

FCR 17

Office of the President
September 18, 2026

Members, Board of Trustees:

PATENT ASSIGNMENT REPORT

Recommendation: that the Board of Trustees accept the patent assignment report for the period April 1, 2026 to June 30, 2026.

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 April 1, 2026 TO June 30, 2026

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:** 19/638,560
UKRFID: 2451
Filed: April 3, 2026
Title: SUBTALAR ARTHRODESIS NAIL IMPLANT SYSTEM
Inventors: Arun Aneja, Gavin Hautala, Arjun Srinath, (formerly College of Medicine) and Lorenzo Deveza (Baylor College of Medicine)
Description and Application: This invention covers a method for fusing the subtalar joint using an implanted nail secured with interlocking screws and, when needed, a U-shaped spacer that restores lost hindfoot height. The spacer may incorporate porous, trabecular surfaces that promote bone ingrowth, while the nail applies and maintains compression across the fusion site. Compared with conventional screw-and-bone-graft procedures, the system is designed to create a more stable fusion, improve alignment, support revision surgeries, and potentially permit earlier weight-bearing with less prolonged immobilization. The relevant global foot and ankle devices market was valued at \$4.8 billion in 2024 and is projected to reach \$9.2 billion by 2033, representing a 7.3% compound annual growth rate (CAGR).
License: Licensed to IMNovations, Inc.
- 2. U.S. Patent Application Number:** 19/647,340
UKRFID: 2985
Filed: April 14, 2026
Title: TIME AND SPATIALLY RESOLVED HYPERSPECTRAL IMAGING OF DEEP TISSUE OPTICAL PROPERTIES, HEMODYNAMICS, AND METABOLISM
Inventors: Guoqiang Yu, Faraneh Fathi, Faezeh Akbari, Fatemeh Hamedì and Lei Chen (Stanley and Karen Pigman College of Engineering)
Description and Application: This invention is a time and spatially resolved hyperspectral imaging system that combines tunable and coherent pulsed lasers with a gated single-photon camera to noninvasively map tissue blood flow, oxygen saturation, optical properties and oxygen metabolism at different tissue depths. By collecting multispectral intensity and speckle-contrast data through a single camera, the system avoids sensor co-registration and complex tomographic reconstruction while supporting rapid, wide-field imaging in a portable platform. These capabilities could enable continuous bedside monitoring and improved evaluation of cerebral and cardiovascular disorders, peripheral vascular disease, cancer, diabetes, and wound healing, where tissue blood flow and oxygenation

may change independently. The global medical hyperspectral imaging systems market is projected to reach \$6.3 billion by 2030, reflecting an 11.6% CAGR.

License: N/A

3. U.S. Patent Application Number: 19/663,541

UKRFID: 2781

Filed: April 30, 2026

Title: HYBRID NANOPARTICLES FOR TARGETED DELIVERY OF SENOLYTICS FOR THE TREATMENT OF OSTEOARTHRITIS

Inventors: Ramkumar Annamalai (formerly College of Medicine) and Sushant Prajapati (Stanley and Karen Pigman College of Engineering)

Description and Application: This invention covers a disease-modifying treatment for osteoarthritis. This platform uses hybrid nanoparticles made from synthetic lipids and chondrocyte-derived membranes to deliver senolytic drugs directly to damaged cartilage. The particles combine collagen-targeting antibodies, chondrocyte-homing membrane proteins and CD47-mediated immune evasion to improve cartilage uptake, reduce clearance by macrophages and extend retention within the affected joint. By selectively removing senescent chondrocytes and reducing the inflammatory signals that accelerate cartilage breakdown, the approach could slow disease progression rather than simply managing pain, while also limiting the systemic toxicity associated with senolytic drugs. The global osteoarthritis therapeutics market is projected to reach \$10.9 billion by 2033, representing an 8.9% CAGR.

