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technology management
& industry relations
DISCOVERIES, INVENTIONS, INNOVATIONS

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MISSOURI TECHNOLOGY Expo 2011

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INNOVATIONS

Schedule of Events

7:30 am - 8:30 am	**Continental Breakfast, Networking and Poster Setup**
8:30 am - 8:35 am	**Welcome and Introduction:** ***Monsanto Auditorium*** Welcome from MU Technology Transfer Director Chris Fender and Deputy Chancellor Mike Middleton
8:35 am - 9:00 am	**Keynote Presentation:** ***Monsanto Auditorium*** Former Senator Christopher S. Bond
9:00 am - 10:00 am	**Tiger Cage (Elevator Pitches - Engineering):** ***Monsanto Auditorium*** Researchers and other technology representatives will pitch their university technologies
10:00 am - 10:30 am	**Network and View for Booths and Posters:** ***McQuinn Atrium***
10:30 am - 11:30 am	**Tiger Cage (Elevator Pitches - Biomedical):** ***Monsanto Auditorium*** Researchers and other technology representatives will pitch their university technologies
11:30 am - 12:30 pm	**Tiger Cage (Elevator Pitches - Life Sciences):** ***Monsanto Auditorium*** Researchers and other technology representatives will pitch their university technologies
12:30 pm - 1:30 pm	**Lunch:** ***McQuinn Atrium***
1:30 pm - 2:30 pm	**Executive Officer Panel:** ***Monsanto Auditorium*** The audience and our moderator will have the opportunity to hear discussion from a distinguished panel of upper level managers consisting of Gregg Scheller, CEO, Katalyst Surgical, Suzanne Magee, CEO & President, TechGaurd Security and Ted Day, President, MO-Sci Corporation
2:30 pm - 2:45 pm	**Break:** ***McQuinn Atrium***
2:45 pm - 4:25 pm	**Investor Presentations and Panel:** ***Monsanto Auditorium*** Investors from DFJ Mercury, Oppenheimer Investments, Allied Minds, Advantage Capital and The Incubation Factory will talk about their business models and investment strategy
4:25 pm - 4:45 pm	**The Next Big Thing:** ***Monsanto Auditorium*** The CEO of Savage River Farms will speak about commercialing university technology and will provide a preview of a revolutionary new product that will hit grocery stores soon.
4:45 pm - 7:00 pm	**Networking Reception:** ***McQuinn Atrium***

Welcome from the Vice Chancellor for Research

It is my pleasure to welcome you to the University of Missouri for the 2011 Missouri Technology Expo. We at MU were awarded more than $480M in academic contracts and grants last year alone and, in addition, our students received more than $200M in external financial aid in all forms, which is quite a testament to our outstanding faculty and students at MU. Many of these awards support research in science and engineering, and often lead to the design of new technologies that we patent. MU's Office of Research exists to foster an academic environment in which MU's research, instruction, service and economic development missions are permeated by the joy and rigor of original discovery, creativity, innovation and scholarship.

Office of Research works to support three main goals:

First and foremost, we exist to facilitate the ability of MU's faculty, students and staff to engage in research, discovery, creation, scholarship and innovation.

Second, we strive to create a research-centered academic environment by developing and articulating connections between MU's research with our teaching and all of our other activities, and by creating a broader foundation for research support with internal and external stakeholders.

By doing the first two objectives effectively, and by intelligently managing University resources, we aim to help grow and financially sustain MU's research enterprise and hence our economy.

We perform several functions to meet these objectives. These include overseeing research compliance regulations regarding sponsored projects, as well issues relating to the use of human subjects or animals in research; providing proposal submission and award management and proposal preparation services; managing internal funds to invest in seeding research; and protecting, managing, marketing and commercializing MU's intellectual property.

Furthermore, we actively promote the value and outcomes of MU's amazing array of research in many ways, including several publications, such as the award-winning research magazine *Illumination*.

One of MU's truly special attributes is the interdisciplinary nature of the campus. The Research Office contributes to this wonderful aspect of MU by overseeing and promoting several campus-wide interdisciplinary research centers.

Thanks for attending this important Expo at MU, and please feel free to contact me or any of our dedicated staff to find out more about the Office of Research, our strategic plan, our organizational structure, or the exciting research and scholarly activities ongoing at MU.

Rob Duncan
Vice Chancellor for Research

Welcome from Director Christopher Fender

Welcome to the second annual Missouri Technology Expo!

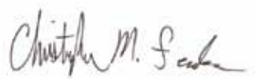
We are truly excited to sponsor this annual event designed to promote the interface between important discoveries of academia and the industries that commercialize those discoveries. Our collective role as stewards of the intellectual property assets discovered and developed by the brightest academic minds in our state is not one that we take lightly. We truly hope your engagement in this event will provide access and insight to the discoveries that will drive the economy of our state and region for years to come.

The event will begin with a morning plenary session featuring former Senator Christopher S. Bond as keynote speaker. Senator Bond's career in Missouri politics and support to constituents has been remarkable. From Mexico, Missouri to Washington, D.C. and back, he realizes the importance of furthering commercialization of Missouri innovations.

The Missouri Technology Expo is an interactive event with poster displays of technologies available for licensing from a broad range of academic disciplines. Tiger Cage presentations will feature researchers and other technology representatives pitching their university technologies. In panel format, the audience will hear discussion from upper level business managers and various investors will talk about their business models and investment strategies. Start-up companies on the brink of commercializing promising university research will share their experiences. Throughout the day, and during the evening reception, networking is encouraged between Missouri business and investment representatives, inventors and technology transfer staff. Take in all this day has to offer and help us attain our goal of fostering an environment that stimulates research collaborations and technology development, leading to successful commercialization of Missouri technologies and innovations.

The day concludes with a closing reception that will offer an opportunity to build relationships with potential collaborators and business partners. Technology transfer is often referred to as a "contact sport" in that it relies heavily on the establishment and cultivation of relationships among the parties involved. It is our hope this event provides the starting point for many such opportunities that will seed future collaborations and create commercialization for the outstanding innovations that exist in our great state.

The MU Office of Technology Management and Industry Relations (OTMIR) is excited to co-host this event with the Office of Research, and the University Center for Innovation and Entrepreneurship (UCIE). We thank our Platinum Sponsor **Thompson Coburn LLP**, Gold Sponsor **Senniger Powers LLP** and Silver Sponsor **Polsinelli Shughart PC** for lending expertise in intellectual property and entrepreneurship to this event.



Chris Fender
Director, Office of Technology Management and Industry Relations

Keynote Speaker - Christopher S. Bond

Christopher S. "Kit" Bond, a former four-term United States Senator from Missouri, is a partner with Thompson Coburn in the Public Finance and Public Law practice group. Drawing from the knowledge and experience he gained during his nearly 40 years of public service, Bond represents clients on matters related to international trade, economic development, biotechnology, agriculture and transportation. He works from the firm's Washington, D.C. and St. Louis offices.

Senator Bond has focused much of his energy on fostering business growth and economic development. During his time in the U.S. Senate, he became a recognized expert and leader on a wide range of subjects, including international trade and Asia; transportation and economic development; cyberintelligence and national security; and plant biotechnology. He was a senior member of the Senate Appropriations Committee; ranking member and Chairman of the subcommittees that fund our nation's housing and transportation programs; and he served as the Vice Chairman of the Senate Select Intelligence Committee. He recently was awarded the National Intelligence Distinguished Public Service Medal.

Prior to his career in the U.S. Senate, Bond served two terms as Governor of Missouri, from 1973 to 1977 (the youngest in the state's history at age 33) and from 1981 to 1985. Before being elected State Auditor in 1970, he was chief counsel of Missouri's Consumer Protection Division. In addition, he served as a judicial clerk to the Chief Judge of the U.S. Fifth Circuit Court of Appeals in Atlanta after graduating first in his class from the University of Virginia Law School.

Education
University of Virginia School of Law - J.D. (1963)
Princeton University (1960)
Noteworthy
United States Senator from Missouri (1987-2011)
Governor of Missouri (1973-1977, 1981-1985)
State Auditor of Missouri (1970-1973)
Assistant Attorney General of Missouri (1969)

Gregg Scheller is the current CEO of Katalyst Surgical, LLC. Katalyst is a medical device company focused on the development of surgical products for ophthalmology. He was previously the Director of Entrepreneurship and Industry Partnerships and Co-Director of the MU Biodesign and Innovation Program at the University of Missouri-Columbia (MU), College of Engineering. In these positions, he lead strategic technical business development with faculty and students. In 2008-09, his entrepreneurial efforts included serving as Executive Director of Nanotechnology Enterprises, Inc. and Executive Agent and founder of the NanoTechnology Enterprise Consortium. He currently serves on the Board of Directors for MU's Biodesign and Innovation Program.

With a Mechanical Engineering degree from the University of Missouri-Columbia, Mr. Scheller has been Founder/CEO of three consecutive successful medical device companies, taking the second company public in 2005. Mr. Scheller is listed as inventor on over 50 US Patents and was the 2007 Ernst & Young Midwest Life Sciences Entrepreneur of the Year.

Suzanne Magee, a native of St. Louis, Missouri, is co-founder, CEO and President of TechGuard Security, an Information Technology products and services company mission-focused on US Critical Infrastructure Security and National Cyberdefense. Founded in February 2000, TechGuard is a women-owned, small, disadvantaged business, providing trusted security services, research and development, and training programs to defense and intelligence communities, federal and state governments and commercial clients. TechGuard services include network vulnerability analysis, certification and accreditation of systems, systems testing and evaluation, security architecture development and certified security awareness training programs.

Ms. Magee contributes volunteer hours to several groups in the Missouri area and has won many honors including the National Association of Women Business Owners (NAWBO) Public Policy Advocate of the Year Award; Distinguished Woman Business Owner; Missouri Regional Top 50 Company; SBA Small Business Team of the Year for the Eastern Missouri Region; St. Louis Economic Council Entrepreneurial Company of the year; and Maryland IT Incubator Company of the Year. TechGuard is located in incubator facilities in the St. Louis Enterprise Center in St. Louis, Missouri; in the UMBC Technology Center in Baltimore, Maryland; and in the Western Michigan Science and Technology Initiative in Grand Rapids, Michigan.

Ted Day grew up in Rolla and married his high school sweetheart (Kim). After graduating from pharmacy school in 1986 from the University of Missouri-Kansas City, he went to Fort Leonard Wood General Hospital where he acted as the Clinical Coordinator for their Pharmacy Department. Mr. Day was the Director of Pharmacy at both Salem Memorial District Hospital and Phelps County Regional Hospital, where he was responsible for the coordination of pharmaceutical services and experimental drug research. In 1998, he joined Mo-Sci Corporation as Executive Vice President becoming President in 2005. In 2007, he became the sole owner of Mo-Sci Corporation, a company that manufactures high-tech glass products for health care, automotive and aerospace industries. Founded in 1984 by his father, Delbert Day, Mo-Sci has been internationally recognized for its contributions to innovative product development. The younger Mr. Day's research interests include continued development of new treatments for inoperable cancers using radioactive glass bead technologies and the development of new bone-forming treatments for patients suffering from orthopedic injuries or disease. He has received numerous outstanding pharmacy achievement awards and is a member of Sigma Xi Research Society. He is active in the Rolla community serving on the Phelps County Community Partnership Board, Phelps Regional Health Care Foundation Board and the Presbyterian Manor of Rolla Board. He is also active in the First United Methodist Church Board of Trustees, Kiwanis Club, RREC, RTC Health Advisory Group and the Community Child Care Development Corporation.

Chris Silva is CEO of Allied Minds, Inc. Allied Minds is the premier private equity-funded innovation company that commercializes US university inventions on a national scale with nearly 40 university partnerships across the country. Allied Minds forms, funds, manages and builds technology based startup companies. Mr. Silva sits on the boards of 14 Allied Minds portfolio companies. Before joining Allied Minds, Mr. Silva was a Partner at JSA Partners, a professional M&A and strategy firm in Boston. In addition, he was in A.T. Kearney's Aerospace Aviation and Defense Practice and also was the Director of Business Development for GRC International, a scientific and technical support contractor to the Department of Defense and US Intelligence Community. Earlier, Mr. Silva served in the US Air Force and Intelligence Community.

His education includes a degree in economics from Tufts University and a Masters of Business Administration.

Dan Janiak is an Associate with DFJ Mercury, where he focuses on developing and originating science-based investment themes and startup opportunities. Prior to DFJ Mercury, Mr. Janiak was an Associate in the Physical and Biological Technologies practice at In-Q-Tel, the strategic venture investment arm of the US Intelligence Community. While at In-Q-Tel, Dan was responsible for the management and oversight of technology development programs in numerous In-Q-Tel portfolio companies. In addition, he was responsible for leading technical due diligence on all potential investment candidates in the advanced materials space.

Mr. Janiak received his B.S. and Ph.D. in Materials Science and Engineering from the University of Maryland. While at Maryland, Mr. Janiak was a Future Faculty Fellow and held the Robert E. Fischell Fellowship in Biomedical Engineering, conducting research in the design, synthesis and characterization of artificial antibodies with applications in medical diagnostics and biopharmaceutical purification.

Jeff Craver is a member of Advantage Capital's national expansion team and works to develop and expand capital formation and economic development programs. He sits on the board of directors for the Missouri Biotechnology Association as well as the Missouri Institute of Biotechnology and Innovation. He also serves on the policy councils for the International Economic Development Council, the National Association of Seed and Venture Funds, and both the Missouri and Illinois Chambers of Commerce and Industry. Before joining Advantage Capital in 2006, Mr. Craver was Tax Counsel for the Missouri Chamber of Commerce and Industry.

Mr. Craver's background is focused heavily on tax and economic development law and the legislative process. Prior to joining the Missouri Chamber, he was general counsel for the Missouri Senate's Research Division. He also served as bill drafter for the Senate Committees on Ways and Means, Tax Policy and Economic Development. Before joining the Senate, Mr. Craver worked for the General Counsel's Office for the Missouri Department of Revenue and was engaged in private corporate law practice in Virginia.

Mr. Craver earned a bachelor's degree in history and French from Duke University. He earned his J.D. degree from the University of Richmond and an LL.M. degree in taxation from Washington University in St. Louis. Mr. Craver also has earned a Maîtrise des Etudes Juridiques Européennes et Internationales from the University of Paris.

Jeffrey Holtz is Director of Investments in the St. Louis office of Oppenheimer & Co. Inc. Mr. Holtz joined Oppenheimer with more than 10 years of investment banking and venture capital experience, following a 20-year career in investment management and public accounting. Jeff is developing strategic alliances with CPA firms in St. Louis with the aid of the firm's Professional Alliance Group (PAG).

Mr. Holtz joined Oppenheimer after serving as the Managing Partner of Ponte Vedra Energy Partners, LLC ("PVEP") an energy and natural resource investment banking and venture capital firm he founded in 2002. During his career with PVEP, Mr. Holtz became a partner with CDX Gas, LLC of Dallas, Texas on several transactions, including the acquisition of the Jicarilla Apache Gas Field and the corresponding $140 million twelve-year "forward" gas sale. PVEP has also been an advisor/principle in a 20 BCF natural gas storage facility in West Virginia; the "spin-out" from the Boeing Corporation of its reverse engineering subsidiary, RE-ALIDI, LLC; the creation of an international commodities brokerage firm; and the acquisition of a 50 million ton metallurgical coal mine in Utah.

Before his career in investment banking and management, Mr. Holtz held a variety of positions as a CPA with both KPMG Peat Marwick and Deloitte &Touche. Mr. Holtz holds a B.S. in Economics from the Wharton School, University of Pennsylvania and a M.A. from Covenant Theological Seminary.

Bill Rowe is a Principal and the Executive Vice President of TIF Marketing Group. Mr. Rowe is an accomplished business leader and innovator with a demonstrated track record of growing successful businesses, both inside existing Fortune 500 organizations and as stand-alone companies. Mr. Rowe has served in a broad range of business development, product commercialization, alliance management and leadership positions in professional services, healthcare and technology markets. Throughout his career, Mr. Rowe has leveraged proven skills in effective management, consultative sales, strategic marketing and alliance development, combined with a demonstrated success in leading teams to optimize company growth and profitability through constant innovation.

