



# Missouri Technology Expo 2010

October 7, 2010 • Christopher S. Bond Life Sciences Center • University of Missouri Campus • Columbia, MO

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University of Missouri

presents

## MISSOURI TECHNOLOGY EXPO 2010

Thursday, October 7, 2010

Christopher S. Bond Life Sciences Center

1201 Rollins, Columbia MO 65211

# “SHOW-ME”

Technology today, propelling the innovations of tomorrow

*Join us in celebrating discoveries, inventions and innovations in the State of Missouri.*

<http://muconf.missouri.edu/MTE2010>

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## WELCOME FROM VICE CHANCELLOR OF RESEARCH DR. ROBERT V. DUNCAN



It is my pleasure to welcome you to the University of Missouri for the 2010 Missouri Technology Expo. We at MU were awarded over \$570M in academic contracts and grants last year alone, which is quite a testament to our outstanding faculty and students at MU. Many of these awards support basic 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 and all of the institution's 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.

We perform several functions to meet these objectives. These include 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, 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.

A handwritten signature in black ink that reads "Robert V. Duncan". The signature is written in a cursive, flowing style.

**Robert Duncan**

Vice Chancellor for Research

## WELCOME FROM DIRECTOR OF OTMIR CHRISTOPHER FENDER



Welcome to the first ever Missouri Technology Expo!

We have been planning this event for more than a year, and are truly excited to be a part of what we hope will become an annual event that is one of the highlights of your business development calendar. We created this event to promote the interface between the important discoveries of academia and the industries that commercialize those discoveries. Our collective roles 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 that 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 a keynote presentation by Stephen Padgette, Vice-President for Biotechnology at Monsanto. Monsanto has achieved great success as a corporation through a focused effort on the global commercialization of technology. His experience and insight will provide attendees a prime example of how to effectively commercialize innovation.

The Missouri Technology Expo is designed to be very interactive. We will have poster displays of technologies available for licensing from a broad range of academic disciplines. Inventors and technology transfer staff from various universities will be on hand to answer questions and engage in discussions that will hopefully stimulate collaborations for research and technology development leading to commercialization. There will be formal presentations on more advanced technologies as well as 'elevator pitch' presentations on early stage inventions. Additionally, there will be informative panel discussions for those interested in intellectual property protection or wishing to accelerate technology development through a start-up company.

The MU Office of Technology Management and Industry Relations (OTMIR) is excited to co-host this event with the Office of Research, the University Center for Innovation and Entrepreneurship (UCIE), and the Columbia Regional Economic Development, Inc. (REDI). REDI will host and moderate two plenary sessions designed to showcase the resources available in Columbia and Missouri that exist for starting a business as well as a session that highlights a variety of entrepreneurs who have successfully launched their own firms.

The day will conclude 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 that 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.

A handwritten signature in black ink that reads "Christopher M. Fender".

**Chris Fender**

Director OTMIR

**KEYNOTE SPEAKER: DR. STEPHEN R. PADGETTE – VICE PRESIDENT, MONSANTO**

Dr. Steve Padgette is currently the Vice President for Biotechnology in the Technology Sector of Monsanto, with responsibility for the worldwide discovery and development of plant biotechnology products.

After obtaining his B.S. and Ph.D. in Chemistry from the Georgia Institute of Technology, Steve joined Monsanto in 1984, focusing on the development of enzymes and genes to confer glyphosate tolerance to crop plants. Steve is co-inventor of Roundup Ready® technology, the most widely-used crop biotechnology trait in history. He assumed technical project responsibility for glyphosate-tolerant soybean, canola, and cotton in 1989, and led the regulatory science safety studies for these products starting in 1991. Following several years of research in plant metabolic engineering and co-leadership of the Soybean Business Team, he assumed his current role in 1998. During Steve's tenure, Monsanto Biotechnology has strengthened its industry-leading position in the discovery and development of crop biotechnology traits. Steve also has responsibility for Monsanto's external collaboration and alliance strategy for biotechnology and genomics. Steve received his MBA from the Kellogg School of Management of Northwestern University in 2007.

Steve is a member of the Board of Directors of Mendel Biotechnology. He serves as a member of the External Advisory Board, Georgia Institute of Technology, Institute for Bioengineering and Bioscience, is a member of the Technological Innovation: Generating Economic Results (TI:GER) Advisory Board, Georgia Institute of Technology College of Management, and is a member of The Department of Energy's Biological and Environmental Research Advisory Committee. He served on the St. Louis Science Center Board of Trustees and is currently serving as a member of its Science and Leadership Committee. Steve is also a Monsanto Distinguished Science Fellow. Steve and his family reside in St. Louis, Missouri.



## PROGRAM

## MORNING SESSION

- 7:00-8:00 am **Poster Setup** (*McQuinn Atrium*)
- 8:00-9:00 am **Welcome Speech** – Chancellor Brady Deaton  
**Keynote Lecture** – Stephen Padgette, VP of Biotechnology, Monsanto  
*(Monsanto Auditorium)*
- 9:00-10:30 am **Company Presentations:** Technologies that have resulted in the establishment of companies seeking research collaboration and/or investment  
6 presentations - 15 minutes each (*Monsanto Auditorium*)
- 10:30-10:45 am **Coffee Break**
- 10:45-11:45 am **Elevator Pitch Presentations - Engineering** (*Monsanto Auditorium*)
- 10:45-11:45 am **From Conception to Corporation – It’s an idea, is it an invention?** (*Room 572*)  
*Moderator:* Harriet F. Francis; *Panelists:* Charles P. Romano, Dennis A. Bennett, Julie Scott.
- 11:45-1:00 pm **Lunch** (*McQuinn Atrium*)  
**Mizzou Advantage** – Brian Foster  
**Enterprise Investment Program** – Michael Nichols

## AFTERNOON SESSION

- 1:00-2:00 pm **Elevator Pitch Presentations - Life Sciences** (*Monsanto Auditorium*)
- 1:00-2:00 pm **From Conception to Corporation – Getting Off Square One** (*Room 572*)  
*(Moderator:* Paul Hippenmeyer; *Panelists:* Matt Volkert, Jim Gann, Jake Halliday)
- 2:00-3:00 pm **Elevator Pitch Presentations – Biomedical Sciences** (*Monsanto Auditorium*)
- 2:00-3:00 pm **From Conception to Corporation – Accelerate to Commercialization** (*Room 572*)  
*Moderator:* Wayne McDaniel; *Panelists:* Greg Scheller, Andrew Beverly, Brian Clevenger
- 3:00-3:30 pm **Coffee Break**
- 3:30-4:30 pm **REDI Program: Entrepreneurial know-how** (*Monsanto Auditorium*)  
*Moderator:* Vicki Russell; *Panelists:* Jimmy Winkelmann, Kat Cunningham, Brant Bukowsky, Tariq Shah
- 4:30-5:30 pm **REDI Program: There is help for people like you** (*Monsanto Auditorium*)  
*Moderator:* Mike Brooks; *Panelists:* Raina Knox, Jake Halliday, Mike Crist, Stan Gerling

## EVENING SESSION

- 5:30-8:00 pm **Networking Reception** (*McQuinn Atrium*)
- 6:00-6:15 pm **Closing Remarks** – REDI, CLIMB, Office of Research (*McQuinn Atrium*)

Break out rooms are available from 10.00 am – 3.00 pm upon reservation for one-on-one meetings.



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Organovo, Inc. is a regenerative medicine company founded on patent pending technology developed at University of Missouri. We are focused on delivering breakthrough three dimensional biology capabilities to create tissue on demand for research and surgical applications. The NovoGen Bioprinting technology has been demonstrated to reproducibly produce small 3D biological constructs of complex architecture from cellular building blocks, including tissues without polymer scaffold, that successfully persist *in vivo*. As the first company with a three-dimensional tissue technology that works across tissue types, Organovo is meeting the promise of regenerative medicine to fill unmet medical needs.



**Keith Murphy, Chief Executive Officer and President,** has 16 years of experience in biotechnology. He is a veteran of biotechnology startup Alkermes, Inc, where he played a central role in product development.

He served 10 years at Amgen, including four years as Global Operations Leader for the largest development program in Amgen's history, Phase 3 osteoporosis/bone cancer drug denosumab



**Gabor Forgacs, Scientific Founder** is the George H. Vineyard Professor of Biological Physics at the University of Missouri. He developed Organovo's breakthrough organ printing technology while leading a team of

top regenerative medicine scientists from multiple universities, with the backing of a \$5M National Science Foundation Grant.

# VeraPulse

Early detection and monitoring of metastatic tumor cells

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 1201 E Rollins Road  
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 Phone: 573-884-2862  
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## OVERVIEW

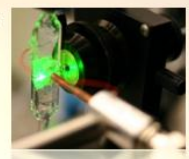
VeraPulse, LLC is dedicated to the detection and treatment of cancer. Our products are based on novel and proprietary technology developed at University of Missouri. This technology allows us to detect and isolate with high efficiency circulating tumor cells in the blood, as an early indicator of metastatic cancer. Early detection of the spreading cancer and efficient monitoring of cancer is critical for optimizing the patient's treatment regime and saving the life of the cancer patient.

## TECHNOLOGY

Our patent pending photoacoustic technology allows us to identify cancer cells by detecting laser induced ultrasound. A newly developed, patent pending flow cell allows us to isolate the identified cells for further analysis.

## PRODUCTS

Our first products, the MelaScan System and Test Kit, are aimed at detecting metastatic melanoma cells. A pilot study involving samples from Stage IV melanoma patients is underway.



## FOUNDERS



**John A. Viator, PhD,** Associate Professor of Biological Engineering and Dermatology, University of Missouri



**Paul S. Dale, MD,** Professor of Clinical Surgery and Chief of the Surgical Oncology Division, Ellis Fischel Cancer Center, University of Missouri Health Care

# NANOS Technologies

# NEMS/MEMS WORKS

[www.nemsmems.org](http://www.nemsmems.org)

NANOS Technologies, LLC and NEMS/MEMS WORKS, LLC are Engineering and Material Science companies that specialize in manipulating materials at the atomic level. Both companies synthesize nanostructured materials such as dye-doped nanoparticles, nanofilms, nanorods, and nanowires for life sciences, energy and defense applications

NEMS/MEMS WORKS is the world's leading developer of high surface area CuO nanorods and nanoenergetics. Due to our leadership in the field, we have received \$10M from DoD for the development of military applications. However, our patented and exclusively licensed nanoenergetics technology is so precise that we can use these atomic explosives for much more, such as catalysts for chemical reactions, guidance of projectiles and satellites, and in medical products like drug delivery and cell transfection devices.



**Founder, President & CEO**  
**Keshab Gangopadhyay:** Research professor of Electrical and Computer Engineering, adjunct professor of Nuclear Science and Engineering Institute, University of Missouri. Tel: 573.356.9459



**Founder, Chief Technology Specialist (CTO)**  
**Shubhra Gangopadhyay:** C.W. LaPierre Endowed Chair Professor Electrical and Computer Engineering Department, Co-Director of the MU International Center for Nano/Micro Systems and Nanotechnology, University of Missouri

[www.nanostechnologies.com](http://www.nanostechnologies.com)

NANOS Technologies focuses on patent pending coating technologies and has an exclusive license to develop organosilicate nanoparticles and nanoparticle films for a variety of applications. For example, by incorporating fluorescent dye into the organosilicate nanoparticles and functionalizing the nanoparticle surface for biological labeling, the coating can be used to indicate the presence of specific biological agents.



