implants, precision molds and impellers. The global CNC machine tools market was valued at $81 billion in 2024 and is projected to reach $115 billion by 2030, representing a CAGR of 6% from 2025 to 2030.
License: NA

8. **U.S. Patent Application Number:** 19/280,702
UKRFID: 2964
Filed: July 25,2025
Title: BIOPOLYMER-BASED HYDROGELS AND METHOD FOR ENTEROSORPTIVE REMOVAL OF TARGET MOLECULES
Inventors: Zach Hilt (Pigman College of Engineering), Peter Sawaya (College of Medicine) and Sachin Sundar (Pigman College of Engineering)
Description and Application: This invention is a biopolymer-based hydrogel enterosorbent designed for in vivo binding and removal of harmful target molecules, such as PFAS and synthetic food dyes, from the digestive tract without entering systemic circulation. The hydrogel is composed of agarose or other FDA-recognized safe biopolymers, optionally formulated with additives such as activated carbon, clays or ionic/biological polymers to enhance adsorption selectivity and capacity. This approach uniquely enables oral enterosorption of persistent contaminants, addressing the unmet need for safe, scalable and non-systemic PFAS and toxin removal methods in humans and animals, an area where current water filtration or chemical treatments fail to work internally. Key applications include human and veterinary health products, dietary exposure mitigation and clinical detoxification adjuncts. The global adsorbents market, including activated carbon and biopolymer-based materials, is projected to grow from $5.3 billion in 2024 to $7.9 billion by 2030, reflecting a CAGR of 6.8%.
License: N/A

9. **U.S. Patent Application Number:** 19/281,243
UKRFID: 3080
Filed: July 25,2025
Title: SYNTHETIC-BASED HYDROGELS, SYNTHETIC-BASED HYDROGEL COMPOSITES AND METHOD FOR ENTEROSORPTIVE REMOVAL OF TARGET MOLECULES

Inventors: Zach Hilt, Sachin Sundar, Victoria Klaus and Mei Li Weatherly (Pigman College of Engineering)
Description and Application: This invention is a synthetic-based hydrogel and hydrogel composite system designed to bind and remove harmful compounds from the digestive tract through enterosorption without being metabolized or absorbed into the bloodstream. The technology leverages engineered hydrogel matrices, typically composed of poly(ethylene glycol) diacrylate (PEGDA) and functional co-monomers such as (3-acrylamidopropyl) trimethylammonium chloride (DMAPA-Q), often combined with activated carbon or protein additives to enhance sorption efficiency. Unlike existing detoxification or filtration methods, this oral hydrogel platform offers a non-systemic, selective binding approach for carcinogens, PFAS, nitrates, nitrosamines and synthetic food dyes, enabling in-vivo mitigation of toxic exposure. The technology addresses the growing health concerns associated with persistent environmental and dietary contaminants — a global challenge given the ubiquity of PFAS, nitrates and synthetic additives in food and water supplies. Key applications include clinical and consumer health supplements for toxin mitigation, veterinary detox products and adjunctive therapies for populations exposed to contaminated environments. The global detoxification and digestive health supplement market is projected to exceed $80 billion by 2030, growing at a CAGR of 7-8% from 2024 to 2030.
License: N/A

10. **U.S. Patent Application Number:** 19/297,439
UKRFID: 2959
Filed: August 12, 2025
Title: A CONCENTRATION, EXTRACTION AND IDENTIFICATION SYSTEM AND A MICROFLUIDIC CHIP READING INSTRUMENT FOR THAT SYSTEM
Inventors: Scott Berry, Soroosh Torabi, Ann Noble, William Strike, Mohammad Banadaki, Abigail Phillips (Pigman College of Engineering), James Keck (formerly College of Medicine) and Soroush Farahbakhsh (Pigman College of Engineering)
Description and Application: This invention is a Concentration, Extraction and Identification System (CEIS), a microfluidic-based device and portable reader designed for rapid detection of low-prevalence pathogens in environmental or wastewater samples. The system integrates paramagnetic particle-based nucleic acid extraction