At The Incubation Factory, Mr. Rowe's role is to manage the "Front-End" component of technology identification, including marketing, sourcing, conducting diligence and licensing of high-potential opportunities.

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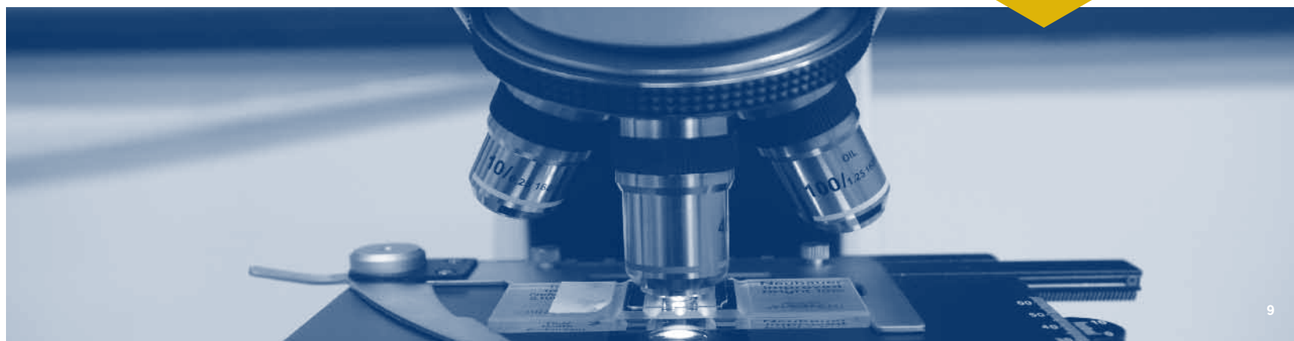

MONITORING ELDERS FOR CHANGE DETECTION, EARLY ILLNESS RECOGNITION, FALLS AND FALL RISK ASSESSMENT

A network of sensors is installed in the home setting and used to collect data on physiological conditions, physical function and activity patterns of a resident, and to detect alert conditions such as falls. Sensors protect privacy and may include a combination of passive motion sensors, bed sensors, 2D and 3D privacy-protecting vision sensors and acoustic sensor arrays. The sensor data are processed and stored, and made accessible via a web interface. Using a combination of automated processing and human observation by trained nurses using visualization displays, the sensor data are analyzed for signs of change that may show early indications of health problems. Other monitoring networks for eldercare focus on keeping the elder safe and/or identifying serious problems. The system described here includes such features for safety but also includes a proactive analysis to identify early signs of illness in an effort to address small problems before they become serious problems.

Potential Areas of Application:
Assisted living facilities for seniors or other nursing homes
Private homes
Patent Status: Patent pending
Inventor(s): Marjorie Skubic, James Keller, Marilyn Rantz, Zhihai He, Mihail Popescu
Contact Info: Wayne McDaniel
McDanielWC@missouri.edu; 573-884-3302

ELECTRICAL METHOD FOR THE RAPID DETECTION OF VIABLE BACTERIA IN SUSPENSIONS

The core technology is an electrical method that can detect the presence of viable bacteria present at low concentration (< 100/ml) in various suspension 4-10 times faster than currently possible.

Although this can be used for multiple applications (water and food quality testing, diagnosis of various human and animal diseases), we plan to focus on rapidly detecting septicemia (bacterial infection of blood). Sepsis, the systemic response to such infection, causes over 200,000 deaths each year in the US (more than lung and breast cancer combined). Quick identification of the pathogen and timely administration of a targeted antibiotic is key to better outcomes. But because of the low numbers of bacteria typically present (1-10/ml of blood), they must be “cultured” to confirm their presence, which takes time.
Using current technologies, blood cultures take 12-120 hrs (1-5 days). Our instrument will reduce the time taken to 2 - 24 hours. Benefits include better outcomes for patients, significant cost savings and reduced fostering of antibiotic resistance.

Potential Areas of Application:
Diagnosis of Septicemia/Sepsis
Diagnosis of other bacterial/mycobacterial diseases in humans & animals
Food Quality Monitoring
Water Quality Testing
Patent Status: Patent Pending
Inventor(s): Shramik Sengupta, Sachidevi Puttaswamy, Hsueh-Chia Chang
Contact Info: Wayne McDaniel, Ph.D.
McDanielWC@missouri.edu; 573-884-3302

HYDRAULIC BED SENSOR

ELEVATOR PITCH

The present invention provides a hydraulic bed sensor to noninvasively monitor pulse, respiration and restlessness during sleep. This sensor is designed for in-home, hospital, nursing home or other home use for the elderly as part of an integrated sensor network for the early detection of illness and functional decline in elderly adults. The invention also provides output from the bed sensor which includes quantitative pulse and respiration rates along with time periods of restlessness.

Potential Areas of Application:
Medical hospitals
Nursing homes
Out-patient care
In-home monitoring
Patent Status: Patent pending
Inventor(s): David Heise, Marjorie Skubic, Licet Rosales Paniagua
Contact Info: Wayne McDaniel
McDanielWC@missouri.edu; 573-884-3302

SICON NANOCOMPOSITE DIELECTRIC THIN FILM

SiCON is a nanocomposite thin film consisting of silicon dioxide, silicon carbide and carbon nitride nanostructures deposited by plasma-enhanced chemical vapor deposition. SiCON harnesses the beneficial characteristics of silicon dioxide and silicon carbide by employing nanotechnology and materials science to combine these characteristics into a coating that is transparent, high strength, scratch resistant, crack free, and has favorable optical and electrical properties. The coating can be performed at various deposition temperatures from near-ambient to 400°C without sacrificing the beneficial properties. This characteristic provides the ability to coat on many materials including glass, metals and plastics. Electrical measurements indicate SiCON has excellent insulating properties and a high breakdown strength greater than 7MV/cm. The coating can also be used in extreme environments, such as high temperature and radioactive environments, without significantly altering the properties of SiCON.

Potential Areas of Application:
As a dielectric coating to provide proper insulation for surgical tools
Fabricate low cost and light weight high energy storage capacitors
Fabricate memory devices and photonic devices
This scratch free coating can be used as a protective layer for glass, windows, etc.
Can be used as anti-reflecting coating
Can be modified to achieve hydrophobic and hydrophilic coating
Can be used as a barrier material for low dielectric constant materials for metal diffusion
Can be used as a dielectric layer for all flexible electronic and photonic circuits utilizing inorganic & organic materials
Being thermally stable up to 800°C, can be used for corrosion free, abrasion resistant, wear-resistant, mechanically hard coatings
Patent Status: Patent pending
Inventor(s): Shubhra Gangopadhyay, Maruf Hossain, Keshab Gangopadhyay
Contact Info: Wayne McDaniel
McDanielWC@missouri.edu; 573-884-3302

HIGHLY EFFICIENT, THERMALLY-POWERED EJECTOR COOLING AND REFRIGERATION SYSTEM

ELEVATOR PITCH

ThermAvant is developing its patent-pending, thermally-driven refrigeration technology that uses an advanced ejector vapor compression cycle to convert 200-350°F heat into useful cooling at unprecedented efficiencies. Co-invented by ThermAvant and the University of Missouri, the HHP-JET technology is currently funded by the US Army to convert the exhaust heat from gas-powered generators to provide air conditioning to soldiers in forward operating bases in order to lower generator fuel consumption (and cost) by up to 50%. Future applications include natural gas-powered HVAC units, vehicle exhaust passenger cooling and solar thermal-driven chillers. The HHP-JET utilizes low-to-medium grade heat to convert the pressure energy of a propellant into a supersonic, low pressure jet stream that evaporates, entrains and compresses a low pressure, low temperature refrigerant to remove heat from the controlled environment. The HHP-JET has few moving parts; is built from relatively low cost components; and avoids the energy, environmental and economic challenges posed by status quo electrically-powered air conditioners. Building cooling is the number one use of grid-tied peak demand electricity, and the worldwide air conditioning equipment market is $70 billion per year. ThermAvant expects to begin installing commercial HHP-JET systems within 24 months in order to penetrate this very large market opportunity.

Potential Areas of Application:
Waste heat or natural gas-powered space cooling
Vehicle exhaust-powered air conditioning
Water desalination
Patent Status: Patent pending
Inventor(s): Hongbin Bill Ma, Peng Cheng, Joe Boswell
Contact Info: Joe Boswell
Joe.Boswell@ThermAvant.com; 415-264-0668

NOVEL SOFTWARE-BASED CHARGE DEEP LEVEL TRANSIENT SPECTROMETER

One of the most widely utilized methods for characterization of the energy properties of semiconductor materials is deep-level transient spectroscopy or DLTS. This technique is based on the measurement of junction capacitance transients due to thermal emission during a thermal scan; however, conventional DLTS suffers from inherent setbacks. For example, if the series resistance of the Device Under Test (DUT) is large, the capacitance transient may vary with the measurement frequency. If the resistivity is large enough, the capacitance transient might approximate the geometric capacitance for all measurement frequencies. For heavily doped materials, capacitance spectroscopy suffers from poor sensitivity. Furthermore, systems using a capacitance bridge for measurement are inherently slow. Alternative measurement schemes have been proposed over the years. Some of these methods rely on the direct measurement of thermally stimulated current transients, or the integration of these currents to yield charge transients (Q-DLTS). Most of these systems rely on hardware-based timing mechanisms to perform the required DLTS signal processing. Computer systems that perform such functions have been proposed but they are generally cumbersome or difficult to build. We present an apparatus that is a combination of a relatively simple circuit structure, and software-based signal processing algorithms used to obtain a Q-DLTS emission spectrum and a quantitative spectrum analysis. This configuration takes advantage of the advent of high-speed data acquisition (DAQ) cards and ever faster computer processor speeds.

Presented is a novel Charge-based Deep Level Transient Spectroscopy (Q-DLTS) system for the characterization of semiconductor materials (i.e., LEDs, diodes etc.). This straightforward design takes advantage of the emergence of fast data acquisition cards and effective graphical development environments. This system foregoes all hardware-based data processing in favor of adaptable software-based algorithms. The only necessary electronic components are those essential to amplify and integrate the thermally emitted trapped charge transients, and to provide the timing signals that control each measurement cycle. The software program then digitally filters the raw data, compensates for spurious input signals and produces a Q-DLTS spectrum based upon user-defined input parameters.

Potential Areas of Application:
Semiconductor characterization
Improvement to sensing devices
Patent Status: Patent pending
Inventor(s): Daniel E. Montenegro, Jason B. Rothenberger, Mark A. Prelas, Robert V. Tompson, Annie Tipton
Contact Info: Wayne McDaniel
McDanielWC@missouri.edu; 573-884-3302

GEOCDX: AN ENTERPRISE SYSTEM FOR CHANGE DETECTION IN HIGH-RESOLUTION SATELLITE AND AERIAL IMAGERY

ELEVATOR PITCH

GeoCDX is an enterprise system for change detection processing and exploitation of large volumes of high-resolution satellite and airborne imagery. It supports all current US high-resolution commercial satellite imagery sensors and numerous airborne sensors. The change detection algorithms are cross-sensor and cross-resolution capable. Fully automated processing of imagery includes: image cataloging, image overlap identification, image-to-image co-registration, automated feature extraction, change detection and change-type clustering. An easy-to-use web interface allows for interaction with the change detection results in a variety of ways. GeoCDX can export results of analysis as HTML and/or self-contained KMZ files containing analysis tags, placemarks, polygons, before and after imagery overlays (supports time-cycling in GoogleEarth™), and change intensity maps.

Terra 4D Systems, LLC currently has a world-wide, exclusive license to the GeoCDX technology. Following the University's use of the system as an operational prototype for a US government agency, Terra 4D Systems, LLC has landed two pilot projects utilizing GeoCDX: one with a satellite imagery provider and another with an aerial photography and GIS firm.

Potential Areas of Application:
Military intelligence and defense
Disaster monitoring and assessment
State and local governments
Cost-effective map and GIS data maintenance
Patent Status: Patent pending
Inventor(s): Curt Davis, Matt Klaric, Grant Scott, Brian Claywell, Chi-Ren Shyu, James Keller
Contact Info: Matt Klaric
matt@t4ds.com; 573-424-5302

NANOTHERMITE MICRO-FLUIDIC EJECTORS

ELEVATOR PITCH

Nanothermite micro-fluidic ejectors have been fabricated from MEMS processing techniques with the intent to serve as miniaturized needle free transdermal vaccine delivery injectors. Micro-ejectors are assembled from three separately processed silicon wafers referred to as an ignition substrate, energetic material chamber and fluid reservoir. A PDMS membrane is bonded in between the energetic material chamber and fluid reservoir to serve as an elastic piston during device actuation. The devices function by igniting a small quantity of nanothermite in a confined geometry and converting the liberated chemical energy into mechanical work to eject a fluid at high velocity. The developed technology is designed to address traditional pitfalls associated with hypodermic needle injections such as the causation of pain and bruising, needle phobias, cross contamination and the requirement of a trained administrator; all of which may lead to patient non compliance.

Potential Areas of Application:
Shockwave drug delivery and killing cancer cells provided effective particle delivery with minimal tissue damage
Imaging: Delivery of magnetic or florescent particles that can be detected using MRI or spectroflorometer, respectively
Patent Status: Patent pending
Inventor(s): Clay Staley, Chris Morris, Steve Apperson, Keshab Gangopadhyay, Shubhra Gangopadhyay
Contact Info: Wayne McDaniel
McDanielWC@missouri.edu; 573-884-3302

COMBINATION OF SINGLE-CELL ELECTROPORTATION AND ELECTRICAL RECORDING USING THE SAME ELECTRODE

Cells release electroactive substances, which can be detected by nearby electrochemical microelectrodes. In addition, extracellular electrodes can be used to measure changes in membrane potential of a nearby cell. On the other hand, electroporation of cells can be used to introduce substances, e.g., to stimulate the cell or introduce genetic materials. The present invention discloses a method to use electrodes located directly adjacent to the cell(s) to both electroporate cells and record electrical signals originating from the cell. The present invention is used at the single-cell level and takes advantage of the desirable location of the stimulating/recording electrode for a cell-recording device with minimal complexity. This invention provides applications in the basic study of physiology by the following: discovering or assaying drugs which target cell activity, cell-based biosensors of toxins, and introducing exogenous molecules into the cell to affect cellular mechanisms.

Potential Areas of Application:
Medical applications of screening for drugs
Pharmaceutical applications
Patent Status: Patent pending
Inventor(s): Kevin Gillis, Jaya Ghosh
Contact Info: Wayne McDaniel
McDanielWC@missouri.edu; 573-884-3302

ALUMINUM NITRIDE VACUUM ULTRIAVIOLET PHOTODIODE

Researchers at the University of Missouri, for the first time, successfully created a p-n junction using aluminum nitride, a compound with a wide band gap. This could allow aluminum nitride semiconductors to have the same success seen with gallium nitride. These semiconductors are now widely used in state of the art optical devices, including the well known consumer products derived from Blu-ray technology.

The recent attention given to III-V compound semiconductors is justified given their ability to utilize different parts of the electromagnetic spectrum. While Blu-ray technology operates at about 405 nm, aluminum nitride could operate in the ultraviolet range at about 200 nm. This could translate, for example, into 4x the data storage capacity as compared to Blu-ray.

Any III-V semiconductor is characterized by its band gap energy. Aluminum nitride has the widest band gap of any III-V compound at 6.2 eV. Comparatively, Blu-ray, which utilizes gallium nitride, has a band gap of 3.4 eV. This difference in band gap leads to aluminum nitride's ability to produce the highest energy, shortest wavelength photons on the market. Also, aluminum nitride semiconductors could play a key role in a variety of markets because of its key physical properties that allow it to operate in the toughest environments, such as: radiation, high temperatures, harsh chemicals or high pressure.