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 St. Louis, MO 63104  
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Advanced Spectroscopic Technologies, LLC (AST), is focused on enhancing the instrumentation sensitivity of optical spectrophotometers. AST's products are based on the work of researchers at the University of Missouri-St. Louis who developed a unique and novel technology. Our technology increases the sensitivity of optical spectrophotometers by one hundred fold, allowing for measurements of substances at a much lower concentrations than ever before possible. AST technologies will dramatically enhance detection in Fourier Transform Infrared Spectrophotometry and Process Analytical Technology markets. Further opportunities exist with additional detector types including; UV-Visible, Atomic Absorption, Circular Dichroism, High Performance Liquid Chromatography and Capillary Electrophoresis.

### Technology

Our patented technology provides greatly enhanced sensitivity which allows for testing on samples of much lower concentration, thus bringing spectrophotometry into new markets not possible with current instrumentation. This technology enhancement can be easily retrofit into current devices and implemented into newly manufactured devices at very cost effective rates.

### Applications

- Inline Detection & Monitoring of Production Processes & Reactions
- Analysis of Chemical & Biological Samples
- Identifying levels of nutritional components
- Identifying levels of foreign materials
- Identifying levels of raw materials
- Verifying Semiconductor purity
- Medical & Academic Research and Applications

### The Team

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 University of Missouri, St. Louis



**David W. Larsen, Ph.D.**  
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**Wayne Garver**  
 Research Scientist  
 Department of Physics  
 University of Missouri, St. Louis



### The Incubation Factory

A "Commercialization Agent" for leading Technology Transfer Organizations, National Laboratories And Research Institutions worldwide. The Incubation Factory removes the "art of the start" by utilizing structured, proven processes that result in **faster time to market, lower commercialization risk and high returns.**



- Trace Analysis; Contamination Detection, Impurities Analysis, Elemental/Molecular Analysis, Regulatory Compliance, Surface Analysis, etc.
  - Testing of Air, Water and Soil Quality
  - Food/Agricultural Products
  - Manufactured Consumer Products
  - Pharmaceuticals, and more
  - Materials
  - Crude Oil
  - Colorimetry





**CARDIALEN, INC** is developing low-energy internal cardioversion therapy with a primary focus on atrial fibrillation (AF) and a secondary focus on ventricular fibrillation (VF). In each condition, its goal is to restore normal sinus rhythm using

internal cardioversion, without pain or trauma to the patient. Cardialen has an exclusive global license to low-energy technology developed by Igor Efimov, PhD, jointly from Washington University in St. Louis (WUSTL) and Case Western Reserve University. Based on virtual electrode polarization (VEP) and unpinning theories developed by Efimov et al and subsequent in vitro and in vivo data, including data, from the company's most recent acute canine studies, we first propose a novel atrial defibrillator system, which can safely deliver low-voltage multiple pulse shock waveforms for effective, pain-free internal cardioversion. Initially financed in July 2009, the company completed acute studies in a vagally-mediated canine AF model in February 2010, achieving defibrillation thresholds (DFTs) of 0.1 Joule (J) using a new multi-stage therapy for which it filed additional patent claims in May 2010. Cardialen and WUSTL are now conducting chronic AF studies and will shortly complete VF trials in an infarcted canine model. The company completed second financing round in August 2010 and anticipates a Phase I SBIR/ NIH grant in December 2010. It seeks further financing of up to \$600K by end 2010 for preparatory work on first-in-human acute safety, efficacy and pain studies planned for mid-2011. In strategic alliances with industry partners, Cardialen will then progressively develop implantable low-energy implantable devices incorporating pacing and conventional VF backup, conduct preclinical and clinical studies, obtain required regulatory approvals and proceed to global commercialization.



## Nanoparticle Biochem, Inc.

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### NBI FOUNDERS



**Henry W. White, PhD**  
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**Anandhi Upendran, PhD**  
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**Kattesh V. Katti, PhD**, Curator's  
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Director Cancer Nanotechnology  
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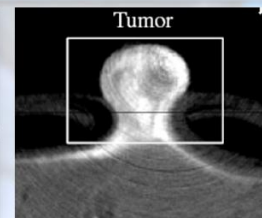
**Raghuraman Kannan, PhD**  
Assistant Professor of Radiology  
Co-Director Nanoparticle Production  
Core Facility, University of Missouri

**Nanoparticle BioChem, Inc. (NBI)** was started in 2004 as the first University of Missouri spin off company with a focus on research and product development relating to applications of nanotechnology to human health and hygiene. NBI has made significant progress in developing over 150 different types of nanoconstructs, has won several extramural grants from NCI/NIH including a Phase II clinical trial contract, and in 2009, NBI was recognized by the State of Missouri as a 'Rising Star'.

➤ **NANOPARTICLES:** Standard and custom gold, palladium, silver and "green" nanoparticles

➤ **NANOMEDICINE:** NBI-29, cancer therapeutic currently undergoing animal testing and that will soon enter Phase I clinical trials

➤ **ANTIMICROBIALS:** Nanoparticle-based products with superior efficacy, able to penetrate biofilm and kill *Staphylococcus*, black mold, and agents of bioterrorism



*Tumor imaged with gold nanoparticles*

## ENGINEERING ABSTRACT INDEX

- MULTI-MODE NANOTHERMITE THRUSTERS WITH TUNABLE IMPULSE
- ALUMINUM NITRIDE VACUUM ULTRAVIOLET PHOTODIODE
- SICON NANOCOMPOSITE DIELECTRIC THIN FILM
- CONJUNCTIVAL SCANNING FOR BIOMETRIC IDENTIFICATION
- SOY BASED POLYOLS
- COMPACT SHOCK WAVE GENERATING DEVICE FOR DRUG DELIVERY
- NANOPOROUS, HIGH SURFACE AREA CARBON FOR GAS STORAGE
- CLOG FREE INKJET PRINTHEAD
- RADIOISOTOPE MICORBATTERY BASED ON LIQUID SEMICONDUCTORS
- HYBRID INTEGRATED THERMAL ELECTRIC AND EJECTOR ACTIVE COOLING SYSTEM
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- ORGANOSILICATE NANOPARTICLES AND ITS APPLICATIONS IN CHEM-BIOSENSORS, ELECTRONICS, MULTIFUNCTIONAL COATINGS AND TEXTILES
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- RESEARCH AND COMMERCIALIZATION FOR CONVERTING OILY BIOMASS INTO USABLE DRY PRODUCTS IN NON-OILY AND FREE-FLOWING FORM
- DIELECTRIC CONSTANT OF PARTICLES DETERMINED BY IMPEDANCE SPECTROSCOPY
- HIGHLY EFFICIENT WATER HEATER
- AN AFFORDABLE HYBRID AUTOMOTIVE TRANSMISSION
- RECRYSTALLIZED LASER DEPOSITED MATERIALS
- EXPLORING LOGIC FOUNDATIONS OF QUANTUM MECHANICS: LABORATORY EXPERIMENTS IN AN ELECTROMAGNETICALLY ISOLATED ENVIRONMENT

### MULTI-MODE NANOTHERMITE THRUSTERS WITH TUNABLE IMPULSE

Microthrusters have applications in projectile guidance systems, and micro-nano-satellite control. Thrusters are an integral part of a guidance system that includes orientation and trajectory sensors and target recognition components. The thrusters provide the actuation force to move the projectile.

Nanothermite composites containing metallic fuel and inorganic oxidizer have unique combustion properties that make them potentially useful for microthruster applications. The nanothermite formulation can be tuned to achieve specific impulse characteristics. Depending on the application of the thruster, nanothermite formulation and motor design can be chosen to meet the application requirements. If properly configured, the reaction can have a velocity of <3mm/s or >1000m/s. The efficiency of the thrusters is not drastically affected by the duration of reaction.

#### POTENTIAL AREAS OF APPLICATIONS:

- Projectile guidance
- Micro/Nano Satellite Guidance
- Micro-Robot Actuation

**PATENT STATUS:** Prototype tested and non-provisional application filed

**INVENTOR(S):** Shubhra Gangopadhyay, Ph.D.; Steven Apperson, Ph.D.; Keshab Gangopadhyay, Ph.D.; Rajagopalan Thiruvengadathan, Ph.D.; Andrey Bezmelnitsyn, Ph.D.

**CONTACT INFO:** Wayne McDaniel, Ph.D.; [McDanielWC@missouri.edu](mailto:McDanielWC@missouri.edu) ; 573-884-3302

**ALUMINIM NITRIDE VACUUM ULTRAVIOLET PHOTODIODE**

This invention teaches a method of creating a novel photodiode that will enable a significant improvement in data storage capacity over the Blu-Ray technology. More than 4x the amount of data could be held on a VUV storage disc as compared to a Blu-Ray disc, which could, for example, allow storing multiple movies on one disc.

III-V compound semiconductors have received much recent attention due to their many applications in electronics and optoelectronics, the highest profile application being Blu-Ray technology, which uses a gallium nitride semiconductor. Gallium nitride has a band-gap of 3.4 eV which produces photons in the blue spectrum and blue diodes have found significant commercial applications with new applications being developed all the time. The ultimate development of similar III-V UV diodes would be expected to have similar commercial applications.

This invention teaches thin film doping of aluminum nitride, which then has a larger band-gap than gallium nitride, and goes beyond the state of the art blue diodes by operating in the ultraviolet spectrum. This larger band-gap and shorter spectral range translate into a technology that has more than 4x the data storage capacity of Blu-Ray.

**POTENTIAL AREAS OF APPLICATIONS:**

- VUV photodiode
- High temperature electronics
- VUV photovoltaic cells for nuclear energy conversion

**PATENT STATUS:** Non provisional patent application on file

**INVENTOR(S):** Mark Prelas; Tushar Ghosh; Robert Tompson; Dabir Viswanath; Sudarshan Loyalka

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**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 5MV/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 APPLICATIONS:**

- High energy density capacitors
- Insulating layer for surgical tools, etc.
- Chemical- and etch-resistant coating
- Anti-reflection and anti-scratch coating for screens and lenses
- Coating used in extreme environments like high temperatures or radioactive environments

**PATENT STATUS:** Provisional or Non provisional patent application on file

**INVENTOR(S):** Shubhra Gangopadhyay; Keshab Gangopadhyay; Maruf Hossain

**CONTACT INFO:** Wayne McDaniel, Ph.D.; [McDanielWC@missouri.edu](mailto:McDanielWC@missouri.edu) ; 573-884-3302

**CONJUNCTIVAL SCANNING FOR BIOMETRIC IDENTIFICATION**

Researchers at UMKC have developed a biometric device which recognizes the physical characteristics of sclera veins which are visible through the conjunctival membrane in the human eye. The vascular structures of the conjunctiva and episclera are rich with specific details that are useful in identifying individuals. Unlike retinal scans, the vascular structures of the conjunctiva and episclera provide extensive and unique information that can be obtained from various and selected regions of the eye and processed to authenticate or identify individuals. The technology can work with less light, on non-compliant targets, and from much greater distances than currently employed methods. It can function as a stand-alone biometric or could be used in conjunction with existing ocular-based biometrics to achieve enhanced performance and spoof-proofing.

**POTENTIAL AREAS OF APPLICATIONS:**

- Airport /border security
- Law enforcement
- Casinos
- Private security

**PATENT STATUS:** U.S. Patent no. 7,327,860

**INVENTOR(S):** Reza Derakhshani; Arun Ross

**CONTACT INFO:** James Brazeal; [brazealj@umkc.edu](mailto:brazealj@umkc.edu) ; (816) 235-5091

**SOY BASED POLYOLS**

Commercialization of Natural Oil Polyols, or NOPs, began in the late '90s to satisfy demand for sustainable products. One of the largest applications of NOPs is for urethane foams, where both Ford and General Motors are sparking demand by implementing NOPs into seats and other automotive foam applications. Such foams are also being introduced in shoe soles, mattresses, furniture, and other foam applications. The chemistry incorporated to make these foams is still emerging, and researchers at the University of Missouri have developed novel high molecular weight polyols and efficient means of production.