with isothermal amplification and smartphone-enabled optical readout, enabling sample-to-result analysis in under one hour without the need for laboratory infrastructure. It differentiates itself through an immiscible filtration assisted by surface tension microfluidic design that automates multi-step processing (including lysis, isolation, washing and amplification) using a simple magnet-actuated chip reader with onboard heating and cell-phone visualization. This innovation addresses a significant market need for affordable, field-deployable pathogen monitoring tools, particularly for wastewater-based epidemiology and infectious disease surveillance in low-resource settings. Key applications include public health monitoring, rural and developing region surveillance, outbreak response and environmental microbiology. The global environmental pathogen detection market was valued at $3.8 billion in 2024 and is expected to reach $6.2 billion by 2030, representing a CAGR of 8.5%.
License: N/A

11. **U.S. Patent Application Number:** 19/301,481
UKRFID: 2942
Filed: August 15, 2025
Title: METHOD FOR PREPARING STABLE ORGANIC ELECTROCHEMICAL TRANSISTORS
Inventors: Alexandra Paterson (Pigman College of Engineering) and Vianna Le (CAER)
Description and Application: This invention describes a method for fabricating stable organic electrochemical transistors (OECTs) through a two-step process combining solvent degassing and controlled chemical doping to enhance device stability and performance. The approach removes oxygen from the solvent using freeze-pump-thaw degassing before introducing a p-dopant such as fluorinated fullerene, which tunes threshold voltage and improves on/off current ratios while preventing degradation in aqueous or oxygen-rich environments. This innovation addresses a critical limitation in current OECT technology: poor operational stability due to oxygen-induced redox reactions, which restricts reliable use in biosensors, medical devices and neuromorphic circuits. Key applications include bioelectronic interfaces, chemical and biological sensing, neural prosthetics and adaptive healthcare systems, where both ionic and electronic conductivity are essential. The global organic electronics market, including bioelectronic transistors and related materials, is valued at

$94 billion in 2024 and is projected to reach $188 billion by 2030, reflecting a CAGR of 12%.
License: N/A

12. **U.S. Patent Application Number:** 19/303,115
UKRFID: 2909
Filed: August 18, 2025
Title: SYSTEMS AND METHODS FOR PROVIDING IN-DRAM ACCELERATOR FOR TRANSFORMER NEURAL NETWORKS
Inventors: Ishan Thakkar (Pigman College of Engineering), Sudeep Pasricha and Salma Afifi (Colorado State University)
Description and Application: This invention describes ARTEMIS, an in-DRAM accelerator system for transformer neural networks that enables high-speed, low-power computation by combining stochastic and analog processing directly within DRAM memory arrays. The architecture integrates metal-oxide-metal capacitors and stochastic-to-analog circuits within DRAM subarrays to perform multiply–accumulate operations in-memory, drastically reducing data movement and achieving up to 64 MACs in just 48 nanoseconds. This hybrid design differentiates itself through token-based dataflow scheduling and pipelined execution, optimizing transformer attention and feed-forward layers for speed and energy efficiency. This technology addresses the growing computational and energy challenges of large-scale transformer models used in natural language processing, computer vision and AI inference, where traditional GPUs and TPUs face bottlenecks in memory bandwidth and power consumption. Key applications include AI data centers, edge computing, autonomous systems and next-generation neuromorphic accelerators. The global AI accelerator market was valued at $42.9 billion in 2024 and is projected to reach $127.2 billion by 2030, growing at a CAGR of 19.7%.
License: NA

13. **U.S. Patent Application Number:** 19/307,593
UKRFID: 2717
Filed: August 22, 2025
Title: COMPOSITION AND METHOD FOR SUPPRESSING SMOKING URGE AND SMOKE-RELATED MALODOR PERCEPTION USING PENTANOL
Inventors: Timothy McClintock and Dong Young Han (College of Medicine)