Potential Areas of Application:
Ultraviolet lasers
Vacuum ultraviolet photodiodes
High temperature electronics
Patent Status: Patent application filed
Inventor(s): Mark Prelas, Tushar Ghosh, Robert Tompson, Dabir Viswanath, Sudarshan Loyalka
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RADIOISOTOPE MICROBATTERY BASED ON LIQUID SEMICONDUCTORS

A major obstacle to realizing the potential of miniature micromechanical devices has been the power source. Large batteries have prevented some of these systems from being employed as stand-alone devices. A long lasting source is also important in many potential micro/nanotechnology systems. The invention reports a novel technique using liquid semiconductors for a highly efficient and long-life microbattery based on MEMS technology.

Potential Areas of Application:
Small power sources
Long life batteries
Patent Status: Patent pending
Inventor(s): Jae Kwon, Tongtawee Wacharasindhu

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ELECTRO-OPTIC BEAM DEFLECTOR AND ANALOG-TO-DIGITAL CONVERSION

This invention is a critical component of an integrated electro-optic analog-to-digital converter (EOADC) that is based on the electro-optical deflection of an optical beam that is subsequently projected on a spatial filter. A high speed photodetector is needed at the output of the spatial filter to convert the optical signal into a digital voltage signal. The EO (electro-optic) beam deflector operates on the principle of the linear EO effect which has an intrinsic response speed in the terahertz range. The microwave frequency optical beam deflector enables A/D conversion at the rate of up to 100G samples/second. Both the rate of conversion and the ADC resolution stand to increase with improvements in fabrication.

Potential Areas of Application:
High-speed electro-optic analog to digital conversion
Optical signal processing
Patent Status: US 7,233,261 and US 6,714,149
Inventor(s): William Nunnally, John Gahl
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HIGHLY EFFICIENT PAPER BASED SURFACE ENHANCED RAMAN SCATTERING SUBSTRATE

Surface Enhanced Raman Scattering (SERS) is a surface sensitive technique that results in the enhancement of Raman scattering by molecules adsorbed on rough metal surfaces. Conventional substrate designs are based on rigid surfaces such as silicon, alumina and glass, which resist conformal contact with the surface under investigation, making the sample collection inefficient. Washington University researchers have developed a technology that allows conformal contact with real-world surfaces, thus enhancing the sample collection efficiency compared to the conventional rigid substrates. Research performed at Dr. Singamaneni's lab demonstrated the detection of less than 150pg of 1,4-benzenodithiol residue spread over a $4cm^2$ surface.

Potential Areas of Application:
Explosive detection
Water quality monitoring
Clinical analysis of physiological liquids
Patent Status: Provisional application filed 12/03/10
Inventor(s): Srikanth Singamaneni
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NANOTHERMITE MICRO-THRUSTERS-POSTER PRESENTATION

ELEVATOR PITCH

Micro-thrusters created utilizing nano-scale composites of an inorganic oxidizer and metallic fuel source have been shown to provide tunable thrust amplitude at least one order of magnitude higher and tunable durations at least one order of magnitude lower than other energetic materials tested in comparably sized motors. These composites, known as nanothermites, are formed using a wet synthesis technique and then packed into thrusters to varying densities. The performance characteristics of the micro-thruster can be tailored to a wide variety of applications by controlling the nanothermite composition, the thrust motor geometry, and the packing pressure.

Potential Areas of Applications:
Projectile guidance
Micro- and pico-satellite guidance
Vehicle collision avoidance systems
Advanced air-bag deployment systems

Patent Status: Patent pending
Inventor(s): Clay Staley, Kris Raymond, Adam Drewery, Rajagopalan Thiruvengadathan, Steve Apperson, Keshab Gangopadhyay, Shubhra Gangopadhyay
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COPPER OXIDE NANORODS MANUFACTURING AND ITS APPLICATION IN BIOMASS CONVERSION-POSTER PRESENTATION

ELEVATOR PITCH

Currently, combustion is the only type of thermochemical conversion due to limitations. This invention overcomes these limitations of reducing tar formation and providing rapid, uniform heating and deals with the use of nanoparticles as oxidizers, thermites and catalysts to enhance the thermochemical conversion. Specifically, the invention comprises a nanothermite system with metal oxide nanorods as oxidizers and aluminum nanoparticles as fuel to research the effect of the nanostructured materials in biochemical conversion (sawdust was used as the biomass). Novel application of these nanostructured materials to thermochemical conversions has the potential to greatly increase the conversion yield in both air and supercritical processes, and also has the potential to be used as a tool for understanding the mechanism and kinetics of thermochemical conversion.

Potential Areas of Application:
Utilization in thermochemical conversions of biomass
Patent Status: Patent pending
Inventor(s): Shubhra Gangopadhyay, William Jacoby, Daniel Tappmeyer, Keshab Gangopahyay, Rajogopalan Thiruvengadathan
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SENSOR ORGANOSILICATE NANOPARTICLES FOR DIAGNOSTIC DEVICES AND ENVIRONMENTAL DEVICES-POSTER PRESENTATION

ELEVATOR PITCH

This invention reports a novel technique for the rapid and cost-efficient synthesis of organosilicate nanoparticles (OSNPs) that have been successfully applied as individual building blocks for various applications. Through our patented technology of novel bottom up fabrication technique, these nanoparticles have been used to fabricate highly porous transparent films. Optically smooth hydrophobic films with low refractive indices (as low as 1.048) and high surface areas (as high as 1325 m^2/g) can be achieved on large area substrates. These films have been studied and used for a solid phase microextraction (SPME) membrane for identification and quantification of polychlorobiphenyls (PCBs) for replacement of polydimethylsiloxane (PDMS) membranes which are currently used to detect PCBs in underground water.

Furthermore, doping these nanoparticles with fluorescent dyes results in highly fluorescent, biocompatible and water soluble nanoparticles with demonstrated long term photostability and with surface groups that can be readily used to attach various biological moieties. Fluorescent intensity of dye-doped OSNPs (22.4 ± 5.3 nm) is shown to be 200 times brighter than the constituent dyes.

These unique materials can be readily interfaced with existing immunoassays in the form of inexpensive dip-stick assays for the novel diagnostic strips for point of care applications. Our preliminary evaluation of these films in combination with dye-doped OSNPs for construction of diagnostic immunoassays gave ~180 fold enhancement in fluorescence signal enhancement compared to traditional (microscope glass slide and fluorescent dye molecules) based assays.

Potential Areas of Application:
Diagnosis of CNS diseases
Monitor the efficacy of treatment of CNS disease
Estimate the degree of CNS tumor growth
Measure progression of clinical and preclinical pathologies in drug trials
Surgery guidance
Patent Status: US Patent 7,907,809
Inventor(s): Shubhra Gangopadhyay, Keshab Gangopadhyay, Venumadhav Korampally, Sangho Bok
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GangopadhyayK@NanosTechnologies.com

NANOPOROUS CARBON

This invention teaches a method of manufacture and associated composition of nanoporous carbon with extremely high surface area. The nanoporous structure enables the carbon to adsorb large amounts of gas at low pressures. The large surface area of the carbon adsorbs gas molecules by the nature of surface attraction forces, which are what make adsorbed natural gas (ANG) possible.

This invention has multiple viable applications. The largest market is in motor vehicles, and this research team at the University of Missouri was the first to reach the Department of Energy's target of holding 150 V/V storage capacity at 500 psig and have since achieved storage capacities above 190 V/V.

Potential Areas of Application:
Fuel storage for motor vehicles
Storage for transport in midstream oil operations
Collection and storage from landfills, CAFOs, etc
Patent Status: Patent pending
Inventor(s): Peter Pfeifer, Galen Suppes, Parag Shah, Jacob Burress
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NOVEL BIONANOCOMPOSITE FOR ORTHOPEDIC AND DENTAL APPLICATIONS

ELEVATOR PITCH

Bone and tooth are composed of nanoscale hard inorganic building blocks in a soft organic matrix. For years, metals have dominated orthopedic and dental implant markets due to their sufficient mechanical properties, even though metal implants often have to be removed in secondary surgery and are sometimes the cause of adverse medical reactions. The University of Missouri and Nanova are currently developing revolutionary biomimetic non-metal nanocomposites that will threaten the orthopedic market dominated by metal.

These nanocomposites also have the potential to be the strongest available dental composite for dental restoration procedures. With a stronger, more reliable product that causes fewer complications, these nanocomposites should quickly penetrate the orthopedic implant and dental markets.

Potential Areas of Application:
Orthopedic implant
Dental restorations
Patent Status: Patent pending
Inventor(s): Hao Li, Qingsong Yu, Liang Chen, Meng Chen
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SPORE-BASED BIOCATALYST FOR POLLUTION REMOVAL

ELEVATOR PITCH

The extensive use of chemicals in modern society is of great concern. Chemicals are used as pesticides as well as medicines and can pose significant health risks to humans, animals and plants. For example, atrazine is the second most used herbicide in the US and is used extensively on crops and golf courses. It is slow to break down in soil and often contaminates ground water and drinking water in agricultural areas. Atrazine has been linked to sexual abnormalities in several species and has been banned in Europe due to environmental and health concerns. There are a number of other chemicals similar to atrazine in the environment resulting from human activities that also pose potential health risks. An invention that can remove or detoxify such chemicals would be of great significance and value.

The current invention developed by researchers at the University of Missouri is a spore-based biocatalyst for remediation of pesticides like atrazine and other environmental pollutants. Enzymes capable of detoxifying organic chemicals are tethered to the spore of a harmless bacterium, which serve as production facilities, delivery vehicles and enzyme stabilizers. The system is inexpensive, easily scalable, does not require tedious protein purification, and can be tailored to a variety of chemicals and applications.

Potential Areas of Application:
Production of enzymes for commercial use
Soil cleanup and prevention of field runoff
Bioreactors for biomass conversion into biofuel
Biofilters for water purification
Patent Status: Patent application filed
Inventor(s): Brian M. Thompson, Chung-Ho Lin, George C. Stewart
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PHOTOACOUSTIC DETECTION OF METASTATIC MELANOMA

ELEVATOR PITCH

We in the Viator lab at the University of Missouri have invented a cell sorting apparatus that is capable of high throughput analysis of blood samples from patients at risk for metastatic melanoma. This invention is similar to flow cytometry except that we induce high frequency ultrasonic waves in pigmented melanoma cells as a result of nanosecond laser light absorption. We subsequently capture these cells for further study. We are adapting this technology for non-melanoma cancers by selective attachment of nanoparticles that act as targets for the laser. This technology serves as an early detector and monitor of metastatic disease.

Currently, cancer metastasis is diagnosed by conventional imaging methods, such as CT, MRI or PET scans. These imaging modalities require metastatic tumors to be several millimeters or more in order to show up on such scans. By this time, the metastatic tumors may be too advanced for effective therapy. Our technology detects metastatic disease when individual cells are traveling through the blood and lymph systems searching for distant organs in which to seed secondary tumors. Our laser induced ultrasonic flowmeter processes blood samples from patients, detecting metastatic disease at the single cell level. Thus, our low cost blood test can determine metastasis months or even years before current technology. Additionally, it only requires a simple blood draw from patients who have or are at risk for metastatic disease. The test is inexpensive and can be run in approximately one half hour. This method has been proven for melanoma detection and is being developed for other cancers.

Potential Areas of Application:
High throughput screening for melanoma
Monitoring of melanoma patients
Isolation of melanoma cells
Patent Status: Patent Issued
Inventor(s): John A. Viator, Paul S. Dale, Devin McCormack, Kiran Bhattacharyya
Contact Info: John A. Viator
573-884-2862

ENGINEERING ANIMAL MEAT

ELEVATOR PITCH

The global market for meat has increased as the economies of developing countries advance. By 2050, it is estimated that there will be more than 9 billion people in the world to feed. With the increase in population and the decrease in natural resources and less arable land, alternate methods of food production must be found in order to increase the worldwide food supply and sustain the global population. The current invention is potentially an economically attractive method to address this increasing market. Additionally, an invention that can provide sustainable high quality protein for the growing population while decreasing the need for additional land and animals is likely to be highly marketable and commercially attractive.

The current invention developed by researchers at the University of Missouri is a method which uses bioprinting as its core technology. Bioprinting allows the rapid construction of living three dimensional structures of desired topology. The type of cells used to prepare the multicellular rods, which serve as bioink in this technology, determines the cellular composition of the construct. Using appropriate animal cells allows the fabrication of constructs with meat-like texture. For this method, cells obtained from animals by biopsy are subsequently grown to the needed numbers in vitro. The meat produced by this method has the potential to have the same or higher nutritional value, texture taste and a richer variety than conventional meat.

Potential Areas of Application:
Global food industry
Patent Status: Provisional patent application filed
Inventor(s): Gabor Forgacs, Francoise Marga
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A FAST AND COST-EFFECTIVE SPORE-BASED VACCINE PLATFORM

Most vaccines created today are costly to produce. In addition, the creation of new vaccines to combat emerging diseases such as novel influenza strains like H1N1 and SARS is slow and not able to meet the demand early in the disease cycle.

The current invention developed by researchers at the University of Missouri is a new vaccine platform utilizing inactivated spores that is easy to customize to a disease of interest. The time between identification of an emerging pathogen to vaccine creation can be shortened to as little as 3 weeks. By utilizing bacterial cells that grow to high titers in simple growth medium, large batches of vaccine can be made in little time with immunogenic proteins surface displayed on the spores. Cost and time savings are achieved because no protein purification steps are required. The spores are easily inactivated and stable in the absence of refrigeration. Bacterial spores are recognized by the immune system as foreign and have the natural ability to stimulate the immune system and lead to effective immune responses. Thus, our platform system should not need the use of adjuvants to produce a robust immune response. Lastly, we have the ability to express proteins from different antigen sources to create a multivalent vaccine against multiple pathogens.

Potential Areas of Application:
Vaccine development and production
Patent Status: Patent application filed
Inventor(s): George C. Stewart, Brian M. Thompson
Contact Info: Harriet F. Francis
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FIELD MANAGEMENT TOOL FOR AGROCHEMICAL APPLICATION

With increasing costs of inputs and rising concerns over environmental contamination, effective management tools are required for the application of fertilizers and other agrochemicals to maximize efficiency and reduce environmental losses. For example, enhanced efficiency fertilizer, such as slow-release fertilizers, can reduce the risks of nutrient loss compared to conventional fertilizers, but at a higher cost. One strategy to overcome in-field differences in potential nutrient loss is to apply the enhanced efficiency fertilizer to the high risk nutrient loss areas of a field while applying conventional fertilizer to the low risk areas. An invention that would assist farmers to identify and map the low and high risk areas of a field and then facilitate the application of multiple agrochemicals in a field based on those identified areas would help to increase profits and lower environmental losses.

The current invention developed by researchers at the University of Missouri is a software tool and algorithm to determine and apply different types and amounts of agrochemical sources to predetermined zones within a field. The tool takes into account spatial differences in intrinsic soil properties that affect agrochemical efficiency including soil drainage and water content. It allows for storage of historical data so that better management practices can be achieved and thus increasing productivity while reducing negative environmental impact.

Potential Areas of Application:
Map zones vulnerable to agrochemical loss or reduced efficiency based on spatial differences in soil and environmental properties
Field management and control of variable source agrochemical application
Establishes geographically-referenced application history
Patent Status: Patent application filed
Inventor(s): Peter P. Motavalli, Kelly A. Nelson
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SEMEN STIMULATING ADDITIVE FOR ARTIFICIAL INSEMINATION

Artificial insemination is a technology that has aided both human and animal reproduction. However, artificial insemination does not always result in pregnancy whether human or animal. In the food animal production industry, an animal that does not conceive after artificial insemination results in inefficiencies and potential economic loss for the producer. In humans, the emotional toll and financial costs for couples being unsuccessful in conceiving can be substantial. Both the human and animal assisted reproductive industries are billion dollar entities and inventions that improve fertilization rates are highly sought after.

The current invention developed by researchers at the University of Missouri is a simple and inexpensive additive for semen extenders and fertilization media that improves fertilization rates after artificial insemination and in vitro fertilization. In addition, mammalian oocytes fertilized in vitro in a medium with the additive have superior developmental potential, benefiting commercial embryo transfer in livestock species and infertility treatment in humans.