An improved process for converting unsaturated vegetable oils into polyols is comprised of one or more of the following conversion mechanisms: i) bodying the vegetable oil to allow for increased hydroxyl equivalent weights, ii) partially oxidizing carbon-carbon  $\pi$ -bonds to attach reactive moieties such as epoxy or alcohol moieties, iii) reacting carbon-carbon  $\pi$ -bonds with monomers containing oxygen moieties, and iv) hydrolyzing ester bonds to replace ester moieties with alcohol moieties. A urethane foam recipe containing both alcohols and epoxies was particularly effective with the polyols of this invention. The useful molecules of this invention are not limited to polyols and applications generally include those applications where alcohols of carbon numbers greater than about 12 are applied. Additionally, two catalysts were identified to have significance.

**POTENTIAL AREAS OF APPLICATIONS:**

- Anything in the wide range of urethane applications, but particularly consumer products where sustainability of raw materials is desirable
- Insulation for appliances
- Cushions for furniture/vehicles

**PATENT STATUS:** Non-provisional patents pending

**INVENTOR(S):** Galen J. Suppes; Z. Lozada; A. Lubguban; Fu-hung Hsieh; Yuan-chan Tu; Pimphan Kiatsimkul

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**COMPACT SHOCK WAVE GENERATING DEVICE FOR DRUG DELIVERY**

Genetic Engineering and Biotechnology News reported that “the burgeoning markets that surround biopharmaceuticals, RNA interference screening, and stem cell research are limited by the lack of a silver bullet for successful gene transfer. Because stable transfection is hard to achieve in primary cell lines, this application continues to be an important untapped niche in the transfection market.”

Inventors developed a microdevice creating shock waves from the reaction of nanoenergetic materials of fuel and oxidizer in nanoscale. The shock waves then permeabilize target cells allowing delivery of genetic material into the cells. The characteristics of the shock wave that can be controlled include pulse intensity, and pulse duration. The tunability of the shock waves allows the device to be adapted for use in a wide range of applications. DNA and nanoparticle delivery have been demonstrated.

As compared to existing cell transfection products, this device achieves a significantly greater transfection success rate, significantly greater cell survival rate, and should cost less than most, if not all other methods. The invention was compared with commercially available chemical-based transfections (SiPort NeoFx, SiPort Amine, Lipofectamine 2000, Lipofectamine LTX, Transit LT1), and electroporation. The prototype of the invention produced transfection and survivability rates in excess of 99% while none of the existing transfection methods resulted in a rate greater than 10%, and the survivability of those transfected cells ranged from 0% to 80%.

This device has the potential to revolutionize cell transfection, as the shock waves are particularly good at making the cell membranes porous, while at the same time the shock waves are gentle and do not cause catastrophic damage during the transfection, so cells survive.

**POTENTIAL AREAS OF APPLICATIONS:**

- Cell Transfection
- Shockwave drug delivery for killing cancer cells
- Precision drug delivery of imaging particles
- Fragmentation of kidney stones
- Destruction of plaques

**PATENT STATUS:** Prototype tested and patent application 12/253,706 published

**INVENTOR(S):** Shubhra Gangopadhyay, Ph.D.; Steven Apperson, Ph.D.; Luis Polo-Parada, Ph.D.; Keshab Gangopadhyay, Ph.D.; Andrey Bezmelnitsyn, Ph.D.

**CONTACT INFO:** Wayne McDaniel, Ph.D.; [McDanielWC@missouri.edu](mailto:McDanielWC@missouri.edu) ; 573-884-3302

**NANOPOROUS, HIGH SURFACE AREA CARBON FOR GAS STORAGE**

This invention teaches a method of manufacturing carbon so that it adsorbs large amounts of gas at low pressures due to the high surface area and associated nanopores. For example, a full tank of this carbon can hold more than three times (3x) the amount of natural gas at 500 psig than an otherwise empty tank at the same pressure. The high surface area adsorbs gas molecules by the nature of surface attraction forces.

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 and only to reach the Department of Energy’s target of holding 150x storage capacity at 500 psig (this team actually achieved 180x). This invention also covers high pressure storage, where adsorption is slightly better than ordinary compression.

Because other gases adsorb onto activated carbon, this invention likely has many other applications in gaseous storage and it is made from an abundant and inexpensive source, corn cobs.

**POTENTIAL AREAS OF APPLICATIONS:**

- Natural gas or hydrogen powered vehicles
- Upstream oil operations or natural gas collection and shipping

- Miscellaneous smaller markets such as oxygen tanks and other gas tanks

**PATENT STATUS:** Non provisional patent application on file

**INVENTOR(S):** Peter Pfeifer; Galen Suppes; Parag Shah; Jacob Burress; Jeffrey Pobst

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#### **CLOG FREE INKJET PRINTHEAD**

This invention reports a novel technique for clog free inkjet printhead. The specially designed inkjet printhead prevents clogging problems in inkjet printers. The printhead does not have drying or solidifying problems and keeps printing fresh ink drops using a novel sealing mechanism. The manufacturing of current printhead designs can be modified to incorporate this mechanism. The mechanism does not require any “cleaning cycle” using strong signals, large amounts of ink and external forces, which can serious damage.

#### **POTENTIAL AREAS OF APPLICATIONS:**

- Inkjet printheads
- Other systems where orifice clogging of microfluidic systems is a problem such as droplet-on-demand technologies in drug discovery, genomics, and proteomics

**PATENT STATUS:** Non provisional patent application on file

**INVENTOR(S):** Jae Kwon, Ph.D.

**CONTACT INFO:** Wayne McDaniel, Ph.D.; [McDanielWC@missouri.edu](mailto:McDanielWC@missouri.edu) ; 573-884-3302

#### **RADIOISOTOPE MICORBATTERY BASED ON LIQUID SEMICONDUCTORS**

The solid state semiconductors in state of the art betavoltaic micro batteries result in poor coupling between the rectified junction and the semiconductor junction and degradation of the conversion device, which has been the major challenge of commercializing betavoltaic micro batteries. This invention reports a novel technique using liquid semiconductors for a microbattery based on MEMS technology. The specially designed microbattery is provided with high efficiency and a long life time.

#### **POTENTIAL AREAS OF APPLICATIONS:**

- Any field that requires a reliable small power source with a long life
- Particularly well suited for powering sensors in inaccessible environments
- Micro electro mechanical systems (MEMS) such as:
  - Thermal, magnetic and optical sensors and actuators
  - Micro chemical analysis systems
  - Wireless communication systems
  - Biomedical devices
  - Normal and extreme environments

**PATENT STATUS:** Non provisional patent application on file

**INVENTOR(S):** Jae W. Kwon; Tongtawee Wacharasin

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**HYBRID INTERGRATED THERMAL ELECTRIC AND EJECTOR ACTIVE COOLING SYTEM**

The current active thermal electric cooling system being used for electronic components or systems has a low coefficient of performance (COP) which directly limits the application. The invention is a hybrid of both thermal electric and ejector refrigeration systems which can significantly increase the COP of the active cooling system. And it has no moving parts and the effect of the temperature difference across the thermal electric cooling module on the system COP can be significantly reduced.

**POTENTIAL AREAS OF APPLICATIONS:**

- Electronic cooling
- Computer chip thermal management
- Laser cooling

**PATENT STATUS:** Provisional patent application on file

**INVENTOR(S):** Hongbin Ma; Peng Cheng; Joe Boswell

**CONTACT INFO:** Wayne McDaniel, Ph.D.; [McDanielWC@missouri.edu](mailto:McDanielWC@missouri.edu) ; 573-884-3302

**METHOD AND APPARATUS FOR PLANT DROUGHT STRESS MANAGEMENT**

Physiologically based drought stress evaluation is desirable for sustainable biomass production and irrigation, but effective measurements and technologies are lacking. The present invention provides a method and apparatus to measure water deficiency (drought) by the primary physiological function of water, electron donation in photosystem II (PSII). Delayed fluorescence (DF) is measured as an output variable of the PSII phototransduction system and its dependence on the availability of electron donors (water) is modeled and analyzed. This yields an effective and immediate method to define and measure water availability or, conversely, the water deficiency (drought stress) according to the PSII photoelectron generation efficiency. Water deficiency is determined by the deficit from the maximum photoelectron generation efficiency available.

**POTENTIAL AREAS OF APPLICATIONS:**

- Effective tool for irrigation optimization
- Plant drought research

**INVENTOR(S):** Jinglu Tan and Ya Guo

**CONTACT INFO:** Wayne McDaniel, Ph.D.; [McDanielWC@missouri.edu](mailto:McDanielWC@missouri.edu) ; 573-884-3302

**ORGANOSILICATE NANOPARTICLES AND ITS APPLICATIONS IN CHEM-BIOSENSORS, ELECTRONICS, MULTIFUNCTIONAL COATINGS AND TEXTILES**

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. Doping these nanoparticles with fluorescent dyes results in highly fluorescent, biocompatible, 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 with 94% of the initial fluorescence intensity retained than the constituent dyes under continuous excitation for 10 minutes. In contrast, under identical test conditions, individual dye molecules retained only 58% of the initial fluorescence demonstrating that these

nanoparticles have excellent utility in lifesciences research, forensics, chemical – biological sensors and biological imaging 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<sup>2</sup>/g) can be achieved on large area substrates. These unique materials can be readily interfaced with existing immunoassays in the form of inexpensive dip-stick assays for the sensitive detection of chemical and biological warfare agents or novel diagnostic strips for point of care applications. Our preliminary evaluation of these coatings 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.

OSNPs used as filler elements within sol-gel based coatings have been shown to greatly enhance their structural stability, flexibility and wear resistance. Crack-free coatings (with thicknesses exceeding 30 microns)/novel multifunctional electrospun fibers have been successfully achieved by employing OSNP fillers (up to 75% by weight) within sol-gel compositions.

**POTENTIAL AREAS OF APPLICATIONS:**

- Chemical Biological sensors
- Medical Diagnostics
- Multifunctional coatings
- Next generation Chemical-Biological protection textiles (Soldier technologies)

**PATENT STATUS:** Non provisional patent application on file

**INVENTOR(S):** Sangho Bok; Venumadhav Korampally; Luis Polo-Parada; Vamsi Mamidi; Keshab Gangopadhyay; William R. Folk; Purnendu K. Dasgupta and Shubhra Gangopadhyay

**CONTACT INFO:** Wayne McDaniel, Ph.D.; [McDanielWC@missouri.edu](mailto:McDanielWC@missouri.edu) ; 573-884-3302

**NEUTRON AND GAMMA RAY SPECTROSCOPIC DETECTION SYSTEM**

The Domestic Nuclear Detection Office's mission is to improve the nation's ability to detect unauthorized nuclear importation, and the office was allocated \$1.2 billion to accomplish its goal. The office has invested heavily in advanced spectroscopic portals, but these have turned out to have very low detection efficiencies despite the fact that they cost nearly \$400,000 a piece. However, the office continues to search for new technologies that adequately detect neutrons. This invention, developed at this premier nuclear engineering school with the largest research reactor in the country, proposes a novel solution for neutron detection.

Diamond based detection systems are becoming popular with the technological advances in CVD diamond film growth technologies. Within the past ten years, diamond film purities have reached levels that allow undoped diamond plates to be used as an intrinsic semiconductor. With this, several charged particle and ultra-violet detection systems have been developed, along with a few neutron detection systems. Neutron detection utilizing diamond use neutron absorption into carbon for fast neutron detection. However, the cross section for this detection mechanism is small and so these detection systems are limited in their active detection volume. If the volume of the diamond detection medium were increased, then this detection mechanism would become advantageous. Even more so, the elastic scattering cross section of neutrons from diamond is higher than that of neutron absorption and does not have a 5.7 MeV threshold. Therefore, by increasing the diamond detection volume, another avenue of detection and spectroscopic determination of neutron sources becomes available. There are two ways of doing this, through advancing the CVD growth technology limitations, or through innovation. Here, a plate



combination mechanism is proposed that allows the increase in the active detection volume while maintaining all other characteristics of single diamond plates.