Description and Application: This invention is a composition and method for suppressing smoking urges and masking smoke-related odors through exposure to pentanol-based olfactory formulations. This technology leverages the unique olfactory antagonism and masking properties of pentanol which, when physically mixed with cigarette smoke, reduces both the perceived intensity of smoke odor and the physiological urge to smoke, as demonstrated in controlled human studies. This approach differs fundamentally from existing smoking cessation methods by targeting olfactory–reward neural pathways, effectively diminishing cravings triggered by smoke odor cues. The invention meets a critical market need for non-pharmacological, sensory-based cessation aids that can be deployed through wearable devices, diffusers, sprays or topical applications. Key applications include personal wellness products, smoking cessation programs and odor-neutralizing consumer goods for both smokers and passive exposure environments. The global smoking cessation and nicotine replacement therapy market was valued at $28.1 billion in 2024 and is projected to reach $47.6 billion by 2030, growing at a CAGR of 9.2%.
License: N/A

14. **U.S. Patent Application Number:** 19/320,813
UKRFID: 2800
Filed: September 5, 2025
Title: APPARATUS AND METHOD OF AMPLIFYING SEGMENTS OF NUCLEIC ACID IN A MIXTURE SAMPLE VIA POLYMERASE CHAIN REACTION
Inventors: Guigen Zhang (Pigman College of Engineering)
Description and Application: This invention describes a microfluidic, low-cost, battery-operable apparatus to perform rapid polymerase chain reaction (PCR) to amplify DNA or RNA segments directly within a compact, polymer-based device. The system employs a continuous concentric-ring heating element and a radially oriented fluidic conduit that guides the nucleic acid sample sequentially through denaturation, annealing and extension zones, enabling up to 30-40 PCR cycles in minutes without the need for bulky thermocyclers. This architecture differentiates itself through precise temperature zoning and integrated optical-spectrometer detection, which allow near-instantaneous nucleic acid amplification and in-situ result readout using minimal power input. The invention addresses the market demand for affordable, portable and high-speed molecular diagnostic tools,

particularly for point-of-care testing and decentralized laboratory environments where traditional PCR systems are cost- or infrastructure-prohibitive. Key applications include infectious disease diagnostics, genetic screening, forensic identification, food safety and environmental monitoring, with potential expansion into digital and multiplex droplet PCR. The global point-of-care molecular diagnostics market is valued at $4.9 billion in 2024 and is projected to reach $9.8 billion by 2030, growing at a CAGR of 11.8%.
License: N/A

15. **International Application Number:** PCT/US2025/37003
UKRFID: 2844
Filed: July 9, 2025
Title: STEATOTIC LIVER DISEASE, MITOCHONDRIAL BIOENERGETICS RESERVE, AND NEUROTENSIN SIGNALING
Inventors: Bernard Mark Evers, Jing Li and Moumita Banerjee (College of Medicine)
Description and Application: This invention is a novel diagnostic and therapeutic approach for steatotic liver disease (MASLD and ALD) that targets neurotensin (NTS) signaling and mitochondrial bioenergetic reserve. The technology identifies that neurotensin promotes lipid accumulation in hepatocytes by impairing mitochondrial oxidative phosphorylation (OXPHOS) and provides a method to monitor, treat and evaluate treatment response in liver disease by measuring mitochondrial bioenergetics and modulating NTS signaling through neurotensin receptor (NTSR1) antagonists or inhibitors. This innovation differentiates itself by linking mitochondrial function directly to NTS-driven lipid metabolism, enabling both diagnostic biomarkers and therapeutic interventions for metabolic and alcohol-associated fatty liver disorders. It addresses the urgent need for effective, mechanism-based solutions to monitor and slow the progression of MASLD and MASH, diseases with limited treatment options and rising prevalence worldwide. Key application areas include clinical diagnostics, pharmaceutical drug development, metabolic disease management and personalized medicine platforms. The global nonalcoholic fatty liver disease (NAFLD/MASLD) therapeutics market was valued at $4.9 billion in 2024 and is projected to reach $25.3 billion by 2030, growing at a CAGR of 31.8%.
License: N/A