Potential Areas of Application:

Semen extender with improved sperm viability and mobility
Media increasing the pregnancy rates after in vitro fertilization
Media for embryo transfer in farm animals

Patent Status: Patent pending
Inventor(s): Peter Sutovsky, Young-Joo Yi
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OSTEOARTHRITIS BIOMARKER PANEL

Osteoarthritis is the most common form of arthritis in humans and affects almost 10% of the population in the US and Europe. Currently, there is no commercially available assay for diagnosis, staging or monitoring of the disease. The most common clinical approach uses physical examination and radiographic (X-ray) findings for evaluation of subjects that are exhibiting symptoms. This approach results in osteoarthritis being definitively diagnosed after it has significantly impaired function and quality of life and therapeutic options may be less efficacious.

The current invention developed by researchers at the University of Missouri is a human biomarker panel that may be useful for determining presence, severity and extent of osteoarthritis. The panel uses readily available fluid samples, which are analyzed for specific biomarkers associated with osteoarthritis. By comparing the levels of biomarkers in the fluid samples to normal values, the panels will allow for diagnosis, screening, staging and judging of the effectiveness of treatments with high certainty.

Potential Areas of Application:

In-clinic tests for diagnosis, screening, staging, treatment monitoring and prognostication of osteoarthritis

Patent Status: Patent pending
Inventor(s): James L. Cook, Aaron M. Stoker, Keiichi Kuroki, Bridget Garner, Cristi R. Cook, Richard Evans, Brandon Roller, Prakash Jayabalan
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CROP YIELD PREDICTION FROM AERIAL IMAGES

The current invention developed by researchers at the University of Missouri is a technology that will predict crop yield loss at mid-season. This revolutionary technology allows corn, wheat, rice and potato producers to assess economic loss due to nitrogen deficiency and make sound business decisions about the profitability of mid-season fertilizer application. The color measured aerial imagery produced can be used to target rescue nitrogen applications to areas where profitable yield responses will be obtained, thereby maximizing the crop's yield potential at the minimum amount of labor and fertilizer.

Potential Areas of Application:

Predict yields of crops including corn, wheat, rice and potato
Detect areas for mid-season fertilizer application
Analyze economic outcome of mid-season fertilizer application

Patent Status: Patent pending
Inventor(s): Peter C. Scharf, Vicky Hubbard
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CROP RESISTANCE TO NEMATODES

Parasitic nematodes that attack the roots of plants are estimated to cause an annual worldwide crop damage of over $100 billion. For soybean, the most important pathogen is the nematode Heterodera glycines, which in the US causes an annual loss of more than 120 million bushels valued at over $1.2 billion. Other Heterodera species can cause significant damage to corn, while potato nematodes of the Globodera genus can result in up to 60% reduction in potato yield. Crops resistant to nematodes are therefore of great economic interest.

The current invention developed by researchers at the University of Missouri is a genetic approach to make plants resistant to infestation from cyst nematodes attacking soybean, corn and potato. The nematodes secrete effector proteins in order to connect with the plant's root cells, and plants lacking the receptors these effector proteins interact with have increased nematode resistance. Disruption of the plant receptors did not result in obvious changes to root growth in the plant and can be employed to develop a novel management tactic to reduce cyst nematode parasitism of crop plants.

Potential Areas of Application:

Nematode resistant crops of soybean, corn and potato

Patent Status: Patent pending
Inventor(s): Melissa G. Mitchum, Amy Replogle, Jianying Wang, Xiaohong Wang, Shiyan Chen, Ping Lang, Eric L. Davis, Thomas J. Baum, Richard S. Hussey
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PREDICTING AND INCREASING FEED EFFICIENCY OF LIVESTOCK

The efficiency by which animals convert feed into cellular energy for maintenance and tissue accretion has a major impact on production efficiency and profitability. The more efficiently that an animal converts ingested feed into cellular energy, the more work the animal is likely to perform. Additionally, the more efficiently feed is ingested, the greater likelihood that it will be converted into body mass. Currently, the only way to categorically determine the efficiency of an animal is to phenotype the animal's feed intake and performance over time within a contemporary group.

The current invention developed by researchers at the University of Missouri is a simple blood test that ranks an animal within the population as high, mid or low in feed efficiency. The invention provides a tool to identify animals that are genetically superior in feed efficiency and may spur additional developments that later increase feed efficiency.

Potential Areas of Application:

Selection programs for animal species where feed efficiency is important, such as cattle, sheep, swine and poultry programs
Determination of best practices for animals based upon their feed efficiency

Patent Status: US patent 7,906,702
Inventor(s): Monty S. Kerley, William Kolath, Joseph Golden
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ENGINEERED MINICHROMOSOMES IN PLANTS

The use of genetically modified crops is constantly finding new areas of application, including the production of compounds with therapeutic value. Current technology for producing transgenic crops relies on random integrations that can have variable expression and could potentially disrupt the endogenous genes. Also, combining multiple transgenes requires a lengthy crossing scheme and can bring along linked genes from one variety into another.

The current invention developed by researchers at the University of Missouri is a technology that will allow continued addition of transgenes as the need arises using engineered plant minichromosomes. Artificial chromosome platforms were produced by telomere-mediated truncation while simultaneously adding DNA sequences that will permit amendments to the chromosome indefinitely. These minichromosomes can be used as a vector for efficient stacking of multiple genes for insect, bacterial and fungal resistances together with herbicide tolerance and crop quality traits unlinked to endogenous genes in a circumstance that would foster faithful expression.

Potential Areas of Application:

Genetically engineered crops

Patent Status: US patent allowed and foreign patents pending
Inventor(s): James A. Birchler, Weichang Yu, Juan M. Vega
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BIONANOCOMPOSITE FOR SOFT TISSUE REPAIR

Implanted biomaterials utilized for soft tissue repair suffer from poor tissue integration, which permits sliding and rubbing of the material on the cells and tissues. This lack of control at the biomaterial tissue interface results in repeated cellular injury and chronic inflammatory response, thus leading to decreased function, chronic pain, and eventual implant removal. New soft tissue repair materials have utilized collagen scaffolds, but purified collagen is mechanically weak and chemically cross linked collagen has inadequate biocompatibility.

The current invention developed by researchers at the University of Missouri is a mesh that achieves a higher level of control at the interface between the tissue and the implant, which translates into improved tissue integration and overall biocompatibility. The fabrication from novel bionanocomposite is relatively inexpensive, faster than conventional methods, and utilizes non-toxic, water soluble cross-linking agents.

Potential Areas of Application:

Hernia repair
Meniscus tissue replacement
Cardiovascular patches

Patent Status: Patent pending
Inventor(s): Sheila A. Grant, Bruce Ramshaw, Sharon Bachman, Corey Renee Costello
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A NOVEL CLINICAL TEST TO DETERMINE THE FERTILITY IN BOARS

The current invention developed by researchers at the University of Missouri is a specific sperm binding test that will enable the user to better predict the fertility of boars. The test will enable the technician to identify boars with a high count of functional sperm which are able to bind the egg. This increases sensitivity and is a step up in contrast to tests that focus on sperm mobility and morphology. This test will decrease the amount of effort and expense spent on identifying animals with low fertility. It will also increase the use of higher fertility males which will result in an increase in litter frequency and size, thereby increasing profitability and competitiveness in the pork industry.

Potential Areas of Application:

Fertility testing of boars for the pork industry
Potentially may be adapted for other species

Patent Status: Patent pending
Inventor(s): Gary F. Clark, Peter Sutovsky
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NANOTECHNOLOGY-BASED ELECTROCHEMICAL DNA SENSING

DNA is a code that contains the building instructions for all organisms and is the ultimate identification card. For example, the DNA code of a particular bacterium can tell if that particular strain of the bacterium is harmful or not. DNA sensing and recognition devices are therefore essential for accurate detection of bacteria and other microbes, as well as for the detection and identification of viruses. Furthermore, there is a critical need to develop better methods and devices for DNA detection.

The current invention developed by researchers at the University

of Missouri is a new technology that will increase the DNA sensor sensitivity, specificity and sensing speed over current methods. This novel invention consists of an electrolyte cell, an electrochemical measurement device and a nanostructured ceramic base electrode. The device is so sensitive that it does not require amplification of the DNA by PCR. Additionally, this device is advantageous because of its reusability, increased detection speed and specificity.

Potential Areas of Application:
Recognition of pathogens of medical and public health importance
Environmental analysis such as water quality monitoring
Biological attack and prevention
Food safety
Genetic research and application
Pathology and criminology
Patent Status: Patent application filed
Inventor(s): Charles Carson, Qingsong Yu, Hao Li
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INNOVAJECT

Innovaject converts the current arduous process of delivering intramammary products to dairy animals, into a fast and easy, one device technique. This device increases the efficiency of product delivery and improves the ease of use with an ergonomic vertical handle and compact design. The ability to maintain asepsis is increased with inclusion of a cleaning pad on top of the deliverable treatment product.

Potential Areas of Application:
Over 32 million dry cow prophylactic treatments are administered annually in the US
Large market opportunities also exist in Europe, Brazil, India and China
Small and large dairy operations
Could be further developed for other animal types
Patent Status: Patent pending
Inventor(s): Miranda N. Shaw, Michael A. Barnett, Xandra M. Sifuentes, John R. Dodam, John R. Middleton
Contact Info: Paul Hippenmeyer
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APTAMER-BASED THERAPEUTICS

ELEVATOR PITCH

The molecular PINCERs platform technology is a method to link two or more binders (such as aptamers or antibodies) together such that, upon binding of the macromolecules, a fluorescent signal will be generated. In addition, the combination of more than one binder increases the affinity and specificity of the hybrid binders and enables detection of different molecular species of target proteins. This technology platform, developed at Saint Louis University, and licensed exclusively to Mediomics, will enable quick development of advanced multi-valent binders (PINCER) to compete against, and potentially replace, technologies which rely on the function of single antibodies, such as the standard ELISA-based assay for research, or antibody-based therapeutics for cancer treatment. Mediomics has adapted this technology to efficiently screen for novel nucleic acid-based aptamers.

Potential Areas of Application:
Therapeutics
Patent Status: Patent pending
Inventor(s): Yie-Hwa Chang, Tomasz Heyduk
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PRRSV RESISTANT PIGS- POSTER PRESENTATION

Porcine Reproductive and Respiratory Syndrome (PRRS) is one of the most economically devastating swine viral diseases and is a worldwide problem. In 2005, PRRS caused the loss of approximately $560 million in revenue for US swine producers. PRRS results in severe and often fatal respiratory disease and reproductive failure. It predisposes infected pigs to other viral and bacterial pathogens and is a key component of Porcine Respiratory Disease Complex. Pigs that survive the initial PRRS infection may recover and become carriers of the disease and continue to spread the disease. Another issue in treating this disease is that PRRS transmission dynamics vary among herds and management practices. Some herds may have persistent infections whereas other herds may exhibit viral fadeout and experience reintroduction of the disease. Standardized treatment protocols for PRRS virus have eluded researchers. An invention which eliminates PRRS from swine would be of great value. The current invention being developed by researchers at the University of Missouri are genetically engineered pigs that may lead to the development of PRRS virus resistant swine. These genetically engineered pigs hold great economic promise for the swine industry if they are approved for human consumption. Additionally, future uses may be identified in the field of xenotransplantation.

Potential Areas of Application:
Swine herd health
Human medical advancements
Patent Status: US Provisional Patent filed
Inventor(s): Randall S. Prather
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METHOD FOR INCREASED PLANT OIL PRODUCTION TO MEET THE INCREASING DEMAND OF VEGETABLE OILS

ELEVATOR PITCH

Plant-derived oils are a major commodity, providing a main source of calories and essential nutrients for humans and animals. Vegetable oils have become increasingly important sources of renewable materials for industrial feedstocks and biofuels. Oils are the most energy-dense products that plants produce in large quantities using solar energy and CO2. It can be easily extracted, transported and processed. However, insufficient supply of the feedstock has been one of the biggest challenges in using plant oils as biofuels and other renewable industrial materials. We have identified a new way to substantially increase oil content and production in plants. This involves identification and manipulation of a novel regulatory network that lead to partitioning more photosynthetic carbons to oil accumulation. The findings are applicable to enhancing oil production in crops, such as soybean and camelina.

With this technology, we have demonstrated an unprecedented 30% increase in oil production shown in Camelina sativa and the model oil plant Arabidopsis thaliana. The production of oil from plants is a worldwide enterprise representing significant global commercial potential.

Potential Areas of Application:
Biofuels/biodiesel
High-energy livestock feed
Pesticides/insecticides
Essential oils synthesized for use in flavor and fragrance industries
Cooking oil and food production
Natural oil-based cleaning products
Patent Status: Patent pending
Inventor(s): Xuemin "Sam" Wang, Geliang Wang, Maoyin Li
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PRODUCTION OF BIOCOMPATIBLE GOLD NANOPARTICLES FROM HERBS, PLANTS, SEEDS AND TREE EXTRACTS

ELEVATOR PITCH

Gold nanoparticles are being used in a myriad of medical and technological applications ranging from diagnostic, therapy agents in medicine, to sensors in telecommunication/auto industry and as sources of catalysts in hydrogen production for alternative sources of energy. Therefore, the production of gold nanoparticles (and nanoparticles of other metals) through green nanotechnology routes will have tremendous implications in a number of fields. In 2008, we discovered an unprecedented approach to Green nanotechnology via the use of phytochemicals in soy for the production of gold nanoparticles. This process simply involved mixing of soy seeds, in water, with gold salt that led to the production of well-defined biocompatible gold nanoparticles (Editor's Choice in SCIENCE, 2008). With this genesis of green nanotechnological approach, we have developed numerous processes recently that take advantage of redox properties of phytochemicals in Tea, Cumin, Cinnamon [1] and plethora of herbs, plants, seeds and tree extracts –all of which have resulted in the production of gold nanoparticles through interactions of corresponding phytochemicals with gold salt in water. Our research has further probed on the importance of such green nanotechnological processes for the production of cancer specific gold nanoparticles. For example, gold nanoparticles derived from tea have been shown to have a coating of Epigallocatechin gallate (EGCG), also known as epigallocatechin 3-gallate, the ester of epigallocatechin and gallic acid, and is a type of catechin. EGCG is the most abundant catechin in tea and is a potent antioxidant that has well proven therapeutic applications in the treatment of many human disorders and diseases including cancer. EGCG has an excellent affinity toward Laminin receptors which are overexpressed in hormone refractory prostate cancers. This elevator pitch presentation will provide highlights on prostate cancer receptor specificity of EGCG-gold nanoparticles (EGCG-AuNP) and their subsequent application as prostate tumor therapeutic agent. The overall oncological implications of the emerging field of green nanotechnology with specific examples of the design and development of sophisticated molecular imaging and cancer therapy agents will be presented.

[1] MU's process for the production of biocompatible gold nanoparticles has been highlighted in Discovery Channel News and won the award of "One of Ten Best Inventions in 2010" http:web.missouri.edu/~kattik/katti/Links/Index/Top10.pdf

Potential Areas of Application:
Medicine
Patent Status: Patent pending
Inventor(s): Nripen Chanda, Ajit Zambre, Ravi Shukla, Kavita Katti, Anandhi Upendran, Raghuraman Kannan, Cathy Cutler, Charles Caldwell, Kattesh Katti
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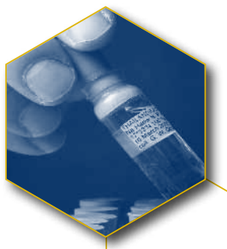

MEDSOCKET: A PERSONALIZED MEDICAL SEARCH ENGINE FOR INFORMATION NEEDS AT THE POINT OF CARE - POSTER PRESENTATION

ELEVATOR PITCH

Physicians are knowledge workers who, according to studies, spend up to 35% of their expensive time searching for information. Still, due to time constraints, they are rarely able to conduct online searches to sufficiently answer patient-specific, clinical or administrative questions at the point of care. Although the information to satisfy their needs is available, it is mostly secured and stored on a multitude of systems that are out of Google's reach. Often these systems are difficult and time consuming to use. A search engine for all available material that would allow easy and secure access to the needed information could not only save a physician time and decrease health care costs, but also improve the delivered patient care.