**POTENTIAL AREAS OF APPLICATIONS:**

- Homeland Security (sea ports, airports, border crossings)
- Nuclear reactor design and management

**PATENT STATUS:** Provisional patent application to be filed

**INVENTOR(S):** Mark Prelas; Eric Lukosi

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**DESIGN and DEVELOPMENT of NANOENERGETIC MATERIALS with TUNABLE COMBUSTION CHARACTERISTICS**

In recent years, nanoengineered thermites with tunable and tailored characteristics have attracted a great deal of attention owing to their enormous potential as excellent reactive materials, green primers, and structural energetic materials etc. Nanothermites are typically composed of metal oxide (oxidizer) and metal (fuel) nanoparticles. A variety of nanostructured oxidizers such as  $\text{Fe}_2\text{O}_3$ ,  $\text{CuO}$ ,  $\text{Bi}_2\text{O}_3$  and  $\text{MoO}_3$  etc have been prepared in our laboratory. Various morphologies of oxidizers include nanorods, nanoparticles, and mesoporous structures exhibiting high surface area. Surfactant templating method has been developed for the synthesis of ammonium nitrate ( $\text{NH}_4\text{NO}_3$ ) nanoparticles with a size distribution of 10–100nm. The physical and the chemical properties such as morphology, surface area, purity, composition, crystal structure of these metal oxide nanostructures have been determined by a host of characterization tools. Among the nanothermites,  $\text{CuO}$  nanorods/ $\text{Al}$  nanoparticles exhibit the best combustion performance measured in terms of combustion wave speed of  $2600 \pm 100$  m/s and reactivity of  $11 \pm 1$  MPa/ $\mu\text{sec}$ . Nanothermites based on  $\text{CuO}$  nanorods/ $\text{Al}$  nanoparticles were then modified by mixing with polymers such as nitrocellulose (NC) and/or explosives such as ( $\text{NH}_4\text{NO}_3$ ) nanoparticles, RDX (micron and nano size) and CL20 and the reaction rates of these nanocomposites were determined. Among the polymers, nitrocellulose coating of nanothermites is very interesting. Both the NC and the Teflon coated  $\text{CuO}/\text{Al}$  based nanothermite systems exhibit the ability to generate shock waves during their fast combustion. The NC coating has shown tremendous potential to reduce the high sensitivity of nanothermites to electrostatic discharge (ESD), friction and impact. Experimentally measured combustion characteristics are found to correlate very well with the physical and chemical characteristics of metal oxide nanostructures. The developed technology in our lab demonstrates the potential to tune and tailor the combustion characteristics of nanothermites to the desired level by proper choice and combination of fuel and oxidizer materials, their dimensions, and the process of self-assembly with reduced sensitivity.

**POTENTIAL AREAS OF APPLICATIONS:**

- Microthrusters;
- Propellants;
- Propellant Initiators;
- Suitable Replacements for Lead and Sulfur based Primers;
- Shockwave drug delivery systems;

**PATENT STATUS:** Provisional and non-provisional application on file

**INVENTOR(S):** Rajagopalan Thiruvengadathan; Andrey Bezmelnitsyn; Steven Apperson; Clay Staley; Keshab Gangopadhyay; Shubhra Gangopadhyay

**CONTACT INFO:** Wayne McDaniel, Ph.D.; [McDanielWC@missouri.edu](mailto:McDanielWC@missouri.edu) ; 573-884-3302

## SMART ROCKS FOR INTEGRATED MONITORING AND MITIGATION OF BRIDGE SCOUR READY FOR TRIAGE

Scour is a process in which a fluid erodes material supporting a structure. When scour occurs near a bridge, the associated erosion can cause that bridge to collapse. Bridge collapses occur in hours or days. To prevent them, scour must be monitored and its mitigation strategy must be developed in real time. This invention introduces magnetic embodiments with sensors, a *smart rock system*, to tackle the grand challenge of scour monitoring and mitigation in *real time*. The smart rock system can facilitate an evaluation of the critical scour condition of bridges and reduce damage and loss of life from bridge failures caused by scour.

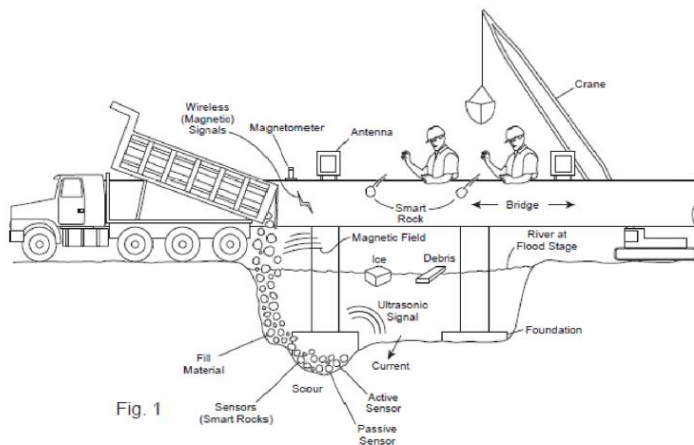


Fig. 1



### POTENTIAL AREAS OF APPLICATIONS:

- Applied for existing bridges
- Applied for new construction
- Tracking rocks that can also be used to stabilize bridge foundations.

**PATENT STATUS:** Provisional Patent Application Filed

**INVENTOR(S):** Genda Chen; David J. Pommerenke; Zhi Zhou; Ying Huang

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Eric Anderson; [ericwa@mst.edu](mailto:ericwa@mst.edu); 573-341-4551; Vera Anderson; [vera@mst.edu](mailto:vera@mst.edu); 573-341-7263

## RESEARCH AND COMMERCIALIZATION FOR CONVERTING OILY BIOMASS INTO USABLE DRY PRODUCTS IN NON-OILY AND FREE-FLOWING FORM

A major environmental problem in food, feed, and biodiesel industries is how to deal with their oily byproducts and wastes, which are in oily and viscous liquid form and easy to be rancid. There are many food, feed and biofuel processing plants in the US, which produce million tons of the oily byproducts and waste every year. The oily wastes are usually disposed onto or into land, which causes environmental pollution. Another way is to use heat and separate the wastes into low-value fat materials in paste form for feed applications. Unfortunately the process is not cost effective and does not cover the processing costs. Also the paste fat materials need to be heated into low-viscosity liquid before the applications, which need more energy to be used. Manufacturers prefer to dispose these wastes as a low cost method, which is not a long-term solution both practically and environmentally.

We have developed two novel encapsulated processes to encapsulate the non-polar materials in liquid and oily form and to convert into the dry fat products in non-oily and free-flowing form and to increase the number of applications for such as (1) fat energy products in solid form for dairy, pork, poultry and aquaculture feeds; (2) a binder for heating processes and (3) a stabilizer in plastic product production. The

fat products in solid form are easily handled, delivered and applied with significantly added value. If the proposed methodology is used for the industries to convert the oily wastes into the solid fat products, this would resolve above problem and add more than hundred millions/year. Our research and scale up were done. We filed patent applications after demonstrating the feasibility of the technologies. Then commercialization was done with related manufacturer and customers. Now our facility in MO produces the value-added product in dry non-oily and free-flowing form from the oily materials in liquid form for resolving the problems and economic development.

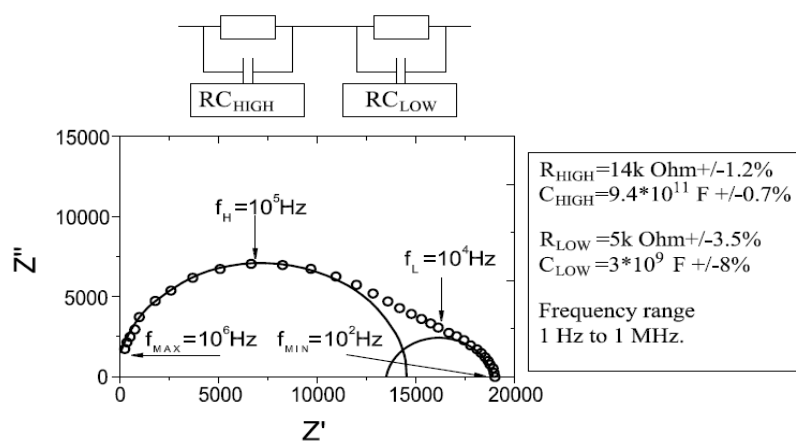
**INVENTOR(S):** John Lee; Rigel Technology Corporation, Lenexa, KS 66215.

**CONTACT INFO:** James Brazeal; [brazealj@umkc.edu](mailto:brazealj@umkc.edu); (816) 235-5091

### DIELECTRIC CONSTANT OF PARTICLES DETERMINED BY IMPEDANCE SPECTROSCOPY

A method of measuring the dielectric constant of a powder, including selecting a powder having an unknown first dielectric constant, selecting a liquid having a known second dielectric constant, and introducing a predetermined amount of powder into a predetermined volume of liquid to define a slurry characterized by a known volume fraction of powder. The impedance spectra of the slurry are plotted over a predetermined frequency range, the measured dielectric constant data is read and the appropriate equivalent circuit for the slurry is determined. Appropriate equivalent circuit equations are applied to the measured dielectric constant data and the first dielectric constant is calculated from the appropriate equivalent circuit equations, known volume fraction of powder and measured dielectric constant data.

*Graph of the calculated dielectric constant of SrTiO<sub>3</sub> particles as a function of increasing solid loading in butoxyethanol slurries according to the present novel technology.*



### POTENTIAL AREAS OF APPLICATIONS:

- Manufacturing of capacitor, microwave, packaging, multilayer co-fire, thin film, and high temperature dielectrics
- Bluetooth dielectric resonator antennae
- Dielectric research and development

**PATENT STATUS:** US Utility Patent Application Allowed

**INVENTOR(S):** Vladimir Petrovsky; Fatih Dogan

**CONTACT INFO:** Keith Strassner; [kdstrass@mst.edu](mailto:kdstrass@mst.edu); 573-341-6725

Eric Anderson; [ericwa@mst.edu](mailto:ericwa@mst.edu); 573-341-4551; Vera Anderson; [vera@mst.edu](mailto:vera@mst.edu); 573-341-7263

### HIGHLY EFFICIENT WATER HEATER

This technology is an improvement to the design of the conventional water heater resulting in faster hot water and more quantities of hot water provided to the user over the period of use. A smaller water heater may be utilized to provide a families hot water needs. This technology incorporates a thermosyphon concept which encloses a fraction of the heating surfaces and limits the large-scale mixing otherwise unavoidably produced by the heat addition process in conventional systems. With a suitably chosen flow restriction, the thermosyphon effect produces a flow of hot water from this internal small volume which does not immediately mix with the remaining stored volume but is instead transported to the upper levels of the storage vessel. The end result is that, during a discharge, the output from the overall system is the *sum* of both the stored volume *and* the hot water generated at the enclosed heating surface, giving a significant increase in total output. In addition, the system recovers quicker because the hot water generated at the heating surface is not dissipated by large scale mixing in the surrounding storage volume, as it is in the early stages of the charging process for conventional storage water heaters.