16. **International Application Number:** PCT/US2025/38480
UKRFID: 2940
Filed: July 21, 2025
Title: DIFFERENTIAL IMMERSION COOLING FOR SEMICONDUCTOR THERMAL BALANCING IN POWER ELECTRONIC CONVERTERS
Inventors: Jiangbiao He, Majid Fard and Reza Ilka (formerly Pigman College of Engineering)
Description and Application: This invention is a differential immersion cooling system for power electronic converters, designed to balance thermal loads and improve reliability by independently managing cooling across semiconductor switches. The system employs dual dielectric cooling flow paths — one for high-temperature and another for low-temperature switches — paired with independent pumps, temperature sensors and closed-loop control to dynamically adjust flow rates and achieve thermal uniformity. This approach differs from conventional immersion or liquid cooling by delivering targeted, adaptive cooling, reducing hotspot temperatures by 30°C and doubling power density while maintaining compact form factors. This technology addresses the growing market need for high-efficiency thermal management in power electronics, particularly in high-density converters used in electric vehicles, renewable energy systems and data centers. Key applications include EV traction inverters, high-frequency power supplies, industrial drives and energy storage systems. The global power electronics thermal management market was valued at $4.6 billion in 2024 and is projected to reach $7.9 billion by 2030, growing at a CAGR of 8.1%.
License: N/A

17. **International Application Number:** PCT/US2025/39848
UKRFID: 2926
Filed: July 30, 2025
Title: SYSTEMS AND METHODS FOR DIGITAL-TWIN BASED OPEN CIRCUIT SWITCH FAULT DETECTION FOR 5L-ANPC CONVERTERS
Inventors: Jiangbiao He, Majid Fard and Benjamin Luckett (formerly Pigman College of Engineering)
Description and Application: This invention is a digital-twin-based system and method for real-time open-circuit switch fault detection in five-level active neutral point clamped (5L-ANPC) power converters,

enabling rapid and precise identification of faulty components without additional hardware sensors. The innovation leverages a digital replica (digital twin) of the converter that continuously monitors DC-link and flying capacitor voltages and load currents to detect deviations indicative of switch failures within a single output frequency cycle. This approach eliminates the need for external voltage sensors or filters and achieves high accuracy across variable load and modulation conditions. This technology addresses the critical need for improved fault detection in high-power and safety-critical applications, where undiagnosed open-circuit faults can cause costly downtime or catastrophic system failure. Its digital-twin framework enhances reliability, reduces maintenance costs and supports predictive monitoring in converters used across electric aircraft propulsion, renewable energy systems, industrial drives and electrified transportation. The global power electronics market, driven by electrification, grid modernization and renewable energy integration, is projected to reach $63 billion by 2030, growing at a CAGR of 5.4% from 2024 to 2030.
License: N/A

18. **International Application Number:** PCT/US2025/41646
UKRFID: 2957
Filed: August 12, 2025
Title: LIBRARY-PREPARATION-ON-A-CHIP APPROACH TO METAGENOMIC WASTEWATER SEQUENCING
Inventors: Scott Berry, Soroosh Torabi, Ann Noble, William Strike, Mohammad Banadaki, Abigail Phillips (Pigman College of Engineering), James Keck (formerly College of Medicine) and Soroush Farahbakhsh (Pigman College of Engineering)
Description and Application: This invention is a library-preparation-on-a-chip device and method for metagenomic sequencing of wastewater samples, enabling rapid, decentralized pathogen detection and genomic surveillance. The technology integrates all stages of nucleic acid processing (extraction, repair, adapter ligation and cleanup) onto a single sealed microfluidic chip using paramagnetic particle manipulation and immiscible liquid barriers to prevent contamination and simplify workflow. This design eliminates the need for complex laboratory infrastructure, allowing for field-deployable sequencing preparation compatible with platforms such as Oxford Nanopore Technologies. It addresses the urgent global need for

scalable, point-of-use genomic surveillance tools to monitor infectious disease spread, antimicrobial resistance and emerging pathogens in low-resource environments. Key applications include public health monitoring, environmental surveillance, biothreat detection and rapid diagnostics. The global wastewater-based epidemiology and genomic surveillance market is projected to grow from $2.4 billion in 2024 to $6.8 billion by 2030, reflecting a CAGR of 18.9%.
License: N/A