MedSocket LLC developed an innovative and patent-pending search engine from a physician's point-of-view delivering only results most relevant to the user. It offers a single user interface and is highly customized to search medical information, enabling a simultaneous search of the best online resources; a user's personal digitized knowledge stored in notes, emails or documents; and a hospital or departmental intranet. To achieve an optimal search experience, it integrates into electronic health record systems and offers many levels of personalization.

MedSocket's search solution is currently available to 280 users at the University of Missouri's Department of Family and Community Medicine, its first customer. Also, MedSocket LLC is negotiating with Cerner Corp., the largest provider of electronic medical systems in the US, on a collaboration to integrate MedSocket with its EHR.

Potential Areas of Application:
Hospitals and clinics
Patent Status: US Patent filed
Inventor(s): Karl Kochendorfer
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STEERABLE EPIDURAL CATHETER

ELEVATOR PITCH

When injecting pain medication at the cervical spine, physicians have two choices: the transforaminal approach, where a needle is inserted directly between the vertebrae (the foraminae) to reach the target nerve root, or the interlaminar approach, where the drug is dispersed more liberally into the epidural space where it impacts multiple nerve roots. When addressing the upper reaches of the cervical vertebrae using the transforaminal approach, a physician will place a needle near the target nerve root by accessing the foraminae, while with the interlaminar approach, the physician will access the epidural space beneath the target nerve root at a point where there is a comfortable amount of space between the vertebrae (most often the top of the thoracic vertebrae).

Although the interlaminar approach requires more drug to do the same job as the transforaminal approach, many anesthesiologists prefer the interlaminar approach when working with the cervical spine, because, in the cervical region, the small openings between the vertebrae are extremely tight. In this compact environment, the risk of damaging the spinal cord or nerve root is highest when using the transforaminal approach to access the upper cervical vertebrae. Consequently, most anesthesiologists use the interlaminar approach when dealing with the upper cervical spine where they insert the drug delivery needle near the boundary of the cervical spine and the thoracic spine and treat the entire epidural space with drug.

The invention describes a catheter design for a modified interlaminar approach capable of being threaded into the epidural space via the lumbar region up to the thoracic and cervical levels and directs pain medication into a precise space more safely and more reliably than current methods. This device is designed to have a structural integrity that will allow the catheter to be threaded through blockages but a shape that minimizes the risk of trauma.

Medical literature has paved the way for this device, as the procedure for threading a catheter in the epidural space has been described in numerous publications. However, the market does not yet offer a readily available product for the procedure. This intellectual property has been developed to fill that void, and it is ready for commercialization.

Potential Areas of Application:
Health care marketing, specifically involving back surgeries
Other types of surgeries, particularly involving epidural injections
Patent Status: Patent pending
Inventor(s): Ebby Varghese, William Verbarg, Zachary Hafez, Nicole Patino
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McDanielWC@missouri.edu; 573-884-3302

DETECTING MICRORNA (MIRNA) USING NANOPORE SINGLE MOLECULE DETECTOR

MicroRNAs (miRNAs) are a class of short (~18-24-nt) non-coding RNA molecules that regulate gene expression at the post-transcriptional level. Aberrant expression of miRNAs has been found in all types of tumors. Most notably, specific miRNAs are released from the primary tumor into blood circulation, making the detection of circulating miRNAs a powerful tool for noninvasive cancer detection, diagnosis, staging and monitoring.

We developed a robust nanopore sensor that selectively detects single molecules of circulating miRNAs derived from primary cancer. The nanopore is a fabricated 2-nm molecular pore. Such a tiny pore can generate a signature current signal when a miRNA molecule is specifically captured in it. These signals function as fingerprints that enable us to identify a specific miRNA and quantify its concentration. The prototype has demonstrated the capability to discriminate single nucleotide difference, between

miRNAs. In clinical tests, we have differentiated miRNA levels in blood between lung cancer patients and healthy people.

Due to the label-free single molecule detection without nucleic acid amplification, the nanopore sensor is highly selective, precise and accurate over the gold standard RT-PCR and microarray. The nanopore array in development would achieve high throughput capability for detecting miRNA profile.

Potential Areas of Application:
Detection of any nucleic acids fragments, including all microRNAs and pathogenic DNAs or RNAs
Study of nucleic acid folding unfolding reactions
Study of miRNA mechanism and principle of regulation
Study single nucleotide polymorphisms (SNPs)
Study of oligonucleotide-protein and oligonucleotide-drug interactions for drug discovery and development
Biomarker characterization
Diagnostics, prognostics and theranostics.
Patent Status: Patent pending
Inventor(s): Li-Qun Gu, Yong Wang
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DENTAL PLASMA BRUSH

ELEVATOR PITCH

State of the art dental restorations using composite resin last only 6-8 years due to the weak filler-tooth bonding strength, which will eventually lead to tooth loss after the 2nd or 3rd restorations. University of Missouri, in collaboration with Nanova Inc., has developed a miniature atmospheric cold plasma brush (m- ACPB) which can significantly improve the bonding strength and thus improve the durability and longevity of dental composite restoration. In addition, plasma treatment of tooth decays or dental surfaces using such a device can avoid contamination, actively fight bacterial infections, effectively fluorinate the tooth surfaces, and offer additional cleaning to the decayed matters.

This new method will be economical to patients, doctors, and health insurance companies due to increased reliability and inexpensive device construction. The cost for plasma brush treatment could be $10 to $20 per patient. Dentists perform dozens of restorations per week. Therefore, advancements in this area are highly desired and highly profitable. University of Missouri and Nanova Inc. during the last few years have secured federal grants amounting to nearly $4M, from NIH and NSF.

Potential Areas of Application:
Dental restoration
Treatment and disinfection of hard and soft tissue in oral cavity.
Patent Status: Patent application filed
Inventor(s): Qingsong Yu, Meng Chen, Hao Li
Contact Info: Meng Chen
chenmeng@nanovamed.com; 573-884-2273

NANOSECOND PULSED TIRPAS: IMPROVED PHOTOACOUSTIC DETECTION

ELEVATOR PITCH

The development of specialized methods that allow for rapid and inexpensive detection, identification and quantification of biologically and chemically relevant compounds have the potential to both revolutionize the detection and treatment of disease and result in quantum leaps in scientific knowledge. Photoacoustic spectroscopy is such a novel technology for the detection of chemicals that it has great potential for multiple applications across various market segments.

The current invention developed by researchers at the University of Missouri is an improvement to photoacoustic detection with the potential to revolutionize the detection of small and large absorbing molecules, including environmental pollutions and disease indicators. The combination of Total Internal Reflection Photoacoustic Spectroscopy (TIRPAS) with the use of a nanosecond pulsed laser increases the sensitivity and selectivity of chemical detection over current methods like UV-VIS spectroscopy, and has many of the characteristics of being a disruptive technology.

Potential Areas of Application:
Disease marker detection
Environmental pollution detection
Chemical detection
Patent Status: Patent application filed
Inventor(s): Benjamin S. Goldschmidt, Amanda S. Sudduth, Paul J. D. Whiteside, John A. Viator
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TREATMENT OF TYPE I DIABETES BEFORE AND AFTER EXPRESSION OF PREDISPOSITION MARKERS

Research at the University of Missouri has resulted in a novel technology to treat type I diabetes. This technology uses the unique approach of antigen specific therapy. A peptide from glutamic acid decarboxylase (GAD) autoantigen was genetically expressed on an immunoglobulin molecule and the resulting Ig-GAD was able to restore normoglycemia in hyperglycemic, non-obese diabetic (NOD) mice. This regimen triggered regeneration of endogenous beta cells without assistance of exogenous insulin or stem cell infusion.

Potential Areas of Application:
Treatment of type I diabetes before or after expression of predisposition markers
Patent Status: Patent pending
Inventor(s): Habib Zaghouani, Randal Gregg, Renu Jain
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A NOVEL PROTEIN TARGET FOR ANTI-CANCER THERAPEUTICS

Targeted therapies are transforming the way people treat cancer. With help from cancer biochemistry and computational modeling technologies, it is now possible to discover new therapeutic targets within cancer cells and then design small molecule drug candidates that selectively interfere with their role in cancer.

The current invention is a novel protein target for anticancer therapeutics. It also includes pharmaceutical compositions and a method of treating cancer using such compositions. Known inhibitors of this target have been used in other therapeutic areas and supply proof of principle for chemotherapeutic use.

Potential Areas of Application:
Cancer treatment, chemotherapy
Patent Status: Patent pending
Inventor(s): X. Zou, S. M. Hyder, Y. Liang, S. Z. Grinter, S. Y. Huang
Contact Info: Paul Hippenmeyer
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DNA METHYLATION BIOMARKERS IN LYMPHOID AND HEMATOPOIETIC MALIGNANCIES

Leukemias and lymphomas are a part of the broad group of malignancies of the lymphoid and hematopoietic systems. Accurate and rapid identification of leukemias and lymphomas, especially subtypes of non-Hodgkin's lymphoma (NHL), is essential to successful treatment because clinical outcome and therapy options vary greatly among them. Aberrant DNA methylation often shows abnormal patterns unique to specific cancer types, and thus can be used as biomarkers for detections of specific cancers. However, until recently only a few individual genes were known to be methylated in either leukemias or lymphomas.

This invention comprises a set of genetic sequences whose pattern of DNA methylation can be used as biomarkers to identify and differentiate various subtypes of human lymphomas and leukemias for purposes of early detection, diagnosis, prognosis, staging, monitoring of responses to therapies, and sensitive detection and prediction of relapse. Based on this invention, a commercial kit capable of implementing a non-invasive test can be generated for treatment and management of cancers such as NHL, chronic lymphocytic leukemia (CLL), multiple myeloma (MM), acute myelogenous leukemia (AML) and acute lymphoblastic leukemia (ALL). This novel invention also provides targets and methods for therapeutic epigenetic treatments of various lymphomas or hematologic malignancies.

Potential Areas of Application:
Medicine, Oncology, Chemotherapy
Patent Status: Patent pending
Inventor(s): Charles Caldwell, Huidong Shi, Farahnaz Rahmatpanah, Kristen Taylor, Doug Laux, Dieter Duff, Guo Juyuan
Contact Info:Paul Hippenmeyer
HippenmeyerP@missouri.edu; 573-882-0470

NANOFIBER SCAFFOLD FOR DELIVERY OF HEPARIN BINDING GROWTH FACTORS

Tendon tissue engineering scaffolds require a material to have structural integrity and certain mechanical properties. These scaffolds could also benefit from the ability to deliver growth factors to encourage cellular in-growth. Many artificial polymers have excellent handling characteristics but cannot deliver growth factors without significant modifications. Many biological polymers have excellent growth factor delivery characteristics, but their poor handling properties make their use difficult in a number of clinical scenarios.

The novel scaffold developed by researchers at Washington University results in an optimal growth factor delivering scaffold with the strength to be sutured into a wound. Preliminary studies have been completed in vitro and in vivo demonstrating that the scaffold can deliver growth factors in a sustained manner, can be implanted for flexor tendon repair, is biocompatible and is not cytotoxic.

Potential Areas of Application:
Wound healing, including tendon repair
Patent Status: Provisional application filed 01/07/2011
Inventor(s): Stavros Thomopoulos, Shelly Sakiyama-Elbert
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ACCURATE AND NON-INVASIVE QUANTIFICATION OF CENTRAL NERVOUS SYSTEM PATHOLOGY

ELEVATOR PITCH

Diffusion tensor imaging (DTI) has demonstrated sensitivity to detect pathologies in CNS white matter disorders. However, the capability of DTI to detect CNS white matter pathologies is confounded by the coexisting structural (crossing fibers) and pathological (inflammation associated cell infiltration and vasogenic edema, axonal injury, demyelination and tissue loss) complications.

Washington University researchers have developed diffusion basis spectrum imaging (DBSI), a novel method to quantify diffusion parameters of each fiber tract to reflect the underlying structural and pathological complexity of CNS tissues using commonly implemented diffusion data acquisition schemes retaining its applicability in clinical settings. Preliminary data in mouse models of CNS diseases/injury demonstrated that DBSI is capable of separating different underlying pathologies and estimating the extent of cell infiltration, vasogenic edema, axonal injury, demyelination and tissue loss. This approach also generates realistic noninvasive histology maps of various CNS white matter pathologies directly related to the actual immunohistochemistry staining that is only available after tissue excision and fixation.

Potential Areas of Applications:
Diagnosis of CNS diseases
Monitor the efficacy of treatment of CNS disease
Estimate the degree of CNS tumor growth

Measure progression of clinical and preclinical pathologies in drug trials
Surgery guidance
Patent Status: US Non-provisional pending
Inventor(s): Sheng-Kwei (Victor) Song
Contact Info: Isabel C. Acevedo
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A NOVEL MODEL FOR DISSOLVED HYPERPOLARIZED XENON-129 DYNAMICS IN THE LUNG

The diffusion pathway of xenon through alveolar membranes correlates to that of oxygen and carbon dioxide. The dynamics of dissolved xenon in the lung can be observed and characterized using MR methods. This technique can be used for global (spectroscopy) and localized (imaging) measurements of lung function, structure and physiology.

Researchers at Washington University have developed a simple model of gas exchange in the lung for hyperpolarized xenon-129, which treats individually the two peaks of dissolved xenon signal at different chemical shifts with shared pulmonary parameters. Rapid processing of the normalized dissolved-xenon signal amplitudes as functions of gas-exchange time allows quantification of the following pulmonary structural and physiological parameters: i) surface-area-to-volume ratio; ii) ratio between air-blood barrier thickness and septal thickness; iii) hematocrit; iv) pulmonary capillary transit time; v) gas-exchange time constant.

Since the above parameters are closely related to lung function and physiology, this new model can be used for screening or diagnosis of prevalent lung diseases such as chronic obstructive pulmonary disease (COPD) and fibrosis, as well as diseases that affect capillary blood flow in the lung such as the sickle cell disease (SCD) and ventricular hypertrophy. This technique can also be used to monitor the progression and treatment of lung diseases.

Potential Areas of Application:
MR Spectroscopy
Lung Imaging
Patent Status: Patent pending
Inventor(s): Yulin Chang
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SYNTHESIS OF AVASTIN CONJUGATED GOLD NANOPARTICLES

Gold nanoparticles possess unique properties including preferential binding to leaky blood vessels, ability to bind to a variety of ligands, with no evidence of cellular toxicity, making them an excellent platform for targeted sustained release delivery of drugs and peptides. Avastin is a humanized monoclonal antibody specifically targeting vascular endothelial growth factor that has found widespread use in inhibiting intraocular neovascularization that occurs in macular degeneration and proliferative diabetic retinopathy.

The current invention provides the conjugation of gold nanoparticles (AuNP) with Avastin (Av) to yield AvAuNP nanoconjugates. AvAuNP nanoconjugate is a potential clinical therapeutic agent and has demonstrated excellent ability to deliver Avastin for sustained release of therapeutic dose within the eye.

Potential Areas of Application:
Treatment of Age-related Macular Degeneration
Diabetic Retinopathy
PXE
Patent Status: Patent pending
Inventor(s): Dean Hainsworth, Ravi Shukla, Kattesh V. Katti, Kannan Raghuraman
Contact Info: Paul Hippenmeyer
HippenmeyerP@missouri.edu; 573-882-0470

MODULATION OF SPHINOGOSINE 1-PHOSPHATE-METABOLIZING ENZYMES FOR THE TREATMENT OF INFLUENZA

Influenza virus continues to cause tremendous morbidity and mortality on an annual basis. While vaccines exist to help prevent infection, there are only a handful of drugs approved for treating the infected individual. Moreover, the virus has evolved, in many cases, to become resistant to these treatments. The current discovery identifies sphingosine-1-phosphate pathway as critical for virus replication. Blocking sphingosine kinase activity or over expressing sphingosine 1-phosphate lyase strongly inhibited virus propagation. Therefore, modulation of this pathway could lead to new points of pharmaceutical intervention.