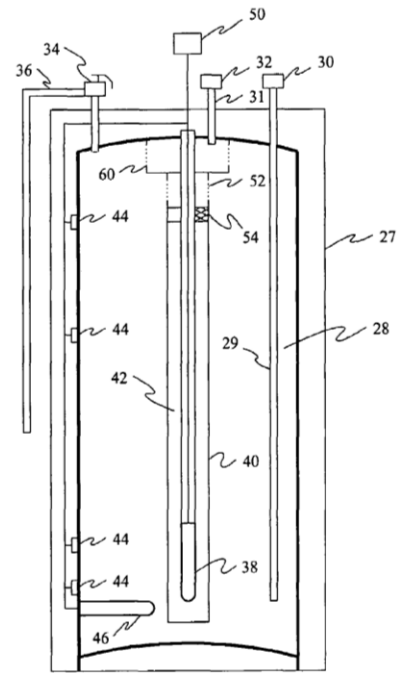


Figure 2 from 7,114,468

### POTENTIAL AREAS OF APPLICATIONS:

- Electric water heaters
- Gas water heaters
- Energy efficient water heaters

**PATENT STATUS:** US Utility Patent No. 7,114,468

**INVENTOR(S):** Kelly Homan

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Eric Anderson; [ericwa@mst.edu](mailto:ericwa@mst.edu); 573-341-4551; Vera Anderson; [vera@mst.edu](mailto:vera@mst.edu); 573-341-7263

### AN AFFORDABLE HYBRID AUTOMOTIVE TRANSMISSION

It is estimated that there are more than 70 automobile models on the road today that use hybrid transmission technology for improving the efficiency of automobile transportation. Most of these transmissions are of the electric hybrid type and are expensive to purchase, and costly to maintain. The original purchase price for a vehicle with an electric hybrid transmission is approximately \$8k more than a comparable vehicle without a hybrid transmission and the replacement cost for electric batteries is about \$3k every five to ten years with an associated disposal problem for the batteries themselves. This situation has resulted in hybrid vehicle technology being accessible to the few who are able to afford the vehicles and who normally consider themselves to be "energy buffs". By and large, hybrid vehicle technology has not been made accessible to the common automobile owner. This technology is aimed at developing a hybrid vehicle transmission that: 1) reduces the first time buying cost of the vehicle by thousands of dollars, and 2) eliminates the need for replacing expensive and environmentally dangerous batteries thus reducing maintenance costs. It so happens that this technology also eliminates conventional disc brakes that wear out and need replacement. Furthermore, this technology eliminates the reverse gear in the mechanical transmission path thus reducing the cost associated with designing and building this part of the mechanical transmission. This technology will rapidly expand the use of energy-efficient automotives as an

affordable hybrid-transmission will be made available for every consumer. With over 60 million vehicles produced every year worldwide this idea will have a tremendous impact on worldwide energy consumption and the environment.

#### POTENTIAL AREAS OF APPLICATIONS:

- Automotive

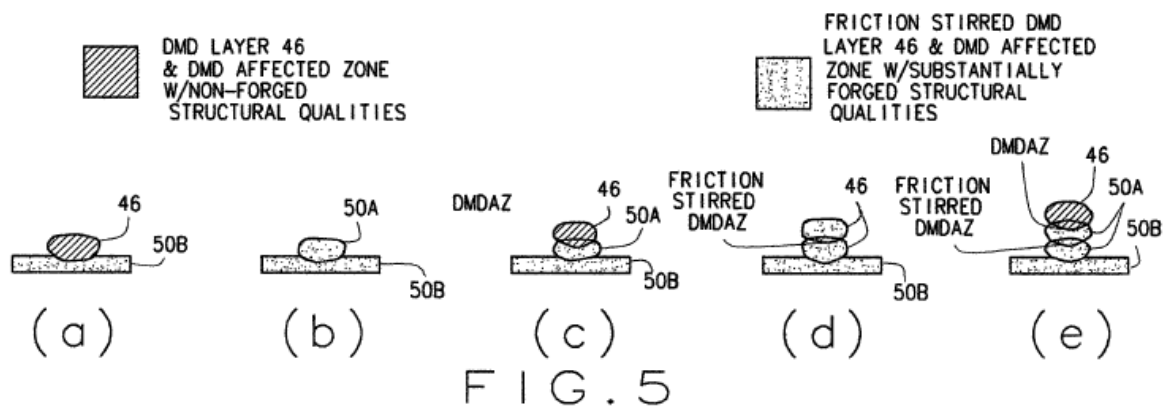
**PATENT STATUS:** Provisional Application on file

**INVENTOR(S):** Noah D.Manring; Junhee Cho

**CONTACT INFO:** Wayne McDaniel, Ph.D.; [McDanielWC@missouri.edu](mailto:McDanielWC@missouri.edu) ; 573-884-3302

#### RECRYSTALLIZED LASER DEPOSITED MATERIALS

This technology is a direct metal deposit with friction a friction stir process that results in a finished aggregated piece with comparable full structural quality to a wholly forged piece. This means that a broken part may be repaired with excellent bonding and strength or a piece may be constructed using rapid prototyping to result in a fully formed piece with completely bonded layers. The inventors showed a Ti-6Al-4V direct metal deposition layer could be formed with forged like characteristics.



#### POTENTIAL AREAS OF APPLICATIONS:

- Metal part repair
- Metal part fabrication
- Metal part design

**PATENT STATUS:** US Utility Patent Application No. 12/787,075

**INVENTOR(S):** Joseph Newkirk; Frank Liou; Romy Francis

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#### EXPLORING LOGIC FOUNDATIONS OF QUANTUM MECHANICS: LABORATORY EXPERIMENTS IN AN ELECTROMAGNETICALLY ISOLATED ENVIRONMENT

In 1995 research began on fabricating an electromagnetically isolated laboratory environment. In 2005 a scientific device called the Spheric Alignment Mechanism was patented. [1] The nested superconducting hemispheric device was designed to block electromagnetic fields from reaching its hollow interior. A 2008 survey was conducted with the assistance Donald P. Ames and Scientific Technical Network (STN). Initially the STN Data Base was searched for electromagnetic field measurement in superconductive sphere

volumes by sensors which did not generate an electromagnetic field; no references were found in the STN abstracts of 10,000 journals covering Chemistry, Engineering, Physics and US and foreign Patents. This search was repeated several times using different Data Base entries; again no references were located. Summary: STN Data Base does not list any papers in referred journals that report EM field measurements by non-EM generating sensors in volumes of spheres protected by superconductive Type 1, Type 2 or High Temperature materials. [2] In 2008 the ESD and EPS embodiments of the Spheric Alignment Mechanism were patented. [3]

By creating an closed superconducting and/or metamaterial shielded environment [4] it is anticipated that the electromagnetic fields will relax to their ground state thus transforming matter from spontaneous symmetry breaking to its less entangled, higher degrees of freedom for a information protomatter-like Higgs mechanism state.

A group of laboratory experiments will be conducted to probe the exact quantum mechanical nature of said controlled phase space. [5]

We anticipate the degrees of freedom for information, evidenced across transformational phase states, will move out from the Higgs Mechanism entangling to matter, into visible matter, and into antimatter [6] across an arrow of entropy where the amount of information constructing the Higgs mechanism not available to do work sets the boundary conditions for each state. When matter is shielded in the device, the Higgs mechanism will reestablish itself as low-energy, macroscopic, highly ordered, quantum mechanical superposition.

**PATENT STATUS:** [1] US Patent 7507916 - Spheric Alignment Mechanism ; [2] EMF MEASUREMENTS SUPERCONDUCTING SPHERE LITERATURE SURVEY, Stephen Burns Kessler & Donald P. Ames; [3] US Patent 7465886 Spheric Alignment Mechanism Entropic Step Down and Propulsion System; [4] Metamaterials Spheric Alignment Mechanism, patent pending, US2009/068602; [5] Experimental Propositions, Burns Kessler et al; [6] Scientists present a precision measurement of a subtle dance between matter and antimatter, <http://www.physorg.com/news63980736.html> paper at: [http://docs.lib.purdue.edu/physics\\_articles/853](http://docs.lib.purdue.edu/physics_articles/853)

**INVENTOR(S):** Stephen Burns Kessler

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- **RELATIVE STUDY BETWEEN ANTI-EGFR AND GE-11 PEPTIDE CONJUGATED GOLD NANOPARTICLES FOR *IN VIVO* TARGETING IN PANCREATIC CANCER**
- **LOW ENERGY IMPLANTABLE CARDIOVERTERS FOR ATRIAL FIBRILLATION AND VENTRICULAR TACHYCARDIA**
- **NOVEL MINI/MICRO-DYSTROPHIN GENES RESTORE NNOS TO THE SARCOLEMMA AND IMPROVE THE THERAPEUTIC OUTCOME FOR DUCHENNE MUSCULAR DYSTROPHY**
- **CLINICAL TRANSLATION OF A NOVEL CANCER NANOTHERAPEUTIC AGENT- BENCH TO BEDSIDE FROM A SMALL COMPANY PRESPECTIVE**

### **NOVEL COLLAGEN BASED SCAFFOLD TO PROMOTE TISSUE REGENERATION FOR COMMERCIAL APPLICATIONS**

Dermelle, LLC is actively pursuing commercialization of a novel collagen matrix having the following bio-histochemical characteristics: reduced native collagen enzymatic degradation, high fibroblast cellular interaction and high tissue in-growth. Their properties are believed to promote tissue regeneration. A

limitation of current injectable collagen soft tissue fillers is their short duration time and lack of cellular integration. By exploiting nanomaterial characteristics, Dermelle will improve upon current interventions for tissue reconstruction. A recent study measuring degradation of our novel collagen scaffold in comparison to a pure collagen control sample demonstrated a significant decrease in total collagen degradation of the novel collagen construct. In addition, a 13 day cell culture of the scaffold indicated a significant increase of DNA over the period of time in the novel collagen matrix, whereas the collagen alone demonstrated a decrease in DNA. Therefore, the treatment of the collagen with the nanomaterials may increase cellularity over time, thus initiate tissue regeneration.

This device has the primary application in the cosmetic market as an injectable dermal filler to reduce signs of aging. The base technology is also believed to be applied to urological, wound, orthopedic and cardiovascular applications. The innovation was developed by researchers at the University of Missouri-Columbia. A provisional patent has been filed; and an option has been executed by Dermelle, LLC. The main advantages of this innovation are a longer lasting product with better efficacy by decreasing degradation, promoting cell-collagen matrix adhesion and antioxidant/ antimicrobial properties.

**INVENTORS:** Rebecca J Rone; Anthony Harris; Sheila Grant

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#### **MEDSOCKET: A PERSONALIZED MEDICAL META-SEARCH ENGINE FOR QUESTIONS AT THE POINT OF CARE**

In the U.S., healthcare is a \$2.4 trillion industry, and health information technology costs exceed \$65 billion per year. Healthcare expenditures are currently at 17% of the U.S. Gross Domestic Product and are expected to rise to 20% by 2017. Improving the information available to physicians and streamlining the delivery of quality care can help stem rising healthcare costs. Through enormous investment in research, the needed information is often available but located in a variety of sources that are difficult and time consuming to use. Due to time constraints, physicians are rarely able to conduct online searches to sufficiently answer patient-specific, clinical or administrative questions at the point of care. Existing search engines don't fit the particular physician needs and preferences giving either too little or too much information.

MedSocket is an innovative and patent-pending search engine that implements an information retrieval system from a physician's point-of-view. Also accessible from mobile devices, it will provide convenient and useful access to medical information sources to answer all types of questions. MedSocket 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 will utilize the user's medical context, query different content sources (set by user), and deliver only results most relevant to the user. Allowing easy and instant access to current research results, MedSocket will speed the information delivery to the patient's bedside, which currently could take as long as 17 years. MedSocket has the capability to greatly improve care delivered by physicians and make a significant impact on the U.S. healthcare system.