License: N/A

4. U.S. Patent Application Number: 19/585,523

UKRFID: 2783

Filed: May 7, 2026

Title: OPIOID COMPOUNDS

Inventors: Thomas Prisinzano, Jill Turner Ortinski, (College of Pharmacy) and Michael Bardo (College of Arts and Sciences)

Description and Application: This invention is a structurally distinct class of conformationally constrained, piperazine-based opioid compounds intended for pain management and harm-reduction applications in opioid use disorder. An exemplary compound, atoxifent, produced potent and long-lasting analgesic effects in preclinical studies, with activity comparable to fentanyl but substantially less respiratory suppression in animal testing. By potentially preserving strong pain relief while reducing the respiratory depression responsible for many fatal opioid overdoses, these compounds may offer an improved therapeutic safety margin over conventional opioid agonists, subject to further clinical validation. The global opioid market was valued at \$22.8 billion in 2022 and is projected to reach \$25.3 billion by 2030, reflecting a 1.4% CAGR.

License: N/A

5. U.S. Patent Application Number: 19/674,920

UKRFID: 3018

Filed: May 12, 2026

Title: MIXTURE ADAPTED FOR MONITORING PRESENCE OF HYDROPEROXIDES IN A NONAQUEOUS ENVIRONMENT AND RELATED METHODS

Inventors: William Boatright (Martin-Gatton College of Agriculture, Food and Environment)

Description and Application: This invention covers a rapid color-based assay for detecting and quantifying hydroperoxides in non-aqueous materials such as edible oils, renewable fuels, petrochemicals, pharmaceuticals and dielectric cooling fluids. The assay combines a structured metal-phosphate complex with a colorimetric reagent, producing a visible response that can be interpreted using a simple color chart, smartphone application, reflectance colorimeter or spectrophotometer. In testing, the platform generated concentration-dependent results within five minutes and demonstrated a strong correlation between color intensity and peroxide value, potentially providing a faster, less expensive and less hazardous alternative to conventional titration and laboratory-based methods. The related global oil condition monitoring market is projected to expand from \$1.2 billion in 2025 to \$1.7 billion by 2030, representing a 7% CAGR.

License: Licensed to VerraGlo, LLC

6. U.S. Patent Application Number: 19/679,014

UKRFID: 3021

Filed: May 15, 2026

Title: USE OF BARREL CHAR IN ALCOHOL CONTAINING PRODUCTS

Inventors: Bradley Berron (Martin-Gatton College of Agriculture, Food and Environment)

Description and Application: This invention covers the use of char recovered from used whiskey, bourbon, rum, brandy or tequila barrels to impart barrel-aged flavor and alcohol-derived compounds to beer and other alcohol-containing products. The recovered char retains substantial quantities of spirit and flavor-active compounds, allowing them to transfer into a beverage during contact periods measured in hours or days rather than the months typically required for traditional barrel aging. Testing showed that three days of contact increased the alcohol content of several beer styles by approximately 2.1 to 2.3 percentage points, offering breweries a scalable, lower-cost method that reduces storage requirements, supports smaller production batches and creates value from a commonly discarded distillery byproduct. The global craft beer market was valued at \$94.2 billion in 2025 and is projected to reach \$170.6 billion by 2033, reflecting a 7.9% CAGR.

License: N/A

7. U.S. Patent Application Number: 19/680,670

UKRFID: 3032

Filed: May 18, 2026

Title: METHODS FOR BIOLOGICAL VIDEO ANALYSIS

Inventors: Blaine Weiss and Christopher Norris (College of Medicine)

Description and Application: This invention covers machine-learning-based methods for analyzing microscopy videos to identify individual active cells, distinguish subcellular compartments, detect signaling events, and measure changes in nearby blood vessels. The platform incorporates motion correction, noise reduction, automated region-of-interest segmentation, wavelet and convolutional signal analysis, and a specialized application that maps cellular activity to immediately adjacent vessel segments over time. By analyzing cells rather than only broad areas of fluorescence, the technology can provide more precise and reproducible measurements of cellular signaling and vascular coupling, supporting neuroscience research, drug development and studies of Alzheimer's disease and other neurodegenerative conditions. The global live-cell imaging market was valued at \$2.8 billion in 2024 and is projected to reach \$4.7 billion by 2030, representing an 8.6% CAGR.