Potential Areas of Application:
Inhibit influenza virus replication
Patent Status: Patent pending
Inventor(s): Bumsuk Hahm, Young-Jin Seo, Stephen Alexander
Contact Info: Paul Hippenmeyer
HippenmeyerP@missouri.edu; 573-882-0470

BIOCOMPATIBLE POROUS TITANIUM FOR BONE REPAIR

Arthritis and trauma are a major problem and one of the leading causes of physical disabilities, necessitating billion-dollar expenditures annually in medical care and rehabilitation. Many times replacing a joint is necessary; our invention describes a method for the preparation of porous titanium (Ti) implants for the repair of diseased or damaged bone. These Ti implants have the requisite mechanical properties to match the strength and elastic modulus of bone. The Ti implants are also coated with a layer of bioactive glass to improve their biocompatibility and the interfacial bonding with bone. This results in a stronger, longer lasting solution.

Potential Areas of Application:
Repairing diseased or damaged bone
Patent Status: Patent pending
Inventor(s): B.S. Bal, T.S. Huang, M.N. Rahman
Contact Info: Paul Hippenmeyer
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INTRAVITREAL INJECTION DEVICE

With the discovery of new drugs to treat macular degeneration and other retinal diseases, the prevalence of intraocular injections for treatment of those diseases has skyrocketed. Current ophthalmologic practice relies on a free hand injection of the medicines using a syringe. This difficult procedure poses a significant challenge to the novice and expert alike. A preferred approach would be to use a device that would guide the needle into the eye in a specific and reproducible manner. This new device will allow reproducible delivery to the eye in a position and orientation-specific manner using current syringes.

Potential Areas of Application:
Intravitreal injections using syringe loaded medicines
Patent Status: Patent pending
Inventor(s): Chetan Rasiklal Soni, Nathan Heseman
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ALTERATIONS IN RNA BINDING PROTEINS TREAT BREAST CANCER

Human breast cancer is broadly divided into two different subtypes: estrogen receptor positive (ER+) and estrogen receptor negative (ER-). The majority of women with breast cancer are ER+ (85%), whereas the remainder is ER- (15%). Patients with ER+ breast cancer can be treated with the drug tamoxifen, but for unknown reasons, many of them develop drug resistance. In contrast, there are no specific treatments for women who are ER-. These patients are usually treated with surgery and chemotherapy, but the tumor eventually recurs resulting in the death of the patient. Hence, there is a need to develop therapies to treat ER- breast cancer, as well as ways of overcoming the development of tamoxifen resistance in ER+ breast cancer. Posttranscriptional gene regulation by RNA binding proteins (RBPs) and microRNAs (miRNAs) regulate gene expression at the level of mRNA stability and translation.

The current invention alters the expression of breast cancer genes at the posttranscriptional level which can block tumor growth by over 90% in difficult to treat breast cancers.

Potential Areas of Application:
Gene Therapy, Cancer Therapy
Patent Status: Patent pending
Inventor(s): Ulus Atasoy, Matt Gubin, Robert Calaluce
Contact Info: Paul Hippenmeyer; HippenmeyerP@missouri.edu
573-882-0470

HELICAL CONSERVATIVE SHOULDER PROSTHESIS

Shoulder replacement surgery is required to supply function to joints damaged by traumatic injury, use injuries or disease. Over 60,000 replacements are performed in the US annually. Presently, the ball (or head) of the replacement joint rests on top of the humerus and is connected to a long shaft (or stem) that penetrated down into the intramedullary canal of the bone.

This invention does not require the stem insertion into the intramedullary canal for stabilizing the ball thus the device does not require reaming into the intramedullary canal. One size stem will fit multiple patient geometries decreasing the need for precise sizing and leading to decreased need for variable manufacturing and inventory.

Potential Areas of Application:
Shoulder implant for shoulder arthritis, post trauma or medical conditions
Patent Status: Patent applications filed
Inventor(s): Matthew Smith
Contact Info: Paul Hippenmeyer
HippenmeyerP@missouri.edu; 573-882-0470

FACILE GAS-INDUCED TRANSFORMATION OF PHARMACEUTICAL POLYMORPHS/ORGANIC SOLIDS

Gas pressurization can be used to convert polymorphs of pharmaceutical agents with ease. Current processing methods are often lengthy and can involve the use of high temperature at great expense to the industrial sector. Our facile method of polymorph transformation eliminates the need for such measures, and offers vast potential for streamlining the processing of pharmaceutical agents, with a concomitant savings in energy costs while potentially creating new pharmaceutical entities and patent extensions.

Potential Areas of Application:
Pharmaceutical manufacturing
Patent Status: Patent pending
Inventor(s): Jerry Lee Atwood, Jian Tian, Scott John Dalgarno
Contact Info: Paul Hippenmeyer
HippenmeyerP@missouri.edu; 573-882-0470

HUMAN ZONA PELLUCIDA GLYCOPROTEINS, THEIR OLIGOSACCHARIDES, AND THEIR USE IN CONTRACEPTION AND IN THE DIAGNOSIS OF HUMAN INFERTILITY

To fertilize the human egg (oocyte), human sperm must first bind on the surface of the oocyte. The sperm binds to the oocytes via both the carbohydrate and protein portion of the glycoprotein. A human glycoprotein that is the equivalent to that on the oocyte can be used as a contraceptive agent by acting as a decoy. The carbohydrate sequences from these glycoproteins can also be used as agents, either singly or conjugated to polymers or other

supports, for multiple uses including methods in the field of human infertility diagnosis. This discovery takes advantage of the unique species specific interactions between human sperm and oocytes.

Potential Areas of Application:
Large potential in the natural contraceptive market
Species specific sperm binding assays
Patent Status: Patent pending
Inventor(s): Gary Francis Clark, William Shu Biu Yeung, Philip Chi Ngong Chiu, Anne Dell, Poh-Choo Pang, Kay-Hooi Khoo
Contact Info: Paul Hippenmeyer
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CLOSED LOOP RESPIRATORY DEVICE WITH DYNAMIC ADAPTABILITY

This invention describes a device for automatically controlling SpO_2 concentrations in the blood of premature infants and other patients in need of respiratory support. This dynamically adaptable device will respond to changing patient conditions where tight O_2 control is desired or in situations of reduced staff monitoring capabilities.

Potential Areas of Application:
Neonatal intensive care units
General respiratory control situations
Patent Status: Patent pending
Inventor(s): Ramak R. Amjad, Roger C. Fales, Timothy Keim
Contact Info: Paul Hippenmeyer
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CONTINUOUSLY TUNABLE EYEGLASS LENS FOR VISION CORRECTION

Correction of age-related optical changes in the eye is increasingly important as the population ages.

Presbyopia (the gradual loss of the eyes' ability to focus on nearby objects) is a natural age-related condition that will affect the majority of adults before the age of 60. Globally, presbyopia affects an estimated 1.18 billion individuals. In the United States alone, eyeglasses represented a $1.1 billion market in 2006. The conventional corrective lenses (bifocal, trifocal) have drawbacks including a limited field of view for each vision task, requiring a conscious effort of refocusing in each distinct horizontal viewing area and sometimes causing dizziness and discomfort as the user gazes down to accomplish near-vision focus. The newer progressive lenses (no-line bifocals) cause visual distortion. This invention is a low-cost electro-optic eyeglasses lens able to continuously focus to different focal lengths with no distortion, correcting vision for people with presbyopia conveniently and aesthetically. This technology has the potential to revolutionize the eyeglasses industry providing a low-cost, elegant solution to age-related vision changes. This invention is a liquid crystal (LC) lens that utilizes a novel electro-optic means of changing the power (in diopter) of the lens along with a low-cost method of fabricating the lens.

Potential Areas of Application:
Adaptive eyeglasses with electro-optic lenses for correction of presbyopia and other vision issues
Employment of adaptive lens for rapid, high-resolution 3D biomedical microscopic imaging without mechanic scanning
Patent Status: Patent pending
Inventor(s): Guoqian Li
Contact Info: Tamara Wilgers
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ADFREEQ

ELEVATOR PITCH

AdFreeq is a real-time, self-service, cloud-based classified ad service for media companies (primarily newspapers) who offer their own branded version of AdFreeq through their web site.

For buyers, it provides a powerful search tool for real-time ads from local classifieds, the AdFreeq network, social sites and the real-time web.

Sellers get effective, free or low cost classified advertising that is pushed into the real-time stream up to 10 times a day. It's faster and richer than Craigslist without their huge limitations. And it's cheaper and far easier to use then eBay.

In Summary, AdFreeq places or finds classified sales ads in the real-time Web. You set it up in minutes and get results in no time - and they cost you almost nothing!

Potential Areas of Application:
Classified ads
Patent Status: Only recently disclosed
Inventor(s): Peter Meng
Contact Info: Brett Maland
malandb@missour.edu; 573-882-1046

NOVEL PROCESS FOR CREATING MO-99

ELEVATOR PITCH

Mo-99/Tc-99 is the most widely used radiopharmaceutical, finding application in about 80% of all diagnostic nuclear imaging procedures. Although usage of this radiopharmaceutical is widespread, the supply is not and about 90% of the world supply comes from five old nuclear reactors. Due to the age of most of these reactors, supply shortages of Mo-99/Tc-99 are common, and there is a great need for alternative sources. Researchers at the University of Missouri have invented a promising method of Mo-99/Tc-99 manufacture that does not require large nuclear reactors.

Potential Areas of Application:
Patent Status: Patent pending
Inventors: John Gahl, Michael Flagg, Gregory Dale
Contact: Wayne McDaniel
McDanielWC@missouri.edu; 573-884-3302

PRESIDENT'S AWARD FOR ECONOMIC DEVELOPMENT

Kattesh Katti, Ph.D.- University of Missouri-Columbia

An outstanding leader in the field of nanomedicine, Dr. Katti joined MU as a research assistant in 1990 and has since been involved in numerous research and development activities that have culminated in major economic developments for the university.

His research and development efforts with Dow Chemical resulted in a $6 million donation of technology and intellectual property to MU—one of the largest donations from the corporate sector in university history. His leadership in the field of nanomedicine has positioned MU as one of only 12 institutions in the country to be recognized by the National Institutes of Health for establishing a Cancer Nanotechnology Platform. And his unique process for producing gold nanoparticles in a 100 percent green process has been cited as the Editor's Choice in Science, Popular Science, the Discovery Channel and the British Broadcasting Company, as well as lauded by Nobel Laureates. As a result, Dr. Katti was named one of the 25 Most Influential Scientists in the World by *rt Image* magazine.

In addition, Dr. Katti has published more than 250 peer-reviewed journal articles, refereed abstracts and reviews, book chapters and monographs. As a colleague notes, "Kattesh and his team are a tremendous story for the campus, the state of Missouri and our nation. His tireless efforts are attracting investment capital from both private and governmental sources into Missouri high-technology product development."

The Economic Development Award recognizes faculty for distinguished activity in meeting the University of Missouri's goal of serving as an economic engine for the state and its citizens. Awardees will demonstrate entrepreneurial innovation in using the classroom, outreach programs or the laboratory as vehicles for increasing or developing new economic activity in the state.

UNIVERSITY OF MISSOURI STUDENT ENTREPRENEUR AWARD

Meghan Orbe - University of Missouri-Columbia

Beyond becoming a budding entrepreneur, Ms. Orbe is a dedicated and busy student in the MU Trulaske College of Business. She currently serves as president of the Flegal Academy for Aspiring Entrepreneurs, increasing the number of speakers the organization has brought to campus. She also is the vice president of fundraising for the MU Entrepreneurs Organization and has served as vice president of growth and networking. She is one of only 30 juniors in the college's Cornell Leadership program.

Ms. Orbes latest business venture is Make Me Your Ad, which she has grown into a limited liability corporation with two employees and 11 signed clients.

As a nominator writes, "Meghan has a combination of charisma and wisdom that is uncommon in a 20 year old. Her peers trust her and look to her for leadership because she has innovative ideas, good judgment and will do more than her share, whatever the task."

This award is to honor University of Missouri students who have demonstrated innovativeness, originality and entrepreneurial spirit in the development of processes, products or technologies of commercial potential and/or of benefit to the University of Missouri.

PRESIDENT'S AWARD FOR INTER-CAMPUS COLLABORATION AWARD

Sonny Bal, M.D., J.D.- University of Missouri-Columbia

Mohamed Rahaman, Ph.D. - Missouri University of Science and Technology

Combining the engineering expertise of Missouri S&T Professor Dr. Rahaman with the clinical expertise of MU Associate Professor of Orthopaedic Surgery Dr. Bal has led to one of the most fruitful collaborations in university history.

Aimed at improving orthopaedic care, this eight-year partnership has resulted in more than three dozen peer-reviewed journal articles, two book chapters, an award from the International Society for Technology in Arthroplasty, five grant-funded projects, two patent applications and five patent disclosures. The team's most recent successful funding includes a project with the National Institutes of Health for the repair of load-bearing bones.

The Inter-Campus Collaboration Award recognizes faculty who engage in activities that foster collaboration across two or more campuses of the University of Missouri System. Collaboration may be in the areas of teaching, scholarship, research, service, creativity, outreach or economic development.

The mission of the CTP Program at the University of Missouri is to accelerate the delivery of healthcare technologies that address important unmet clinical needs and lead to improvement in commercial development and patient care. Funds from the program will be distributed to support collaborative projects between biomedical engineers and clinicians that are explicitly translational in nature.

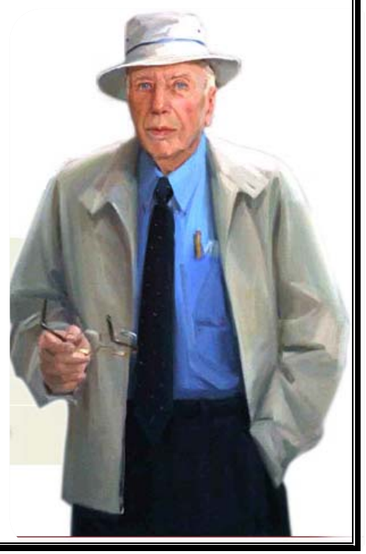
Coulter Translational Partnership Program

At The University of Missouri

Coulter Process:

Idea Generation → Risk Assessment & Screening → Project Selection → Risk Reduction → Follow on Funding

The Coulter Translational Partnership (CTP) Program at the University of Missouri is a five year program that will fund 5-7 new or continuing research projects focused on solving an unmet clinical need each year with an average award size of $100,000. The program deploys the Coulter Process which includes a screening step based on IP, ability to gain follow on funding, clinical collaboration, strength of the need, competitors in the market and ability to hit milestones. Through the partnership, the project will receive mentorship from Coulter as well as industry leaders.



Do you have an IDEA?

The first round of proposals for collaborative projects focused on translating research to commercialization to improve health care will be accepted soon!

Please contact Rebecca Rone at roner@health.missouri.edu or 573-882-2369 for more information.

Also, visit the website at http://bioengineering.missouri.edu/ click on **Coulter Program.**

Mizzou Advantage

University of Missouri

University of Missouri faculty, students and alumni worked together to identify competitive assets that set MU apart from other universities. These assets underlie five dynamic initiatives that collectively are called Mizzou Advantage.

The purpose of Mizzou Advantage is to increase MU's visibility, stature and impact in higher education and enhance

- The quality of faculty and students
- Instructional programs
- The value of an MU degree
- Success of grant proposals
- Fundraising results
- U.S. and Missouri economies
- Venture capital investment

Activities related to each initiative will be driven by a network of collaborators (e.g. faculty members, centers, departments and colleges, corporate partners and other universities). Their efforts will result in more grants and opportunities to recruit top students and the most prominent faculty scholars and scientists. Not only will the Mizzou Advantage contribute to MU's positioning in higher education, but it will create jobs and improve the quality of life for Missourians.