#### **POTENTIAL AREAS OF APPLICATIONS:**

- Point of Care
- Medical Research

**PATENT STATUS:** Pending

**INVENTORS:** Karl Kochendorfer, MD, FAAFP [karl@medsocket.com](mailto:karl@medsocket.com) – MedSocket LLC

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**BREAST CANCER SCREENING AND MANAGEMENT USING NIPPLE ASPRATE FLUID ASSAY**

Early detection and diagnosis are critical to successful treatment of breast cancer. Currently available breast cancer screening tools such as mammography and breast examination miss up to 40% of early breast cancers, are least effective in detecting cancer in young women whose tumors are often more aggressive, and require that an invasive needle or surgical biopsy be performed when an area of suspicion is identified to confirm the presence of malignancy. Over a million surgical or needle breast biopsies will be performed this year to diagnose 203,000 new breast cancers. Using current techniques, women will undergo 5 diagnostic biopsies to diagnose each new cancer, and each biopsy is painful, invasive and expensive.

The current invention developed by researchers at the University of Missouri analyses nipple aspirate fluid (NAF) for predictive biomarkers of breast cancer. One such biomarker is the Thomsen-Friedenreich (TF) glycoantigen, which is over-expressed on the majority of breast cancer cells. NAF can be obtained non-invasively and contains a small number of cancer cells, but relatively high levels of proteins and lipids. We have developed and tested in a clinical study a simple and sensitive immuno-assay for identifying the cancer-associated TF and Tn biomarkers in NAF. Antigen detection and NAF collection are inexpensive procedures, involving commercially available reagents, insuring that the procedures could be rapidly translated to the clinic upon validation.

**POTENTIAL AREAS OF APPLICATIONS:**

- Screening for and managing breast cancer

**PATENT STATUS:** U.S. Patent Application No. 12/187,159

**INVENTOR(S ):** Thomas P. Quinn; Susan L. Deutscher; Ed Sauter

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**NANTIVIRAL COMPOUNDS FOR IMPROVED TREATMENT OF EYE INFECTIONS**

Infections with the herpes simplex virus can lead to severe corneal scarring and opacity. The currently available therapy for HSV keratitis involves the use of a 1% trifluorothymidine(TFT) solution. However, one of the major problems associated with TFT therapy is cytotoxicity, which restricts its use in long-term treatment. Due to problems associated with the use of ointments in the eye, acyclovir (ACV) ointment has not been approved for clinical use in HSV keratitis patients in the United States. In addition, ACV ointment is not effective against stromal keratitis or when the deeper ocular tissues are involved, suggesting that ACV has poor permeation characteristics across the corneal epithelium. The corneal epithelium is composed of 5 to 6 layers of columnar epithelium with tight junctions, making paracellular diffusion across this epithelium minimal. Beneath the epithelial layer is the stroma, which contains more than 90% water, and hence presents a barrier to hydrophobic compounds.

UMKC researchers have developed esters with sufficient hydrophilicity to be formulated into pharmacologically active compositions, such as aqueous solutions (e.g., eye drops). Compounds of the invention can be effectively transported into the ocular tissues. Specifically, such compounds effectively reach the anterior segment and/or the vitreo-retinal segment when administered either topically or systemically. The compounds formulated have been shown to be effective against viral infections, particularly the herpes group of viruses (e.g., herpes simplex types 1 and 2, *varicella zoster virus* (VZV) and human cytomegalovirus (HCMV)).

The present compounds employ oligopeptide transporters for delivery to the deeper tissues of the cornea. Thus, the present compounds are effective in cases where the corneal stroma and underlying tissues have been infected. These compounds have shown excellent *in vitro* antiviral activity against HSV 1 in HFF cells and *in vivo* rabbit epithelial keratitis with no significant cytotoxicity.

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**PATENT STATUS:** U.S. Patent no. 7,553,812

**INVENTOR(S):** Ashim K. Mitra

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### **LATE OSTEOBLAST/EARLY OSTEOCYTE-LIKE CELL LINE FOR VISUALIZING COLLAGEN ASSEMBLY IN LIVING CELLS**

Immortal cell lines representing the late osteoblast/early osteocyte phenotype have been generated that stably express a collagen-GFP or collagen-mCherry fusion protein to fluorescently label type I collagen fibrils either red or green. These novel cell lines allow visualization of collagen fibril assembly in living cells over time, which is not possible with existing technologies. The only other approaches that have been used for monitoring collagen assembly in living cells include using fluorescently labeled antibodies to collagen or a fluorescently labeled recombinant bacterial protein that binds to collagen. These have the disadvantage over our new invention that they may potentially interfere with the protein function and that they only label a population of fibrils at one point in time, which can then be followed (i.e. they do not necessarily label new collagen as it is synthesized). The specificity of the bacterial binding protein for type I collagen as opposed to other collagens is unclear and neither of these probes can be used to follow intracellular steps in the collagen assembly pathway, as they do not cross the cell membrane. Therefore our collagen-GFP and collagen-mCherry probes represent a significant improvement over existing technologies.

#### **POTENTIAL AREAS OF APPLICATIONS:**

- Potential commercial applications of this invention include using these cell lines to screen for drugs that enhance collagen assembly and could therefore have potential as bone anabolic treatments for diseases such as osteoporosis. The cells can also be used to screen for drugs that inhibit collagen assembly and therefore have potential as treatments to prevent fibrosis, etc. The cells also have many potential uses in developing approaches for tissue engineering of bone tissues. For example, the cells can be seeded onto scaffolds and the assembly of collagen can be monitored in real time in the living cultures. Mineral deposition on collagen can be monitored simultaneously using vital dyes for calcium deposition. These cell lines may also have commercial application for looking at mechanisms of tissue destruction, such as degradation of matrix proteins by proteases, such as occurs during inflammation.

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**PATENT STATUS:** Provisional filed

**INVENTOR(S):** Lynda F. Bonewald; Stacey M. Woo

**CONTACT INFO:** James Brazeal; [brazealj@umkc.edu](mailto:brazealj@umkc.edu); (816) 235-5091

### **NANOMEDICINE APPROACH FOR SUSTAINED RELEASE DELIVERY OF AVASTIN: TREATMENT FOR PXE AND AMD**

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 of drugs. Avastin (Bevacizumab) is a humanized monoclonal antibody specifically targeting vascular endothelial growth factor (VEGF) that has found widespread use in inhibiting intraocular neovascularization manifested in macular degeneration and proliferative diabetic retinopathy. The conjugation of gold nanoparticles (AuNP) with Avastin (Av) yields AvAuNP nanoconjugates. Avastin conjugated gold nanoparticles (AvAuNP) can be used as therapeutic agents in the treatment of ophthalmic neovascular disorders, such as macular degeneration, PXE and proliferative diabetic retinopathy. 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. The design and development of AvAuNP conjugate would help in the initiation and completion of preclinical evaluations aimed at determining the ability to achieve long-term suppression of intraocular neovascularization in large animals.

**INVENTOR(S):** Ravi Shukla; Kavita K. Katti; Raghuraman Kannan; Dean Hainsworth and Kattesh V. Katti  
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#### **TREATMENT OF CARDIOVASCULAR RISK FACTORS, NITRIC OXIDE SYNTHESIS, AND C-REACTIVE PROTEIN USING A COMBINATION THERAPY OF VITAMINS AND FLAVANOIDS**

Researchers at the University of Missouri Kansas City have studied the synergistic effects of a novel combination of vitamins and flavanoids on cardiovascular risk factors, C-reactive protein levels, and nitric oxide production in the human body. Clinical trial results showed a marked decrease in the patients' serum nitric oxide and C-reactive protein levels. In addition, Hypercholesterolemic human subjects showed significant reductions in their lipid parameters (except for HDL cholesterol), and all subjects showed increases in total antioxidant status.

#### **POTENTIAL AREAS OF APPLICATIONS:**

- Use as a nutritional supplement

**INVENTOR(S):** Asaf A. Qureshi; Nilofer Qureshi; Christopher J. Papasian; Julia C. Reis; David C. Morrison  
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#### **NOVEL COMPOUNDS TO TREAT URINARY TRACT INFECTION**

Urinary tract infections (UTI) affect a large proportion of the population and account for significant morbidity and high medical costs. Uropathogenic *Escherichia coli* (UPEC) is responsible for up to 85% of infections and a large percentage of recurrent UTI are caused by the same strain of bacteria as the initial UTI despite the antibiotic regimen; the current gold standard. The annual UTI incidence rate is 12.1% in women and 3% among men. Recurrence rates are high with women having a 25% to 44% chance of developing a second episode within 6 months of the initial UTI. Treatment of UTI like other microbial infections is exacerbated by increasing antimicrobial resistance and there is a huge unmet need for alternative therapies. Novel patented compounds such as Pilicides and Mannosides disrupt pili biogenesis and host-pathogen interaction to effectively block disease progression.

#### **POTENTIAL AREAS OF APPLICATIONS:**

- Urinary tract Infections

**PATENT STATUS:** Pilicides: Issued Patents 7,411,066 B2, 7,041,465, and 6,495,539;  
Mannosides: provisional patent on file  
**INVENTOR(S):** Scott Hultgren; Fred Almqvist; Jim Janetka; Jerry Pinkner  
**CONTACT INFO:** Leena Prabhu, Ph.D. MBA; [lprabhu@wustl.edu](mailto:lprabhu@wustl.edu); (314)-747-1906

#### **TWO NOVEL BIOMARKERS FOR EARLY DIAGNOSIS OF RENAL CELL CARCINOMA**

Urinary aquaporin-I (AQP-1) and adipose differentiation-related protein (ADFP) as biomarkers of kidney cancer. This is a new process, applicable to humans, for 1) early and noninvasive detection of renal cancer, 2) population screening for renal cancer, 3) post-treatment surveillance for recurrence of renal cancer, 4) progression, regression or time-course of disease in untreated, partially treated, and definitively treated patients with renal cancer. The process is noninvasive, using readily available biological fluids such as urine and possibly blood. The proteins AQP-2 and ADFP are over-expressed in renal cancer tissue. These proteins may be shed into urine. The invention, per se, is a method (Western blot analysis or ELISA) for the sensitive detection and quantification of AQP-2 and ADFP in human urine, a readily available biological fluid, and the application of this assay for the detection and diagnosis of renal cancer, population screening for kidney cancer, surveillance for recurrence following or during treatment, and determining success of treatment and assessment of prognosis.

**POTENTIAL AREAS OF APPLICATIONS:**

- Oncology
- Markers

**PATENT STATUS:** Pending

**INVENTOR(S):** Evan Kharasch, MD, PhD

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**AN AUTOMATIC CAP ARRANGEMENT SCORING DEVICE**

Poor color vision can be inherited (an estimated 8% of men and .5% of women have a congenital color vision defect) or acquired as the result of disease, certain medications, trauma, aging, or exposure to particular chemicals and other environmental factors. Cap arrangement tests (e.g. Farnsworth-Munsell 100 Hue, Farnsworth D-15, L'Anthony D-15 Desaturated, etc.) are among the most valid and reliable color vision tests to quantify color deficits currently available. However, these tests, particularly the FM 100, are time consuming to score and are highly susceptible to transcription errors.

Researchers at the University of Missouri-St. Louis have developed the Automatic Cap Arrangement Scoring Device (ACASD) to significantly reduce testing time and improve measurement reliability of cap arrangement tests by electronically automating scoring and data entry. Once the patient places the caps in the test tray, the rest will be automatic -- scoring, data entry and printing of results. Upgrading existing cap arrangement devices is easy by transferring existing test papers to the new cap.