19. **Foreign Patent Application Number:** MX 2025/010188
UKRFID: 2341
Filed: August 28, 2025
Title: PHARMACEUTICALLY ACTIVE PYRAZOLO-PYRIDONE MODULATORS OF DCN1/2-MEDIATED CULLIN NEDDYLATION
Inventors: Rodney Kip Guy, Jared Hammill, Hoshin Kim (formerly College of Pharmacy), Bhuvanesh Singh (Memorial Sloan Kettering Cancer Center), Daniel Scott and Brenda Schulman (St. Jude Children's Hospital)
Description and Application: This invention discloses a new class of pharmaceutically active pyrazolo-pyridone compounds that act as modulators of DCN1/2-mediated cullin neddylation, a key regulatory process in protein homeostasis and tumor growth. These compounds selectively inhibit the interaction between DCN1 and UBE2M, disrupting aberrant protein neddylation and thereby restoring normal cellular ubiquitination activity. The approach provides a targeted mechanism to inhibit oncogenic signaling and neurodegenerative pathways driven by DCN1 overexpression or dysfunction, representing a differentiated strategy compared to broad E1 or proteasome inhibitors. This technology addresses a pressing clinical need for selective, orally bioavailable small-molecule modulators with improved safety and pharmacokinetic profiles for cancer and neurodegenerative disease treatment. Key application areas include oncology drug development, neurodegenerative disease therapeutics and anti-infective research, where neddylation pathway control is therapeutically relevant. The global protein degradation therapeutics market, which includes neddylation-targeting drugs, is projected to grow from $3.8 billion in 2024 to $14.4 billion by 2030, reflecting a CAGR of 24.8%.
License: NA

Patent Activities
Fiscal Year to Date as of September 30, 2025

	Total FY2025-26				
	FY26Q1	FY26Q2	FY26Q3	FY26Q4	Total FY26
Invention Disclosures[i]	42	0	0	0	42
Full Patent Applications[ii]	19	0	0	0	19
Provisional Patent Applications[iii]	28	0	0	0	28
Patents Issued	12	0	0	0	12
License Income	$551,786.05	$0	$0	$0	$551,786.05
New Licenses and Options Executed	11	0	0	0	11
New UK Startups Formed	0	0	0	0	0

Patent Activities
FY2024-25

Total FY2024-25					
	FY25Q1	FY25Q2	FY25Q3	FY25Q4	Total FY25
Invention Disclosures	22	30	37	29	118
Full Patent Applications	15	7	22	19	63
Provisional Patent Applications	28	17	24	22	91
Patents Issued	11	30	14	6	61
License Income	$427,185.01	$572,731.30	$905,046.77	$318,024.05	$2,222,987.13
New Licenses and Options Executed	29[1]	14	25	15[2]	83
New UK Startups Formed	1	0	0	0	1

[1] Consolidation of agreements
[2] Capture of outstanding license

Patent Application Summary Table

Inventors	College(s)	Title	Brief description
Biomedical			
Timothy McClintock and Dong Young Han	College of Medicine	Composition and method for suppressing smoking urge and smoke-related malodor perception using pentanol	A composition and method for suppressing smoking urges and masking smoke-related odors.
Bernard Mark Evers, Jing Li and Moumita Banerjee	College of Medicine	Steatotic liver disease, mitochondrial bioenergetics reserve, and neurotensin signaling	A novel diagnostic and therapeutic approach for steatotic liver disease.
Rodney Kip Guy, Jared Hammill, Hoshin Kim, Bhuvanesh Singh, Daniel Scott and Brenda Schulman	College of Pharmacy	Pharmaceutically active pyrazolo-pyridone modulators of dcn1/2-mediated cullin neddylation	A new class of pharmaceutically active pyrazolo-pyridone compounds that act as modulators of DCN1/2-mediated cullin neddylation.
Engineering			
Guigen Zhang	Pigman College of Engineering	3D microfluidic device and method of separating particles by size from a suspension	A 3D microfluidic device with a vertically oriented channel designed to passively separate particles and cells by size in a single device.