License: N/A

8. U.S. Patent Application Number: 19/590,033

UKRFID: 2702

Filed: May 22, 2026

Title: SYNTHETIC HIGH-DENSITY LIPOPROTEIN AND METHOD FOR TREATING SEPSIS AND RELATED CONDITIONS

Inventors: Chang-Guo Zhan, Fang Zheng, Yaxia Yuan, (College of Pharmacy), Xiangnan Li and Ling Guo (College of Medicine)

Description and Application: This invention covers engineered synthetic high-density lipoprotein nanodiscs that combine phospholipids with novel apolipoprotein-mimetic peptides to treat sepsis and other serious bacterial infections. The particles are designed to bind and neutralize bacterial toxins from both gram-negative and gram-positive organisms, promote toxin clearance, restore protective HDL levels, and suppress excessive inflammatory signaling. In preclinical testing, the lead ApoE-based formulation, YGZL3, improved seven-day survival in two sepsis models — including approximately 50% survival following *P. aeruginosa* infection compared with no survivors in the untreated control group — demonstrating the potential for a multi-mechanism therapy that addresses several drivers of sepsis rather than a single inflammatory pathway. The global sepsis therapeutics market is projected to reach \$5.6 billion by 2030, representing a 6.1% CAGR.

License: N/A

9. U.S. Patent Application Number: 19/691,225

UKRFID: 3045

Filed: May 28, 2026

Title: EVALUATING TRABECTEDIN AND DERIVATIVES THEREOF

Inventors: Oleg Tsodikov and Cai-Xia Hou (College of Pharmacy)

Description and Application: This invention covers a structural-biology and drug-screening platform for co-crystallizing the anticancer agent trabectedin, or its derivatives, with specially designed DNA sequences for direct analysis by X-ray crystallography. By replacing competing guanine residues with inosine, the

method limits drug binding to defined DNA motifs and produces uniform complexes that reveal binding geometry, sequence selectivity and structural changes in both the drug and DNA. The platform addresses the previous lack of an experimentally determined trabectedin–DNA structure and could reduce trial-and-error during analogue development, enabling more rational design and screening of potentially safer, more selective or more effective treatments for sarcomas and other cancers. The global soft tissue sarcoma market was valued at \$1.4 billion in 2024 and is projected to reach \$2.8 billion by 2035, representing a 6.7% CAGR.

License: N/A

10. U.S. Patent Application Number: 19/693,135

UKRFID: 2257

Filed: May 29, 2026

Title: METHOD OF MAKING POLYACRYLONITRILE BASED CARBON FIBERS AND POLYACRYLONITRILE BASED CARBON FIBER FABRIC

Inventors: Matthew Weisenberger and John Craddock (Center for Applied Energy Research)

Description and Application: This invention covers a manufacturing process for polyacrylonitrile-based carbon fibers and woven fabrics with lobed cross sections, low thermal conductivity and mechanical properties resembling traditional rayon-derived carbon fibers. The process uses a specially shaped spinneret, avoids high-temperature drawing and carbonizes the fibers below 1,000°C, preserving internal microporosity while allowing adjacent fibers to physically interlock. These features could provide a domestically producible alternative to increasingly scarce rayon-based carbon fibers for heat shields, rocket-motor nozzles and other ablative composites that must remain intact as their surrounding matrix degrades under extreme temperatures. The global PAN-based carbon fiber market is projected to increase from \$4.6 billion in 2025 to \$6.5 billion by 2030, representing a 7.3% CAGR.

License: N/A

11. U.S. Patent Application Number: 19/694,408

UKRFID: 3058

Filed: June 1, 2026

Title: MACHINE LEARNING POTENTIAL FOR FUNCTIONAL ORGANIC MOLECULAR CRYSTALS

Inventors: Chad Risko (College of Arts and Sciences) and Vinayak Bhat (formerly College of Arts and Sciences)

Description and Application: This invention presents a machine-learning platform for predicting the energies, atomic forces, stress tensors, surface properties and morphologies of functional organic molecular crystals used in semiconductor and optoelectronic applications. Trained using more than 15,000 crystal structures and 2.5 million crystal geometries, the system also allows researchers to modify molecular structures and unit-cell parameters, relax the resulting crystals and evaluate their predicted properties through a web-based interface. By reducing a representative crystal-relaxation calculation from

approximately five hours using conventional density functional theory to less than one minute, the platform could substantially accelerate and lower the cost of discovering materials for organic electronics, solar cells, sensors and light-emitting devices. The global materials informatics market is projected to grow from \$170.4 million in 2025 to \$410.4 million by 2030, representing a 19.2% CAGR.