**POTENTIAL AREAS OF APPLICATIONS:**

- Standard cap arrangement color vision tests given not only by optometrists and ophthalmologists as part of a visual examination, but employers filling positions with color vision requirements
- Other applications where specific sequences of small items are necessary

**PATENT STATUS:** U.S. Patent Application No. 12/522,691

**INVENTOR(S):** Carl Bassi; Michael Howe; Wayne Garver

**CONTACT INFO:** Tamara Wilgers; [wilgerst@umsl.edu](mailto:wilgerst@umsl.edu); 314-516-6884

**CELL LINES FOR THE STUDY OF BONE FORMATION AND REGULATION**

UMKC Researchers have developed novel cell lines that are useful in the examination of osteocyte function, biomineralization, SOST/sclerostin, FGF23 and other mechanisms of osteoblast-to-osteocyte differentiation.

The two cell lines were isolated from long bone of a mouse that was generated by crossing the Immortomouse® with a mouse where the DMP1 promoter drives expression of the GFP. One of the cell lines, IDG-SW3 (SW3), expresses all of the markers of osteocytes including Dmp1-GFP, Dmp1, E11/gp38, SOST/sclerostin, and FGF23. The second cell line, IDG-TI (T1), mainly expresses the characteristics of the matrix producing osteoblast such as high alkaline phosphatase, with delayed expression of Dmp1-GFP and E11/gp38, but no expression of SOST/sclerostin or FGF23. Both cells will produce new bone *in vivo*.

#### POTENTIAL AREAS OF APPLICATIONS:

- To generate large numbers of osteocyte-like cells in order to produce sufficient quantities of osteocytes for study.
- To generate large numbers of cells of a homogeneous stage of osteogenic differentiation.
- To study osteocyte secretion of sclerostin, such as screening for sclerostin antagonists.
- To investigate regulation of FGF23 expression in osteocytes and the role of osteocytes in regulation blood calcium/phosphate homeostasis.
- To study the role of osteocytes as mechanosensory cells and their role in regulating bone response to mechanical stress.
- To screen potential new therapies to induce bone formation.
- To track cells responsible for bone formation *in vivo*.
- To identify additional osteocyte-selective markers and receptors.

**PATENT STATUS:** Provisional filed

**INVENTOR(S):** Lynda F. Bonewald; Stacey M. Woo

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#### Q3D: A DEVICE TO QUANTITATIVELY MEASURE VISUAL SUPPRESSION

Vision disorders are the 4th most prevalent class of disability in the United States and the most prevalent handicapping condition in childhood. Early detection of visual suppression increases the likelihood of effective treatment and decreases the negative impact of conditions such as amblyopia, which affects 2-3% of children and is the most common cause of monocular visual impairments in young and middle-aged adults. Researchers at the University of Missouri-St. Louis have developed the **Q3D (Quantitative Three Dot) Test**, a handheld device that quantitatively measures the amount of visual suppression in a patient. Able to detect very small impairments and changes in suppression, the Q3D can catch suppression earlier than current methods. Quantified measurement allows for tracking intervention progress over time.

#### POTENTIAL AREAS OF APPLICATIONS:

- Measuring the depth of suppression in conditions such as amblyopia
- Quantifying an afferent pupillary defect from optic nerve abnormalities
- Measuring the progress and outcome of treatments
- Screening for binocular function

**PATENT STATUS:** U.S. Patent No. 7,686,452 (issued 3/30/2010)

National stage applications filed in AU, CA, EPC, JP

**INVENTOR(S):** Carl Bassi; Michael Howe; Wayne Garver

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## NANOPORE-FACILITATED SINGLE MOLECULE DETECTION OF MICRO-RNAS

Developing new technologies for cancer screening and early diagnosis is a critical issue for saving cancer patients' lives. MicroRNAs (miRNAs) are a class of short (~18-24-nt) non-coding RNAs molecules that regulate gene expression at the post-transcriptional level. Aberrant expression of miRNAs has been found in all types of tumors. Thus miRNAs have been recognized as potential cancer biomarkers. Most notably, specific miRNAs are released from the primary tumor into blood circulation, making the detection of circulating miRNAs profile 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 of nanopore sensor has demonstrated the capability to discriminate single nucleotide difference between miRNAs (single nucleotide polymorphisms, SNPs). In clinical tests, the nanopore has shown the power to differentiate miRNA levels in blood from lung cancer patients and healthy people.

Due to the label-free single molecule detection without nucleic acids amplification, the nanopore sensor is higher selective, precise and accurate over the gold standard RT-PCR and microarray. This noninvasive clinical test requires a mere 5 ml of peripheral blood, with a reduced cost from several hundred dollars today to less than 20 dollars per sample. The developing nanopore array would give a high throughput capability for detecting miRNA profile. If validated in clinical trial, the nanopore sensor will become a system available to monitor cancer patients and to screen high risk populations for early diagnosis of cancers which will potentially save the lives of millions.

### POTENTIAL AREAS OF APPLICATIONS:

- Detection of microRNAs, study of DNA, RNA, DNA/RNA hybrid unzipping kinetics
- Study of miRNA mechanism and principle of regulation
- Drug discovery and development
- Biomarker characterization
- Diagnostics and prognostics.

**PATENT STATUS:** Provisional patent application on file

**INVENTOR(S):** Li-Qun Gu; Yong Wang; Michael Wang and Dali Zheng

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## TARGETED ANTISENSE RADIOTHERAPY

Cancer is the one of the leading causes of death worldwide. While huge strides have been made in the treatment of various cancers, there is still a critical need for effective therapeutics that only target and kill the cancer cells while not affecting other cells in the body.

The current invention developed by researchers at the University of Missouri is a novel agent for simultaneous, targeted gene and radiation therapy of blood cancers. The agent binds selectively to non-Hodgkin's lymphoma (NHL) cells and contains an antisense module that reduces the activity of a cancer gene to sensitize tumors to radiation. Simultaneously, the agent delivers radiation that is highly efficient at killing these sensitized cancer cells. Our invention is superior to conventional targeted radiotherapy because its two simultaneous mechanisms of action work together to ensure better cancer cell killing, potentially giving it more efficacy than existing approaches.

### POTENTIAL AREAS OF APPLICATIONS:

- Treatment of blood cancer
- Can be modified to treat other cancers

**PATENT STATUS:** Provisional patent application cover sheet on file - 10UMC069prov

**INVENTOR(S):** Michael Lewis; Ethan Balkin

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### **CORRECTING VISION PROBLEMS WITH A NOVEL TUNABLE LENS**

Correction of age-related optical changes in the eye, such as presbyopia, has been increasingly important. Researchers at the University of Missouri-St. Louis have conceived of a new and improved adaptive liquid crystal lens employing the hybrid diffractive lens structure. The inventive lens allows large aperture, high light efficiency, fast switching time, low driving voltage, power-failure-safe configuration, and continuous adjustment of the focusing power. The low-cost, electro-optic lenses will be continuously tunable and offer high optical performance for near, intermediate and distance vision. The invention also provides a new fabrication method for the inventive liquid crystal lens.

#### **POTENTIAL AREAS OF APPLICATIONS:**

- Adaptive eyeglasses with electro-optic lenses for correction of presbyopia and other vision issues
- Employment of the adaptive lens for rapid, high-resolution 3D biomedical microscopic imaging without mechanic scanning

**PATENT STATUS:** U.S. Patent Application No. 12/719,646; PCT application filed

**INVENTOR(S):** Guoqiang Li

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### **NON-INVASIVE BLOOD GLUCOSE DETECTOR**

Diabetes, a disease in which the body does not produce or properly use insulin, can lead to serious damage to many of the body's systems, including the nerves, blood vessels, eyes, kidneys and heart. It is also a leading cause of death in the United States; 7th most common cause in 2006 (CDC). It has been shown through two NIH studies\* over 22 years that tight control of blood glucose levels, requiring multiple glucose tests each day, significantly reduces the risk of eye disease (76%), kidney disease (50%), nerve disease (60%) and heart attack and stroke (57%). Current monitoring technology (glucometers) require drawing blood for each glucose level measurement, which is painful, expensive (up to \$800/year for supplies to complete recommended 4-5 measurements per day), and inconvenient (each test requires a new alcohol swab, lancet and test strip). As a result, most diabetics do not test as often as recommended by their doctors.

Researchers at UM-St. Louis have developed technology for a **non-invasive blood glucose detector**. The new portable optical device will allow for pain-free, inexpensive detection of glucose levels in capillaries of the finger with no waste (strips, lancets, etc.). Unlike other non-invasive monitors in development, this technology provides for detection in ~1 second based on a pulsatile approach, eliminating the potential problems of finger movement, temperature change, light power drift, and optical interference from finger components such as fat, muscle, bone, skin, nail and interstitial fluid.

#### **POTENTIAL AREAS OF APPLICATIONS:**

- Non-invasive detection of blood glucose in both Type 1 and Type 2 diabetics
- Non-invasive detection of additional blood analytes (cholesterol, hemoglobin, lactic acid)

**PATENT STATUS:** U.S. Patent Applications filed/published: US-2009-0105565 (published) US-2009-0247843 (published); US-2009-0079964 (published); US-2009-0292186 (published); US-2009-0116017 (published); 12/729,886 (filed); Five PCT applications filed; \*(1) *Diabetes Control and Complications Trial (DCCT), 1983-1993, 1441 people*; (2) *Epidemiology of Diabetes Interventions and Complications EDIC), 1993-2005, 93% of 1441 people in DCCT trial.*

**INVENTOR(S):** Zhi Xu

**CONTACT INFO:** Tamara Wilgers; [wilgerst@umsl.edu](mailto:wilgerst@umsl.edu); 314-516-6884

### NOVEL GENETIC RISK FACTOR FOR ALZHEIMER'S DISEASE PROGRESSION

Researchers at Washington University have identified a novel genetic variant that strongly correlates with disease progression. Alison Goate and collaborators used an established biomarker for the decline of AD patients (cerebrospinal fluid tau phosphorylated at threonine 181, ptau<sub>181</sub>) to find genetic variants that influence levels of ptau<sub>181</sub> in the cerebrospinal fluid. The study found a highly significant association between ptau<sub>181</sub> levels and the rs1868402 SNP located within a regulatory subunit of PPP3R1 (calcineurin B), a gene previously linked to AD pathogenesis. Carriers of the rs1868402 risk allele showed a 6-fold faster rate of disease progression than AD patients without the variant. In addition, individuals carrying allele rs1868402 and rs3785883, a second allele identified in the study, showed an even more pronounced rate of decline. Direct examination of brain samples from AD cases and controls revealed that rs1868402 is in fact associated with reduced PPP3R1 mRNA levels and increased tangle formation, providing biological validation for the genome-wide association study and further implicating PPP3R1 in disease pathology. rs1868402 showed no association with risk for AD or age at onset, but there was a very significant association with rate of progression of disease that is consistent in two independent series. As the first genetic variant associated with rate of AD progression to be reported, its use in clinical trial design and patient care will translate into a significant benefit to patients.