Inventors	College(s)	Title	Brief description
Guigen Zhang and Sheng Tong	Pigman College of Engineering	3D microfluidic transfection devices and method of transfecting target cells with a transfection agent	A 3D microfluidic transfection device that enables efficient, consistent, and clog-free delivery of genetic material into living cells in a continuous flow.
Kunlei Liu, Zhen Fan, Reynolds Frimpong and Heather Nikolic	Pigman College of Engineering	A staged-feed post-combustion co2 capture technology for flue gas stream	A novel carbon capture system that efficiently removes and converts carbon dioxide from gas streams using an integrated solid sorbent and electrochemical regeneration process.
Julius Schoop	Pigman College of Engineering	High speed multi-axis machine tool	A high-speed, multi-axis machine tool designed to cut complex three-dimensional features.
Zach Hilt, Peter Sawaya and Sachin Sundar	Pigman College of Engineering	Biopolymer-based hydrogels and method for enterosorptive removal of target molecules	A biopolymer-based hydrogel enterosorbent designed for in vivo binding and removal of harmful target molecules.
Zach Hilt, Sachin Sundar, Victoria Klaus and Mei Li Weatherly	Pigman College of Engineering	Synthetic-based hydrogels, synthetic-based hydrogel composites and method for enterosorptive removal of target molecules	A synthetic-based hydrogel and hydrogel composite system designed to bind and remove harmful compounds from the digestive tract.

Inventors	College(s)	Title	Brief description
Scott Berry, Soroosh Torabi, Ann Noble, William Strike, Mohammad Banadaki, Abigail Phillips, James Keck and Soroush Farahbakhsh	Pigman College of Engineering	A concentration, extraction and identification system and a microfluidic chip reading instrument for that system	A microfluidic-based device and portable reader designed for the rapid detection of low-prevalence pathogens in environmental or wastewater samples.
Alexandra Paterson and Vianna Le	Pigman College of Engineering	Method for preparing stable organic electrochemical transistors	A method for fabricating stable organic electrochemical transistors with enhanced device stability and performance.
Ishan Thakkar, Sudeep Pasricha and Salma Afifi	Pigman College of Engineering	Systems and methods for providing in-DRAM accelerator for transformer neural networks	An in-DRAM accelerator system for transformer neural networks that combines stochastic and analog processing directly within DRAM memory arrays.
Guigen Zhang	Pigman College of Engineering	Apparatus and method of amplifying segments of nucleic acid in a mixture sample via polymerase chain reaction	A microfluidic, battery-operable apparatus for performing rapid polymerase chain reaction.

Inventors	College(s)	Title	Brief description
Jiangbiao He, Majid Fard and Reza Ilka	Pigman College of Engineering	Differential immersion cooling for semiconductor thermal balancing in power electronic converters	A differential immersion cooling system for power electronic converters.
Jiangbiao He, Majid Fard and Benjamin Luckett	Pigman College of Engineering	Systems and methods for digital-twin based open circuit switch fault detection for 5L-ANCP converters	A digital-twin-based system and method for real-time, open-circuit switch fault detection in five-level active neutral point clamped power converters.
Scott Berry, Soroosh Torabi, Ann Noble, William Strike, Mohammad Banadaki, Abigail Phillips, James Keck and Soroush Farahbakhsh	Pigman College of Engineering	Library-preparation-on-a-chip approach to metagenomic wastewater sequencing	A library-preparation-on-a-chip device and method for metagenomic sequencing of wastewater samples.
Center for Applied Energy Research			
Thomas Robl, Robert Jewell, Anne Oberlink and Tristana Duvallet	CAER	Concrete formulation for sealing and plugging oil or gas wells for abandonment	A specialized concrete formulation engineered to seal and plug oil and gas wells during abandonment operations.

Inventors	College(s)	Title	Brief description
Rodney Andrews, Robert Jewell and Anne Oberlink	CAER	Tequila stillage mortar and concrete	A sustainable mortar and concrete formulation that uses tequila stillage as a partial or complete substitute for water in cement mixtures.
Matthew Weisenberger, Elizabeth Morris, Leah Noble and Ruben Riquelme	CAER	Method of spinning conductive poly(3,4-ethylenedioxythiophene): polystyrene sulfonate fibers	A novel method for spinning conductive polymer fibers for use in smart and functional textiles.

[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.