License: N/A

12. U.S. Patent Application Number: 19/694,615

UKRFID: 3063

Filed: June 1, 2026

Title: DETECTION OF EXPRESSION OF MARKERS USEFUL FOR PREDICTING RISK OF CATASTROPHIC INJURIES IN ATHLETIC ANIMALS

Inventors: Allen Page, Bruno Carvalho Menarim and Anna Rauber-Ramos (Martin-Gatton College of Agriculture, Food and Environment)

Description and Application: This invention provides a blood-based screening method for assessing whether Thoroughbred racehorses and other athletic animals are at heightened risk of catastrophic musculoskeletal injury before obvious symptoms or fractures occur. The approach measures mRNA expression patterns across selected biomarker genes using techniques such as qPCR and can distinguish risk associated with third metacarpal, proximal sesamoid and other long-bone injuries. By enabling routine, minimally invasive screening, the test could help veterinarians and trainers intervene with rest, modified training or targeted imaging before accumulated microdamage progresses to a fatal or career-ending injury, while offering a more practical alternative to frequent CT, MRI or PET examinations. The global equine healthcare market was valued at \$3.5 billion in 2024 and is projected to reach \$5.7 billion by 2030, reflecting an 8.2% CAGR.

License: Licensed to Equine Diagnostic Solutions, LLC

13. U.S. Patent Application Number: 19/594,770

UKRFID: 2778

Filed: June 8, 2026

Title: TAK1 KINASE INHIBITORS

Inventors: Mark Lovell (College of Arts and Sciences) and Thomas Prisinzano (College of Pharmacy)

Description and Application: This invention encompasses a family of small-molecule TAK1 kinase inhibitors designed to be water soluble, orally bioavailable and capable of crossing the blood-brain barrier to treat Alzheimer's disease and other conditions involving neuronal degeneration. The lead compound, UK5141, demonstrated potent TAK1 inhibition, reached the brain following oral administration in mice and produced a 75% reduction in TAK1 activation accompanied by a 43% reduction in tau pathology in a preclinical model. By addressing the poor brain penetration, limited solubility and off-target activity associated with earlier TAK1 inhibitors, these compounds could support a more practical, potentially disease-modifying approach for Alzheimer's disease, traumatic brain injury, concussions and chronic traumatic encephalopathy. The

global Alzheimer's therapeutics market is projected to grow from \$5.1 billion in 2026 to \$9.1 billion by 2032, representing a 9.7% CAGR.

License: N/A

14. U.S. Patent Application Number: 19/702,711

UKRFID: 2866

Filed: June 9, 2026

Title: SYSTEMS AND METHODS FOR PROVIDING AN AUTOMATED SYRINGE EXCHANGE WITH ADAPTIVE WEIGHT-BASED COUNTING

Inventors: April Young (College of Public Health)

Description and Application: This invention covers an automated syringe-exchange vending machine that verifies returned syringes using adaptive weight-based counting and can supplement that measurement with AI image recognition and vibration data. The system securely accepts loose syringes or personal disposal containers, calculates the appropriate exchange quantity, dispenses sterile syringe kits and other harm-reduction supplies, and routes used materials into a monitored sharps bin. By providing around-the-clock, discreet access while reducing manual counting, staffing demands, needlestick exposure, fraud and recordkeeping errors, the platform could help public-health agencies expand syringe-service programs without sacrificing exchange controls or user privacy. The related global medical vending-machine market was valued at \$7.1 billion in 2025 and is projected to reach \$13.4 billion by 2035, reflecting a 6.5% CAGR.

License: In negotiations

15. U.S. Patent Application Number: 19/717,266

UKRFID: 3053

Filed: June 23, 2026

Title: CANCER CLASSIFICATION USING PERIPHERAL BLOOD GENE EXPRESSION

Inventors: Aram Ogholbake and Qiang Cheng (Stanley and Karen Pigman College of Engineering)

Description and Application: This invention provides a minimally invasive cancer-classification platform that analyzes gene-expression patterns in peripheral blood mononuclear cells to assess hepatocellular carcinoma, melanoma and colorectal cancer. Each cancer-specific test uses only two selected genes and an interpretable mathematical formula that can process data from bulk RNA sequencing or single-cell RNA sequencing, avoiding reliance on a complex "black-box" diagnostic model. Across the reported validation datasets, the formulas achieved at least 95% accuracy for hepatocellular carcinoma, 90% for melanoma, and 91% for colorectal cancer, highlighting the potential for an accessible blood-based tool that could complement imaging, tissue biopsy and conventional biomarkers for screening and clinical decision-making. The related global liquid-biopsy market is expected to increase from \$4 billion in 2025 to \$7 billion by 2030, representing an 11.8% CAGR.