MU also will develop new educational programs in these five areas to give students a competitive edge in the global marketplace. (Education Coordinator LuAnne Roth, 573-884-9456, rothl@missouri.edu)

Sustainable Energy – addresses energy issues broadly, building on the work at MU's Research Reactor, education programs in nuclear and other kinds of energy, research in biofuels and MU's biomass power plant. Examines business models, environmental impacts and the cultural and social consequences of energy use and production. (Facilitator Cerry Klein, 573-239-9467, kleinc@missouri.edu)

Food for the Future – capitalizes on MU's strengths in plant and animal sciences; food safety and biosecurity; local food systems; research on aging, obesity and chronic disease; and food-related work in the arts, humanities and social sciences. (Facilitator Jo Britt-Rankin, 573-239-8399, britt-rankinj@missouri.edu)

One Health, One Medicine – expands on MU's pioneering work in the convergence of human and animal health, connecting with research and instruction in health care delivery, policy, business models, medical ethics and the culture of healthy living. (Facilitator Carolyn Henry, 573-882-7821, henryc@missouri.edu)

Media of the Future – draws on the School of Journalism's century of international leadership in media research and hands-on training, along with other campus strengths in digital technologies, business, public policy, graphic design and writing. (Facilitator Charles N. Davis, 573-268-4111, daviscn@missouri.edu)

Disruptive and Transformational Technologies – touches on virtually every part of the university as researchers study how current technologies fundamentally change in these rapidly evolving times. These transformational developments generate new opportunities, change business models and ultimately alter the way we live. (Facilitator Carsten Strathausen, 573-823-2971, strathausenc@missouri.edu)

'MU's unique strengths in five critical areas make it possible for us to do things others can't do.'

– MU Provost Brian Foster

More information: Contact Meg Phillips, Mizzou Advantage Program Coordinator, at 573-884-6197 or email mizzouadvantage@missouri.edu.

MizzouAdvantage.missouri.edu

agriculture and food

BOND LSC

CHRISTOPHER S. BOND
LIFE SCIENCES CENTER
University *of* Missouri

human and animal health

TEAMWORK is key to finding solutions to modern questions and problems in the life sciences. The Bond Life Sciences Center at MU is all about the synergy of teamwork — with internationally recognized research teams working 24/7 to solve problems related to the human, natural and managed biological systems that underlie our quality of life — and translating that understanding into social and economic impact.

scientific discoveries

The Bond Center's innovative culture has enabled our 35 faculty investigators from 12 academic units to form unique collaborations rarely seen on college campuses. Engineers are working with cancer biologists, plant scientists with biomedical researchers, lab researchers with field biologists, and information technology experts with biologists of many stripes. The discoveries of MU researchers are saving lives, saving money and making everyday life better for Missourians and people in all corners of the world.

Just a few examples...

- Our bioengineers are developing laser-based sensing devices to detect environmental pollutants, biological and chemical weapons, and even cancer cells in the blood — plus nano particles that will assist in disease detection and targeted medical interventions.

- Bond LSC faculty researchers collaborate on the impacts of diet on cancer, pregnancy and adult health and fitness — and research causes and cures for diseases such as Muscular Dystrophy, ALS, Spinal Muscular Atrophy, Duchenne's Muscular Dystrophy, Charcot-Marie-Tooth, Sjogrens, Alzheimer's and cardiovascular diseases. And LSC virologists are producing a new generation of custom-designed molecules that block infection by viruses such as HIV.

- Faculty researchers are finding new ways to stop plant pests such as insects, nematodes and diseases that reduce crop yields and cost millions of dollars in Missouri crop losses per year — and billions in losses around the world. MU plant scientists lead the world in understanding how plants grow, develop, and defend themselves against enemies — and what sorts of chemical products plants can provide for us.

- Bond LSC faculty researchers have provided an excellent return on investment for Missouri by attracting external research funding of more than $85 million over a several year period, surpassing the $65 million cost of constructing the facility. Those research dollars carry an estimated economic impact for Missouri of more than $170 million.

economic growth for Missouri

- More than 100 patents or disclosures aimed at turning discoveries into products have been filed by Bond Center investigators, and many LSC faculty are recognized as leaders across campus and around the world in plant sciences, neuromuscular research, infectious diseases and bioengineering.

Bond Life Sciences Center faculty investigators have also mentored more than 160 graduate students and 400 undergraduate researchers who have gone on to positions in industry and prestigious academic institutions in Missouri and around the world. We are increasing our efforts to reach local and broader communities with public education programs and serve as a resource for the citizenry and elected officials needing information on the latest advances in the life sciences.

environment and biofuels

better lives healthier world

bondlsc.missouri.edu
University of Missouri • 1201 Rollins St. • Columbia, MO 65211-7310
573.882.4544 • bondlsc@missouri.edu

Dalton Cardiovascular Research Center
Committed to Collaboration in Research and Teaching

Nanoscience Approaches for the Study of Cardiovascular Physiology and Disease

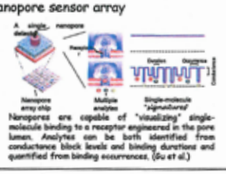
Dalton Cardiovascular Research Center

University of Missouri, Columbia, MO 65211

Development of Nanosensors:

Ion channels as nanomachines
– a new generation of nanosensor

- High-throughput pharmaceutical screening
- Enzyme screening
- Super-sensitive detector for pathogen, biomarkers, DNAs and proteins
- Biodefense and environmental monitoring (toxin ricin)
- Nanopore sensor array



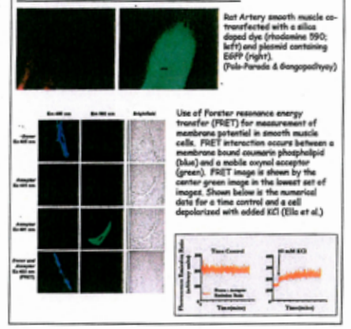
Nanopores are capable of "visualizing" single-molecule binding to a receptor engineered in the pore lumen. Analytes can be both identified from conductance block levels and binding durations and quantified from binding occurrences. (Gu et al.)

- The DCRC is a multidisciplinary research center focused on the ***translation of fundamental science*** to the understanding and improvement of cardiovascular health and disease.

- The DCRC partners with multiple Colleges and Departments of the University of Missouri and is actively engaged in developing links with industry.

- The multidisciplinary nature of DCRC brings together expertise from a variety of disciplines including: medicine, pharmacology, physiology, biomedical sciences, biological engineering computer and electrical engineering and physics.

Nanoscale Measurements of Vascular Cell Biochemistry:



Rat Artery smooth muscle co-transfected with a silica doped dye (rhodamine 590; left) and plasmid containing EGFP (right). (Polo-Parada & Bangopadhyay)

Use of forster resonance energy transfer (FRET) for measurement of membrane potential in smooth muscle cells. FRET interaction occure between a membrane bound coumarin phospholipid (blue) and a mobile oxynol acceptor (green). FRET image is shown by the center green image in the lowest set of images. Shown below is the numerical data for a time control and a cell depolarized with added KCl (Ellis et al.)

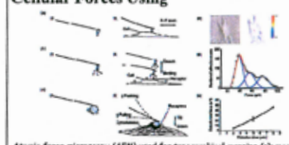
- DCRC Investigators attract funding from a wide array of extramural sources including NIH, NSF, NASA and foundations such as the American Heart Association and the Cystic Fibrosis Foundation. Funding in 2006 totaled $15 million.

- The DCRC provides state-of-the-art core facilities with a current emphasis on advanced micro-imaging and optical approaches.

- Nanoscience and nanomedicine approaches form a focus of DCRC' current research efforts. Areas include: nanosensing, ion channels as nanomachines, study of cellular responses to nanoforces; nanoscale approaches for drug target screening, and nanoscale approaches for studying vascular cell biochemistry.

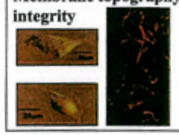
Atomic Force Microscopy:

Application and Measurement of Nanoscale Cellular Forces Using



Atomic force microscopy (AFM) used for topographical mapping (a); measurement of ligand-receptor binding forces (b); and for applying forces through simulated interaction with the extracellular matrix (c). Note in b and c the AFM probe is 'biofunctionalized'. (Sun et al.)

Membrane topography and cytoskeletal integrity



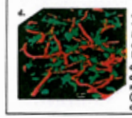
Lefthand panels show AFM images for a control endothelial cell and one treated with cytochalasin D to disrupt the cytoskeleton (lower). Righthand panels show similarly treated cells studied by phalloidin labeling and confocal microscopy. (de Dios et al.)

DCRC Core Imaging Facilities:

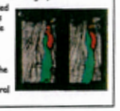
- Confocal microscopy
- Multiphoton microscopy
- High speed confocal microscopy
- Fluorescence microscopy
- FRET imaging
- TIRF imaging
- Interference reflectance microscopy
- Multi-mode imaging
- Atomic force microscopy

a. Immunolabeling for $\alpha_5\beta_1$ integrin (red) with phalloidin stain for actin filaments (green). (Sun et al)

b. Combined AFM and IRM image showing cytoskeletal elements and focal adhesion contacts (blue). (Trache and Meininger).



c. Multiphoton image used to track position of cells in the wall of an arteriole over time. (Martinez-Lemus)



d. Relationship between astrocytes (green) and the microvascular network (red) in the mouse cerebral cortex (Ding)

CONTACT DETAILS:
Gerald A. Meininger, Ph.D.
Director, Dalton Cardiovascular Research Center
University of Missouri
134 Research Park Drive
Columbia, Missouri 65211
Ph: 573 884-7588, FAX: 573 884-4232, E-mail: meiningerg@missouri.edu

Dalton Cardiovascular Research Center
Committed to Collaboration in Research and Teaching

International Institute of Nano and Molecular Medicine

I²NM² is engaged in multifaceted research projects involving the creation of novel boron-containing materials, devices and agents enhanced by nanotechnology with applications in medicine, related materials science and beyond. Research highlights include:

FACULTY

M. Frederick Hawthorne, Ph.D.
Director

Mark W. Lee, Jr., Ph.D.
Assistant Director

Satish Jalisatgi, Ph.D.
Director of Research Operations

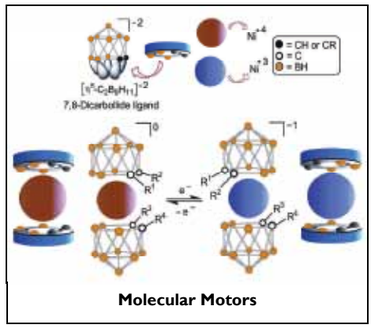
Alexander Safronov, Ph.D.
Research Assistant Professor

Lalit Goswami, Ph.D.
Research Assistant Professor

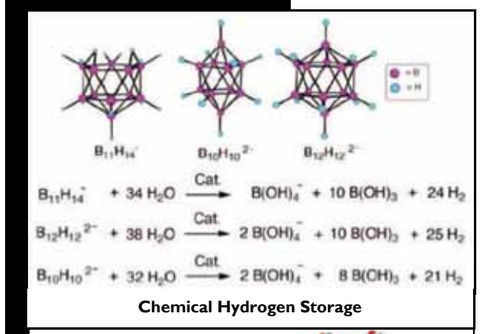
Yulia Sevryugina, Ph.D.
Research Assistant Professor

Lixin Ma, Ph.D.
Assistant Professor

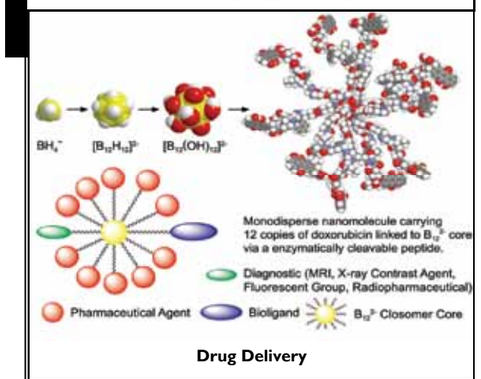
- Development of nano-sized molecular motors with biomedical applications.
- Development of catabolism-resistant pharmaceuticals based on carborane surrogate chemistry.
- Design, synthesis and characterization of new, high-energy materials for energy storage in structural units ranging from nano dimensional to macroscale.



Molecular Motors

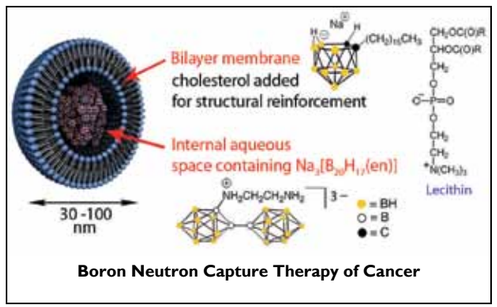


Chemical Hydrogen Storage



Drug Delivery

- Development of advanced chemical storage systems for hydrogen storage based upon nanotechnology and hydride chemistry.



Boron Neutron Capture Therapy of Cancer

- First demonstration of the proof-of-principle for boron neutron capture therapy of cancer, arthritis and radiation mediated surgery (BNCT).
- Discrete molecular (monodisperse) nanoparticles which carry multiple copies of, or a combination of, diagnostic and therapeutic agents for cell-specific delivery to malignant cells.

1514 RESEARCH PARK DR. COLUMBIA MO 65211 573-882-7016 WWW.NANOMED.MISSOURI.EDU

The University of Missouri Research Reactor Center (MURR®)

MURR®
www.murr.missouri.edu

The University of Missouri Research Reactor Center (MURR®) is a multi-disciplinary research, development and education center operated by the University of Missouri in Columbia (MU). At the heart of the MURR Center is its reactor, the premier university research reactor in the United States. This 10 megawatt, 150+ hour per week, light water-moderated reactor is versatile and compact in design, allowing multiple irradiations and experiments virtually around the clock. Because of the depth of technical expertise and adherence to safety and quality, the MURR Center is markedly reliable, able to provide a broad spectrum of high caliber irradiation services, radiochemical products and analytical services to a global research, education and industrial community.

The MURR Center has a four-fold mission of ***promoting basic and applied research*** in neutron-related science and engineering; ***providing educational opportunities*** for students in these fields; ***providing irradiation production and analytical services*** for public and private consumers; and ***promoting economic development***. The breadth and quality of the research programs and the range of facilities and equipment are comparable to those found in the US national laboratories. The scientific programs at MURR span a wide spectrum of research disciplines and techniques in the broad categories of **Life Sciences**, **Social Sciences**, **Materials Science** and **Engineering**, the majority having strong ties within MU and with other academic, national and industrial research laboratories. A sampling of R&D programs involve nanotechnologies, materials analyses, nuclear battery development, semiconductors, biomembranes, environmental analyses, epidemiology, boron neutron capture therapy and international databases having applications in archaeology, anthropology and geology.

MURR's broad capabilities and ***proven partnering success*** in nurturing projects from ***inception to application*** creates a culture for ***ongoing technology transfer***

MURR's reliable operating schedule—6½ days per week, 52 weeks per year—is unparalleled in the world. Couple this operating reliability with custom facilities and instrumentation and expertise in R&D, processing and regulatory compliance, MURR routinely provides research and commercial isotopes to a global community, and in some cases is the nation's sole provider of products and services that directly result in treatments to cancer patients. In recent years MURR built from scratch an FDA-compliant GMP (Good Manufacturing Practices) program that encompasses quality systems, infrastructure, staff and expertise to bring pharmaceutical grade radiochemicals, drug products and analyses to its growing roster of products and services. The 16 MeV cyclotron housed at MURR (co-owned with and operated by Essential Isotopes, LLC) produces a complementary set of positron-emitting isotopes for research and patient applications.

Interdisciplinary Center on Aging
University of Missouri

The MU Interdisciplinary Center on Aging is committed to addressing the needs of the rapidly growing older adult population.

Our mission is to enhance the health and well-being of elders through research, practice and leadership in education.

Our vision is to be a recognized source for expertise in aging issues.

Our values include collaboration, scholarship, integrity, compassion and respect.

Our Center Fellows include 98 MU faculty members conducting research, teaching, and practicing in the field of aging. Over 40 Center Fellows are principal investigators on aging research and training grants totaling over $40 million during the last four years. The Center conducts monthly seminars on aging and sponsors an interdisciplinary small grants program to help advance the research of junior faculty members and graduate students. We have created aging-related courses have been created and gathered others in the curriculum with a goal of offering a Certificate in Aging Studies. Through notices, conferences, publications and collaborations with community agencies, The Center helps translate a comprehensive body of knowledge, expertise and scholarship to improve the lives of older Americans.