License: N/A

- 16. U.S. Patent Application Number:** 19/720,644
UKRFID: 2901
Filed: June 25, 2026
Title: SYSTEMS AND METHODS FOR OPTIMIZED AND AUTOMATED FEDERATED DATA ANALYTICS
Inventors: Hana Khamfroush (Stanley and Karen Pigman College of Engineering)
Description and Application: This invention covers a federated data-analytics platform that enables distributed IoT devices to identify the most useful features within complex, multi-label datasets without transmitting their underlying raw data to a centralized system. The approach evaluates both feature relevance and redundancy, then uses multi-objective optimization to rank a streamlined subset of data for privacy-preserving machine-learning model training. In testing across biological, image and audio datasets, the system matched or exceeded competing methods while using substantially fewer features lowering communication costs, computational demands, and processing delays in resource-constrained edge environments. The global federated-learning market was valued at \$138.6 million in 2024 and is projected to reach \$297.5 million by 2030, representing a 14.4% CAGR.
License: N/A
- 17. International Application Number:** PCT/US2026/021883
UKRFID: 2968
Filed: April 1, 2026
Title: METHOD OF FORMING HYDROCARBONS FROM OLEAGINOUS BIOMASS
Inventors: Eduardo Santillan-Jimenez, Robert Pace, Chukwudalu Great Umenweke and Brian Hogston (Center for Applied Energy Research)
Description and Application: This invention covers a catalytic process for converting lipid-rich waste materials, particularly contaminant-heavy brown grease collected from grease traps, into hydrocarbons suitable for renewable diesel and potentially sustainable aviation fuel. The process uses an alumina-supported nickel-copper catalyst to remove oxygen from the fatty acids while limiting undesirable cracking, coking, catalyst deactivation and metal leaching. Testing demonstrated 100% brown-grease conversion, approximately 93-95% selectivity for renewable-diesel-range hydrocarbons, substantial removal of feed contaminants, and sustained performance for more than 600 hours, offering a productive alternative to landfilling or incinerating this difficult waste stream. The global renewable diesel market was valued at \$30.1 billion in 2025 and is projected to reach \$57.1 billion by 2033, representing an 8.4% CAGR.
License: In negotiations
- 18. International Application Number:** PCT/US2026/022266
UKRFID: 3000
Filed: April 3, 2026
Title: IN MACHINA METHOD FOR SIMULATING A CLINICAL RESPONSE TO A THERAPEUTIC AGENT

Inventors: Terry Hinds, Evelyn Bates and Zachary Kipp (College of Pharmacy)

Description and Application: This invention covers an *in machina* personalized-medicine platform that uses a patient's tissue or blood sample to measure real-time kinase activity across hundreds of cellular signaling pathways before and after exposure to potential therapies. By comparing baseline and drug-modulated activity profiles, the system can rank treatment options, predict efficacy or resistance, and identify off-target effects or unexpected pathway activation without first administering the drug to the patient. In hepatocellular carcinoma samples, the platform identified elevated ABL kinase activity, distinguished the effectiveness of three ABL inhibitors and detected sex-specific and off-target responses, demonstrating its potential as a "clinical trial on a chip" for treatment selection and drug development. The global precision-medicine market was valued at \$116.6 billion in 2025 and is projected to reach \$405.1 billion by 2033, representing a 17% CAGR.

License: N/A

19. International Application Number: PCT/US2026/025168

UKRFID: 3015

Filed: April 24, 2026

Title: LOW ENERGY FRACKING AND PROPPANT SLURRY

Inventors: Thomas Robl, Robert Jewell, Anne Oberlink, Haley Johnson (Center for Applied Energy Research) and Curtis Wilie

Description and Application: This invention covers a low-energy hydraulic-fracturing system that repurposes current-production or recovered Class F fly ash as a micro-proppant in water-based slurries spanning solid loadings of approximately 3 to 16 pounds per gallon. Lower-load formulations exhibit water-like Newtonian or Bingham-plastic flow, while higher-load versions become shear-thinning under pumping conditions, allowing the same technology platform to support different fracture conditions and proppant-placement strategies. The fly ash's predominantly spherical, micron- and submicron-scale particles can enter and stabilize fractures that conventional sand may not reach, while the highly fluid slurries may reduce freshwater requirements by 85% or more, operate at substantially lower pumping rates, decrease hydraulic horsepower and kinetic energy, and create a beneficial use for landfilled or ponded fly ash. The global hydraulic-fracturing market was valued at \$58.5 billion in 2025 and is projected to reach \$95.9 billion by 2033, representing a 6.2% CAGR.

License: Licensed to Enhanced Solutions Services LLC

20. International Application Number: PCT/US2026/025453

UKRFID: 3015

Filed: April 27, 2026

Title: LOW ENERGY FRACKING AND PROPPANT SLURRY

Inventors: Thomas Robl, Robert Jewell, Anne Oberlink, Haley Johnson, (Center for Applied Energy Research) and Curtis Wilie

Description and Application: This invention covers a low-energy hydraulic-fracturing system that repurposes current-production or recovered Class F fly ash

as a micro-proppant in water-based slurries spanning solid loadings of approximately 3 to 16 pounds per gallon. Lower-load formulations exhibit water-like Newtonian or Bingham-plastic flow, while higher-load versions become shear-thinning under pumping conditions, allowing the same technology platform to support different fracture conditions and proppant-placement strategies. The fly ash's predominantly spherical, micron- and submicron-scale particles can enter and stabilize fractures that conventional sand may not reach, while the highly fluid slurries may reduce freshwater requirements by 85% or more, operate at substantially lower pumping rates, decrease hydraulic horsepower and kinetic energy, and create a beneficial use for landfilled or ponded fly ash. The global hydraulic-fracturing market was valued at \$58.5 billion in 2025 and is projected to reach \$95.9 billion by 2033, representing a 6.2% CAGR.

License: Licensed to Enhanced Solutions Services LLC

21. International Application Number: PCT/US2026/034850

UKRFID: 2990

Filed: June 30, 2026

Title: CONCRETE FOR RAPID REPAIR OF DAMAGED SURFACES

Inventors: Thomas Robl, Robert Jewell, Robert Rathbone, Anne Oberlink, Tristana Duvallet (Center for Applied Energy Research) and Christopher Moore

Description and Application: This invention covers a calcium sulfoaluminate-belite and Portland cement formulation developed for the rapid repair of airport runways, roadways, pavements and other heavily used horizontal concrete surfaces. The material remains workable for approximately 30 minutes, begins setting in about one hour and demonstrated compressive strength of up to 41 MPa within three hours and 93 MPa after 28 days, while also providing strong bonding and excellent freeze-thaw durability. By enabling repaired surfaces to support heavy traffic within three hours or less, the formulation could substantially reduce runway, roadway and facility closures while providing a longer placement window than many existing rapid-repair products. The global concrete repair mortars market was valued at \$3.2 billion in 2025 and is projected to reach \$4.9 billion by 2033, representing a 5.6% CAGR.

License: In negotiations

22. Foreign Application Number: P260101362

Country: Argentina

UKRFID: 3015

Filed: May 5, 2026

Title: LOW ENERGY FRACKING AND PROPPANT SLURRY

Inventors: Thomas Robl, Robert Jewell, Anne Oberlink, Haley Johnson (Center for Applied Energy Research) and Curtis Wilie

Description and Application: This invention covers a low-energy hydraulic-fracturing system that repurposes current-production or recovered Class F fly ash as a micro-proppant in water-based slurries spanning solid loadings of approximately 3 to 16 pounds per gallon. Lower-load formulations exhibit water-like Newtonian or Bingham-plastic flow, while higher-load versions become shear-

thinning under pumping conditions, allowing the same technology platform to support different fracture conditions and proppant-placement strategies. The fly ash's predominantly spherical, micron- and submicron-scale particles can enter and stabilize fractures that conventional sand may not reach, while the highly fluid slurries may reduce freshwater requirements by 85% or more, operate at substantially lower pumping rates, decrease hydraulic horsepower and kinetic energy, and create a beneficial use for landfilled or ponded fly ash. The global hydraulic-fracturing market was valued at \$58.5 billion in 2025 and is projected to reach \$95.9 billion by 2033, representing a 6.2% CAGR.