NSEI provides research in critical fields such as nuclear energy, chemical, biological and nuclear sensors, nano particle production, applications and safety, direct energy conversion, environmental remediation and nuclear fuel cycle. Economic development opportunities are created through the institute's technology transfer of the intellectual property developed in the high quality research program.

The Nuclear Engineering Program at University of Missouri was officially established in 1964 and conferred its first Master of Science degree in that same year. The program has flourished since then with faculty and alumni achieving high national and international distinctions. The program forms the core of the Nuclear Science and Engineering Institute that was formally established in 2002. The Nuclear Engineering Program was ranked number one (1) in the nation for faculty scholarly productivity in 2007 by the Academic Analytic Associates as reported in the Chronicle of Higher Education.

The Center does over $3 million in research annually that have led to intellectual property for technologies such as nuclear batteries, cutting-edge sensors and photodiodes.

UNIVERSITY of MISSOURI
OFFICE OF RESEARCH

Faculty scientists and scholars at the University of Missouri have again attained impressive gains in funding support levels during the previous fiscal year, an achievement that highlights the increasing value, both intellectual and economic, of the University's research enterprise.

As I have said many times, the wealth of original thinking and discovery found at our nation's research institutions provide abundant returns to our national economy: In tough times we need more, not less, support for the scientists, scholars and students whose innovative thinking will play a crucial role in leading America's return to prosperity.

I'm happy to report that here at MU our faculty researchers have been fully engaged in leveraging federal, state and private support to advance the economic and intellectual future of our state and nation. Among the scores of noteworthy projects and achievements recorded since our last annual research report, we've seen:

• Two competitively won grants totaling more than $14 million from the National Institute of Food and Agriculture, part of the US Department of Agriculture, awarded to research teams led by the University of Missouri and Texas A&M University. The teams will develop methodologies to breed cattle that more efficiently utilize feed, and that are more resistant to Bovine Respiratory Disease, or BRD. Farmers and feedlot owners spend millions every year feeding some cattle that grow inefficiently, leading to increased greenhouse gas emissions and greater demands for feedstuffs. BRD leads to significant economic losses and reduced animal well being.

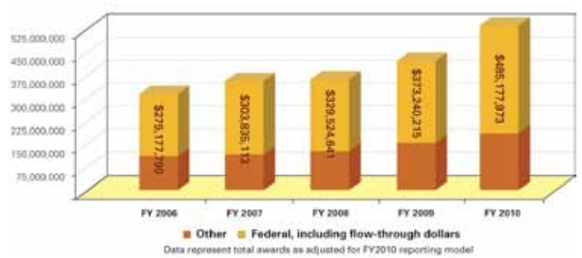
• The selection by the Wallace H. Coulter Foundation of MU as one of four universities to receive a $3.4 million Translational Partnership Award. The award, when coupled with MU matching funds, will provide close to $5 million over five years to support translational research and commercialization of technologies developed by MU's bioengineering faculty and their clinical partners. These technologies will advance the prospects of bioengineering-based businesses and will improve health care for us all.

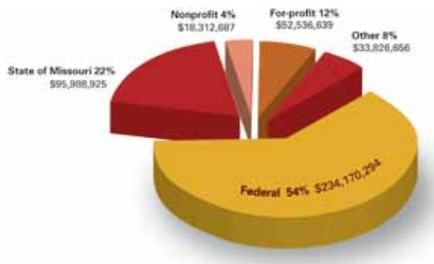
• More than $11 million in highly competitive NIH funding awarded to researchers at the Dalton Cardiovascular Research Center. This funding includes more than $8 million to study how changes in blood pressure affect the health of our circulatory system by affecting the architecture of our blood vessels, and almost $3 million to study how the nervous system influences cardio-pulmonary processes. These projects are further evidence that the Dalton Center has established itself as one of the world's top cardio-vascular research centers.

• A $6.6 million grant from the National Science Foundation to an MU research team studying genes that control the movement of carbohydrates in corn. This research may lead to increased yield, more droughtresistant plants, larger plants and easier production of biofuels.

These important projects are not the only recent developments that members of the University community, and all Missourians, can point to with pride. MU Chancellor Brady J. Deaton, for example, was this spring selected by President Barack Obama to chair the Board for International Food and Agricultural Development, a key federal administrative post that Deaton will fill while continuing as chancellor at MU. The board, Deaton explains, draws on the scientific knowledge and capacity of U.S. higher education institutions, especially those with land-grant missions, "to make a difference in the well-being of the neediest people of the world." In addition, the National Academy of Sciences recently announced the election of James Birchler, Curators' Professor of Biological Sciences at MU, as a new member. Birchler will be inducted into the organization, one of the world's most prestigious honorary societies for scientists and engineers, next April during its annual meeting in Washington, D.C. Such milestones are welcome reminders that in FY 2010, a year characterized by continued economic uncertainty, MU faculty scientists and scholars remained committed to ensuring that today's quest for knowledge leads us toward a better, more prosperous tomorrow.

Dr. Robert V. Duncan
Vice Chancellor for Research





Office of Technology Management and Industry Relations

The Office of Technology Management and Industry Relations (OTMIR) works to identify, assess, protect and market commercially viable intellectual property developed at the University of Missouri. The office files for intellectual property protection with US and foreign patent and trademark offices and negotiates all intellectual property agreements. In addition, OTMIR facilitates industry relations by negotiation and execution of material transfer and non-disclosure agreements as well as assisting with the negotiation of intellectual property provisions in industry sponsored research contracts. Our goal is to produce income for the University and the inventor, as well as to enhance industrial relations, leading to regional economic development.

DIRECTOR Christopher M. Fender, MS, 340 Bond Life Sciences Center, 573-884-8296, FenderC@missouri.edu

Mr. Fender has an MS in Plant Sciences from MU and has been involved with technology transfer at MU since 2002 and in the role as Director of OTMIR since 2008. The office has reorganized to better serve the needs of a diverse and productive research organization like MU. In addition to an experienced central administrative staff, the office contains three Intellectual Property Licensing Units (IPLUs) strategically embedded within the colleges and research centers that generate the majority of invention disclosures on the MU campus. Each of these IPLUs are staffed with personnel of high scientific, business and legal expertise. The OTMIR team has been able to expand on the considerable expertise that previously existed through the addition of several new associates. Collectively, the office is now able to draw on a wide array of experience from both industry and academia. With technological expertise in agronomy, biological and chemical engineering, reproductive physiology, cell and molecular biology, as well as many aspects of pharmaceutical research, the OTMIR team is highly capable of providing effective analysis of the patentability and market potential of the cutting edge innovations developed at MU. Bringing that expertise together with 'real world' business acumen, OTMIR is effective in structuring deals that provide the optimal vehicle for successful commercialization of technology.

ADMINISTRATIVE STAFF, 340 Bond Life Sciences Center. The staff receives invention disclosures and works with inventors to collect all necessary documentation, dockets patent actions, manages financial records, and provides general support to the OTMIR team. The staff handles all NDAs and MTAs, 259 and 215, respectively, in FY2010.

3 INTELLECTUAL PROPERTY AND LICENSING UNITS (IPLUS) are strategically located in close proximity to the faculty within their area of expertise. The IPLUS work with inventors to analyze their inventions for novelty, intellectual property protection, market potential, and to identify commercialization strategies. 73 disclosures were received by the IPLUs in FY2010, 38 licenses and options were executed, and more than $9.5M in revenue was generated for MU.

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The University Center for Innovation and Entrepreneurship

A partnership of MU Extension and the MU College of Engineering

www.missouribusiness.net

The Missouri Small Business and Technology Development Centers assist entrepreneurs with pre-venture, start-up or existing business issues including financial management, marketing, technology, product development and commercialization.

The program's objectives are to:

- Provide entrepreneurial technical assistance to businesses and researchers
- Help entrepreneurs create companies, jobs, investments and profits
- Help researchers and technology entrepreneurs attract research dollars, including Small Business Innovation Research and Small Business Technology Transfer awards.
- Assist businesses in winning government contracts.
- Provide technology and economic value to businesses in Missouri via university faculty by facilitating knowledge transfer between faculty and businesses.

The MO SBTDC offers University expertise to help start, grow or reposition companies. That expertise may take the form of University faculty addressing a problem within a client business, a business management counselor assessing an operation to provide suggestions for improvement, an entrepreneurial expert helping acquire financing to execute a client's business plan or continue research, a procurement specialist aiding an entrepreneur in selling goods and services to the government or a student team taking on a special project to address a specific need. Through the MoFAST program, business specialists help businesses and researchers seek out, apply for and win government Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) awards that will provide money to develop and potentially commercialize innovations. The Missouri Procurement Technical Assistance Center (MO PTAC), a partnership with the Defense Logistics Agency, which is dedicated to helping entrepreneurs obtain government contracts.

Education and Training: The MO SBTDC, MO PTAC and MoFAST programs offer a variety of training and educational programs on a wide range of business topics. Each office is equipped to present programs that meet specific needs within its community.

IMPACT – FISCAL YEAR 2010

- $1.19 billion in total economic impact
- Sales increases totaling $515 million
- Investments totaling $204 million
- 16,143 jobs created or retained
- Procurement awards totaling $274.8 million
- 265 new business started

Location: W1026 Lafferre Hall, Columbia, MO 65211, http://www.missouribusiness.net/UCIE/

Sponsors

PLATINUM SPONSOR

THOMPSON COBURN LLP

For more than 80 years, ***Thompson Coburn LLP*** has provided the high-caliber legal services and counsel our clients need to realize their most critical business goals. The firm represents clients universities, major research institutions, large and small biotech companies, privately and publicly held businesses in every industrial and corporate sector, including life sciences, energy, banking, transportation, manufacturing and communications. Now, with more than 350 lawyers and 35 practice areas, Thompson Coburn continues to serve clients throughout the United States and beyond.

GOLD SPONSOR

SENNIGER POWERS

Senniger Powers LLP is an intellectual property law firm based in St. Louis that practices in all facets of patents, trademarks, copyrights and complex litigation. With most of its attorneys being engineers or scientists with advanced degrees and far-reaching experience in a variety of technical fields, Senniger Powers is the largest IP firm in the state of Missouri, and one of the largest in the Midwest. The firm represents and provides insightful counsel to clients across the country, from Fortune 500 companies to small start-ups, allowing them to achieve a competitive advantage through strategic management and enforcement of their IP portfolios. For more information, visit www.senniger.com.

ORGANIZATIONAL SPONSORS

The Office of Technology Management and Industry Relations (OTMIR) works to identify, assess, protect and market commercially viable intellectual property developed at The University of Missouri. The OTMIR evaluates new technologies, obtains patent protection where needed, identifies licensees and negotiates all intellectual property agreements.
Website: http://tmir.missouri.edu/index.html

The University Center for Innovation and Entrepreneurship (UCIE) houses a wide variety of entrepreneurial and economic development resources together in one easy-to-access location UCIE achieves its objectives through three predominant programs:

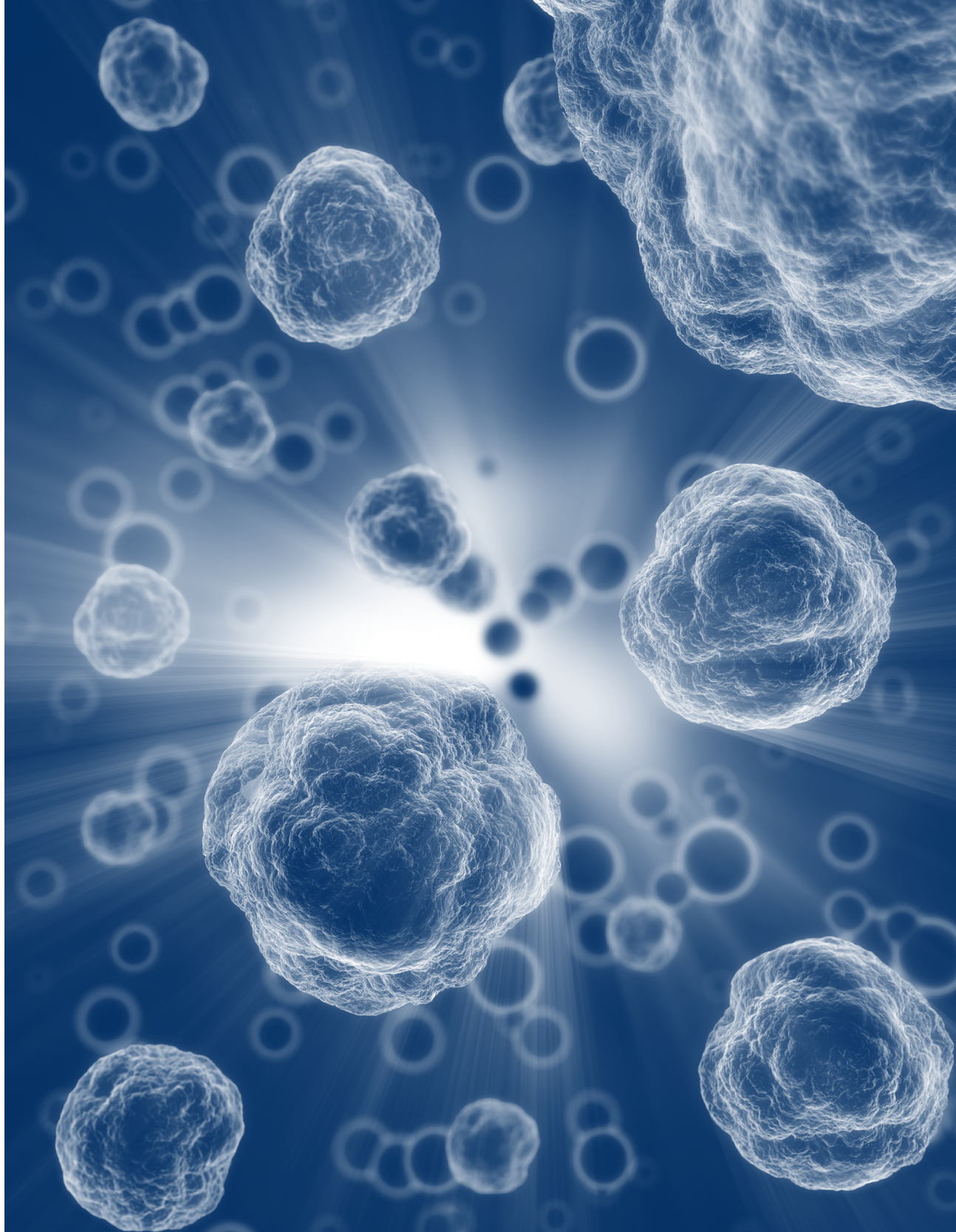
- Missouri Small Business and Technology Development Center (MO SBTDC)
- Missouri Procurement Technical Assistance Center (MO PTAC)
- MoFAST SBIR/STTR program and technology development and commercialization assistance

MO SBTDC is a statewide network of business experts uniquely qualified to help businesses develop and thrive. Every MO SBTDC location provides Missouri small businesses convenient access to this network.

MO SBTDCs offer:

- Topnotch business consulting and counseling services and access to technology resources.
- Training seminars and educational programs on a variety of business topics such as strategic planning, technology development, management, HR, marketing, financial analysis, taxes customer service, business plan development and starting a business.
- Technology commercialization special assistance needed by science and engineering oriented companies. Our special technology program encourages and enhances technology R&D, technology transfer and deployment, providing services for those interested in seeking SBIR/STTR funding

Impact: In fiscal year 2010, MO SBTDC staff successfully assisted business clients, resulting in 16,143 jobs created or retained and $515 million in increased sales.

MU's Office of Research exists to foster an academic environment in which MU's research, instruction, service, and economic development missions are permeated by the joy and rigor of original discovery, creativity, innovation and scholarship. Office of Research performs several functions which includes overseeing research compliance relating to federal, state, and local regulations regarding sponsored projects, as well issues relating to the use of human subjects or animals in research; providing proposal submission and award management and proposal preparation services; managing internal funds to invest in seeding research; and protecting, managing, marketing and commercializing MU's intellectual property. Furthermore, Office of Research actively promotes the value and outcomes of MU's amazing array of research in many ways, including several publications, such as the award-winning research magazine Illumination.

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