License: Licensed to Enhanced Solutions Services LLC

23. Foreign Application Number: P260101365

Country: Argentina

UKRFID: 3015

Filed: May 5, 2026

Title: LOW ENERGY FRACKING AND PROPPANT SLURRY

Inventors: Thomas Robl, Robert Jewell, Anne Oberlink, Haley Johnson (Center for Applied Energy Research) and Curtis Wilie

Description and Application: This invention covers a low-energy hydraulic-fracturing system that repurposes current-production or recovered Class F fly ash as a micro-proppant in water-based slurries spanning solid loadings of approximately 3 to 16 pounds per gallon. Lower-load formulations exhibit water-like Newtonian or Bingham-plastic flow, while higher-load versions become shear-thinning under pumping conditions, allowing the same technology platform to support different fracture conditions and proppant-placement strategies. The fly ash's predominantly spherical, micron- and submicron-scale particles can enter and stabilize fractures that conventional sand may not reach, while the highly fluid slurries may reduce freshwater requirements by 85% or more, operate at substantially lower pumping rates, decrease hydraulic horsepower and kinetic energy, and create a beneficial use for landfilled or ponded fly ash. The global hydraulic-fracturing market was valued at \$58.5 billion in 2025 and is projected to reach \$95.9 billion by 2033, representing a 6.2% CAGR.

License: Licensed to Enhanced Solutions Services LLC

Patent Activities
Fiscal Year to Date as of June 30, 2026

Total FY2025-26					
	FY26Q1	FY26Q2	FY26Q3	FY26Q4	Total FY26
Invention Disclosures ⁱ	42	26	36	39	143
Full Patent Applications ⁱⁱ	20	13	14	23	70
Provisional Patent Applications ⁱⁱⁱ	29	19	32 ¹	27	107
Patents Issued	12	12	7	9	40
License Income	\$551,786.05	\$522,581.31	\$611,929.82	\$479,664.18	\$2,165,961.36
New Licenses and Options Executed	9	9	10	13	41
New UK Startups Formed	0	0	0	2	2

¹ Capture of unreported provisional application.

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	14	25	15	83
New UK Startups Formed	1	0	0	0	1

Patent Application Summary Table

Inventors	College(s)	Title	Brief description
Biomedical			
Arun Aneja, Gavin Hautala, Arjun Srinath and Lorenzo Deveza	College of Medicine	Subtalar arthrodesis nail implant system	A method to fuse the subtalar joint using an implanted nail secured with interlocking screws.
Thomas Prisinzano, Jill Turner Ortinski and Michael Bardo	College of Pharmacy	Opioid compounds	A novel class of conformationally constrained, piperazine-based opioid compounds for pain management.
Blaine Weiss and Christopher Norris	College of Medicine	Methods for biological video analysis	Novel machine-learning-based methods to analyze microscopy videos to identify individual active cells.
Chang-Guo Zhan, Fang Zheng, Yaxia Yuan, Xiangang Li and Ling Guo	College of Pharmacy	Synthetic high-density lipoprotein and method for treating sepsis and related conditions	Engineered synthetic high-density lipoprotein nanodiscs that combine phospholipids with novel apolipoprotein-mimetic peptides to treat sepsis.
Oleg Tsodikov and Cai-Xia Hou	College of Pharmacy	Evaluating trabectedin and derivatives thereof	A structural-biology and drug- screening platform for co-crystallizing the anticancer agent trabectedin.

Inventors	College(s)	Title	Brief description
Terry Hinds, Evelyn Bates and Zachary Kipp	College of Pharmacy	In machina method for simulating a clinical response to a therapeutic agent	A personalized-medicine platform that uses a patient's tissue or blood sample to measure real-time kinase activity.
Engineering			
Guoqiang Yu, Faraneh Fathi, Faezeh Akbari, FatemeH Hamedi and Lei Chen	Pigman College of Engineering	Time and spatially resolved hyperspectral imaging of deep tissue optical properties, hemodynamics, and metabolism	A time and spatially resolved hyperspectral imaging system that combines tunable and coherent pulsed lasers with a gated single- photon camera.
Ramkumar Annamalai and Sushant Prajapati	Pigman College of Engineering	Hybrid nanoparticles for targeted delivery of senolytics for the treatment of osteoarthritis	A disease-modifying treatment for osteoarthritis using hybrid nanoparticles.
Aram Ogholbake and Qiang Cheng	Pigman College of Engineering	Cancer classification using peripheral blood gene expression	A minimally invasive cancer- classification platform that analyzes gene-expression patterns.
Hana Khamfroush	Pigman College of Engineering	Systems and methods for optimized and automated federated data analytics	A federated data-analytics platform that enables distributed IoT devices to identify the most useful features within complex, multi-label datasets.

Inventors	College(s)	Title	Brief description
Center for Applied Energy Research			
Matthew Weisenberger and John Craddock	Center for Applied Energy Research	Method of making polyacrylonitrile based carbon fibers and polyacrylonitrile based carbon fiber fabric	A novel manufacturing process for polyacrylonitrile-based carbon fibers.
Eduardo Santillan-Jimenez, Robert Pace, Chukwudalu Great Umenweke and Brian Hogston	Center for Applied Energy Research	Method of forming hydrocarbons from oleaginous biomass	A novel catalytic process for converting lipid-rich waste materials.
Thomas Robl, Robert Jewell, Anne Oberlink, Haley Johnson and Curtis Wilie	Center for Applied Energy Research	Low energy fracking and proppant slurry	A low-energy hydraulic-fracturing system that repurposes current-production or recovered Class F fly ash as a micro-proppant in water-based slurries.
Thomas Robl, Robert Jewell, Anne Oberlink, Haley Johnson and Curtis Wilie	Center for Applied Energy Research	Low energy fracking and proppant slurry	A low-energy hydraulic-fracturing system that repurposes current-production or recovered Class F fly ash as a micro-proppant in water-based slurries.

Inventors	College(s)	Title	Brief description
Thomas Robl, Robert Jewell, Anne Oberlink, Haley Johnson and Curtis Wilie	Center for Applied Energy Research	Low energy fracking and proppant slurry	A low-energy hydraulic-fracturing system that repurposes current- production or recovered Class F fly ash as a micro-proppant in water- based slurries.
Thomas Robl, Robert Jewell, Anne Oberlink, Haley Johnson and Curtis Wilie	Center for Applied Energy Research	Low energy fracking and proppant slurry	A low-energy hydraulic-fracturing system that repurposes current- production or recovered Class F fly ash as a micro-proppant in water- based slurries.
Thomas Robl, Robert Jewell, Robert Rathbone, Anne Oberlink, Tristana Duvallet and Christopher Moore	Center for Applied Energy Research	Concrete for rapid repair of damaged surfaces	A calcium sulfoaluminate-belite and Portland cement formulation developed for rapid repairs.
College of Arts and Sciences			
Chad Risko and Vinayak Bhat	College of Arts and Sciences	Machine learning potential for functional organic molecular crystals	A machine-learning platform for predicting the energies, atomic forces, stress tensors, surface properties and morphologies of functional organic molecular crystals used in semiconductor applications.

Inventors	College(s)	Title	Brief description
Mark Lovell and Thomas Prisinzano	College of Arts and Sciences	TAK1 kinase inhibitors	A family of small-molecule TAK1 kinase inhibitors capable of crossing the blood-brain barrier to treat Alzheimer's disease.
College of Agriculture, Food and Environment			
William Boatright	College of Agriculture, Food and Environment	Mixture adapted for monitoring presence of hydroperoxides in a nonaqueous environment and related methods	A rapid color-based assay to detect and quantify hydroperoxides in non-aqueous materials such as edible oils.
Bradley Berron	College of Agriculture, Food and Environment	Use of barrel char in alcohol containing products	Char recovered from used whiskey, bourbon, rum, brandy or tequila barrels to impart barrel-aged flavor and alcohol-derived compounds to beer and other alcohol-containing products.
Allen Page, Bruno Carvalho Menarim and Anna Rauber-Ramos	College of Agriculture, Food and Environment	Detection of expression of markers useful for predicting risk of catastrophic injuries in athletic animals	A blood-based screening method to assess whether athletic animals are at heightened risk of catastrophic musculoskeletal injury.
College of Public Health			
April Young	College of Public Health	Systems and methods for providing an automated syringe exchange with adaptive weight-based counting	An automated syringe-exchange vending machine.

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- 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.