### POTENTIAL AREAS OF APPLICATIONS:

- Diagnostic for individuals with rapid decline in Alzheimer's disease
- New protein pathway for drug therapies for treating Alzheimer's disease progression

**PATENT STATUS:** Patent pending

**INVENTOR(S):** Carlos Cruchaga; Alison Goate; David Holtzman

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### ACCRUALMASTER: SOFTWARE FOR PLANNING AND MONITORING ACCRUAL RATES IN CLINICAL TRIALS

The most common reason why clinical trials fail is that they fall well below their goals for patient accrual. Researchers will frequently overpromise and underdeliver on the number of patients that they can recruit during the proposed time frame. The result is studies that take far longer than planned and/or that end with fewer patients than planned. This raises serious economic and ethical issues. We have developed a Bayesian model for accrual that will encourage careful planning of accrual rates as well as allow regular monitoring of accrual patterns during the conduct of the clinical trial. We have developed software in R that can show graphically the expected duration of the trial under initial planning estimates of accrual rates and that can adjust those accrual rates as the trial progresses by combining the actual accrual data with the prior beliefs of accrual. This software can be used by individual researchers, by Institution Review Boards during their continuing review of approved projects, and by Data Safety and Monitoring Boards during their interim analysis. We are working on extensions of the software to multi-center trials, to assessing the



impact of refusal rates and losses due to exclusion criteria, and to non-uniform accrual rates (e.g., accrual rates in a trial expected to have a slow startup period). We are looking for support and collaborators to make the software available on a R server computer using a simplified front-end interface, to test the software prospectively in a series of clinical trials, and to support research on the extensions to new and important areas.

**INVENTORS:** Stephen D. Simon, PhD; Byron Gajewski

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### **IMPROVED CARDIAC LEFT VENTRICLE IMAGING USING MULTIPARAMETRIC STRAIN ANALYSIS (MPS)**

This invention yields the most accurate and clinically useful predictor of myocardial viability – with no ionizing radiation or radioactive agents. The system is a software add-on to MRI systems that gives clear and clinically significant evaluations of left ventricle (LV) function. MPS uses p-vector finite element analysis to evaluate over 15,000 discrete points in the left ventricle in three axes; it compares the variance in the movement against a “normal” database to display variations from a standard deviation from normal. It compares the function of each of the points in the LV against a normal database.

The resulting images are unique in that LV function is quickly and clearly displayed. These pictures are, for clinicians and surgeons, clinically superior to existing imaging modalities. They are easily understood by the layperson. Further, where existing tests (PET, Thallium SPECT, CT) are expensive, invasive and add radiation, MPS is inexpensive and non-invasive with no radiation.

MPS is more accurate in regional, transmural viability determination. It quantitates what other modalities describe qualitatively.

### **POTENTIAL AREAS OF APPLICATIONS:**

- Agnostic to all existing MR machines
- Gives crystal clear and easily understood pictorial views of LV function
- Very inexpensive
- Added on to an already scheduled MR scan
- Displaces more expensive and less useful tests
- Strong IP position – US and foreign applications
- Three month adaptation time to commercial MR systems

**INVENTOR(S):** Michael Pasque, M.D.

**CONTACT INFO:** Ed Fickenschler; [Fickense@WUSTL.EDU](mailto:Fickense@WUSTL.EDU); (314)-497-4497

### **COMPOUNDS AND METHODS FOR OPTICAL IMAGING OF MYELOPEROXIDASE ACTIVITY IN VIVO**

The invention relates to novel diagnostic methods for functionally assessing the presence of myeloperoxidase (MPO) activity in living subjects, including model organisms, animals and humans. While MPO is central to normal host defense mechanisms, dysregulated MPO contributes to the pathogenesis of inflammatory disease states ranging from atherosclerosis to cancer. We show that upon systemic administration, the small molecule luminol and related analogues enable noninvasive, specific and highly sensitive bioluminescence imaging (BLI) of MPO activity in vivo. This can be used to assess the risk of a subject for development of a pathological condition associated with high levels of oxidative stress, in particular, cardiovascular disease. In addition, methods are described for monitoring the effectiveness of therapy in a subject, and for establishing a prognosis in a subject undergoing treatment for a condition such as a cardiac condition, using non-invasive imaging to assess MPO activity in vivo as a specific marker of oxidative stress and as an indicator of disease progression or inhibition thereof.

**POTENTIAL AREAS OF APPLICATIONS:**

- Cardiovascular
- Imaging

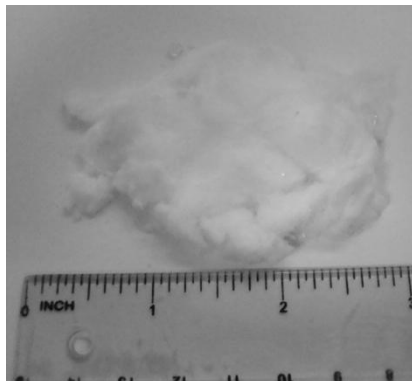
**PATENT STATUS:** Pending

**INVENTOR(S):** David Piwnica-Worms, MD, PhD

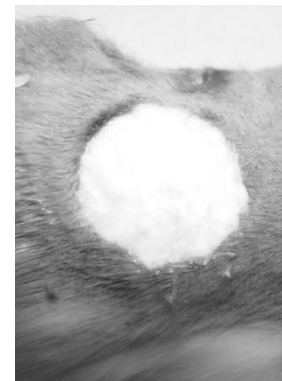
**CONTACT INFO:** Jon Kratochvil, Esq.; [kratochj@wustl.edu](mailto:kratochj@wustl.edu); (314) 747-0923

**WOUND CARE**

The invention can be used as a wound care material for treating both hard and soft tissues in mammals. Wounds such as diabetic ulcers or other open wounds can be covered with this bioactive and biodegradable material to form a temporary and resorbable barrier while providing useful materials to promote the wound healing process. This bioactive material can be made into a variety of shapes and forms for applications ranging from wound covering to implant fixation.



*Fiber mesh for wound care*



*Wound filled with mesh*

**POTENTIAL AREAS OF APPLICATIONS:**

- Flexible dressing for wound care management comprising a three-dimensional compressible body of loose glass-based fibers
- Can also be formed into rigid material for implantation
- Can be combined with other materials to promote healing
- Can be formulated as biocompatible surgical glue for closing a wound
- Material can be compounded to contain trace elements to promote bone, vessel and tissue growth

**PATENT STATUS:** US Patent Utility Application Filed

**INVENTOR(S):** Delbert Day, Steven Jung

**CONTACT INFO:** Keith Strassner [kdstrass@mst.edu](mailto:kdstrass@mst.edu); 573-341-6725

Eric Anderson; [ericwa@mst.edu](mailto:ericwa@mst.edu); 573-341-4551; Vera Anderson; [vera@mst.edu](mailto:vera@mst.edu); 573-341-7263

**RELATIVE STUDY BETWEEN ANTI-EGFR AND GE-11 PEPTIDE CONJUGATED GOLD NANOPARTICLES FOR *IN VIVO* TARGETING IN PANCREATIC CANCER**

Pancreatic cancer is the fourth leading cause of cancer related deaths in the United States due to its severe aggressiveness and lethal malignancy. Epidermal Growth Factor Receptor (EGFR) is over expressed in more than 95% of human pancreatic cancer patients. A number of peptides and monoclonal antibodies have been developed to target the EGFR in pancreatic cancer. Our research has focused on developing EGFR targeting biomolecule conjugated gold nanoparticles for the diagnosis and staging of various cancers. In this study, we have synthesized a series of Antibody EGFR and EGFR-peptide (GE-11) conjugated AuNPs. We investigated the *in vivo* EGFR targeting characteristics of these conjugates in pancreatic tumor bearing SCID mice models. Our investigation has provided evidence that the peptide conjugated AuNPs have high *in vivo* mobility and targets pancreatic tumor effectively. We have also established that the EGFR-peptide-

AuNP conjugates serve as better X-ray contrast agents for early detection of pancreatic cancer in mice models. The details of this comparative study will be presented in this poster.

**INVENTOR(S):** Nripen Chanda; Ajit Zambre; Ravi Shukla; Priyabrata Mukharjee; Debabrata Mukhopadhyay; Evan Boote; Raghuraman Kannan; Kattesh V. Katti

**CONTACT INFO:** Paul Hippenmeyer, Ph.D., M.B.A.; [hippenmeyerp@missouri.edu](mailto:hippenmeyerp@missouri.edu); (573)-882-0470

### **LOW ENERGY IMPLANTABLE CARDIOVERTERS FOR ATRIAL FIBRILLATION AND VENTRICULAR TACHYCARDIA**

Cardialen develops low-energy implantable cardioverter devices to treat cardiac arrhythmias. Its primary focus is on atrial fibrillation (AF); its secondary focus on ventricular fibrillation (VF). AF affects over 3 million people in the US and over 20 million worldwide. It doubles the risk of all cause mortality, significantly increases the risk of stroke and contributes to high healthcare costs. Cardialen will develop, test and commercialize its novel pain-free implantable atrial cardioverters independently, opening a new market segment in AF management. In the more established ICD market, it plans to commercialize its technology in industry partnerships.

Current AF therapies are described as having “limited long term success and significant risks.” With 50% refractory to long term drug therapy and with catheter ablation unable to meet the needs of growing patient numbers, pain-free internal cardioversion therapy will give physicians a new option. Since AF patients typically remain conscious in episodes, pain-free therapy is essential.

Cardialen holds an exclusive global joint license from Washington University and Case Western Reserve University to pain-free cardioversion technology developed by Igor Efimov, phd. The company is currently engaged in pre-clinical trials at Washington University School of Medicine.

Cardialen has closed on second round financing through the St. Louis Arch Angels, biogenerator and others to complete current studies and take it to Series A first-in-man studies.

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### **NOVEL MINI/MICRO-DYSTROPHIN GENES RESTORE NNOS TO THE SARCOLEMMA AND IMPROVE THE THERAPEUTIC OUTCOME FOR DUCHENNE MUSCULAR DYSTROPHY**

Duchenne muscular dystrophy (DMD) is a muscle disease caused by mutations of the dystrophin gene. Gene replacement therapy represents a very promising approach to cure this disease. The dystrophin gene is one of the largest genes in the genome and it exceeds the carrying capacity of adeno-associated viral vector (AAV) and lentiviral vector, the most powerful gene delivery vehicles for muscle. The truncated mini/micro-dystrophin genes have been developed to overcome this hurdle. Despite improvement of muscle function and the dystrophic phenotype by these mini/micro-dystrophin genes, none of them can restore sarcolemmal neuronal nitric oxide synthase (nNOS). Sarcolemmal nNOS plays a crucial role in maintaining blood perfusion during muscle contraction. In DMD patients, sarcolemmal nNOS is lost. Consequently, it leads to functional ischemia and muscle damage. To improve the therapeutic efficacy of the truncated dystrophin genes, one has to develop the new synthetic dystrophin genes with the ability to restore sarcolemmal nNOS.

The motif for nNOS sarcolemmal localization was identified and incorporated into new mini/micro-dystrophin genes. The effect of sarcolemmal nNOS restoration on the muscle functions, blood perfusion in contracting muscle and exercise performance was evaluated.

Dystrophin spectrin-like repeats 16 and 17 (R16/17) are required for sarcolemmal nNOS localization. The synthetic mini/micro-dystrophin genes carrying R16/17 significantly improved muscle function, blood

perfusion and exercise capacity. Our newly developed R16/17 mini/micro-dystrophin genes provide functions close to that of the full-length dystrophin gene. They represent excellent candidate genes for DMD gene therapy.

**INVENTOR(S):** Yue Y Lai Y and D. Duan

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Per Stromhaug, Ph.D., MBA; stromhaugpe@missouri.edu; 573.884.3553

### **CLINICAL TRANSLATION OF A NOVEL CANCER NANOTHERAPEUTIC AGENT- BENCH TO BEDSIDE FROM A SMALL COMPANY PERSPECTIVE**

Nanoparticles of gold are inherently multifunctional in their diagnostic and therapeutic capabilities.  $^{198}\text{Au}$ , provides a desirable beta energy emission and half-life for effective destruction of tumor cells/tissue ( $E_{\text{max}} = 0.96 \text{ MeV}$ ; half-life of 2.7 days). The range of the  $^{198}\text{Au}$   $\beta$ -particle is sufficiently long to provide cross-fire effects of radiation dose delivered to cells within the prostate gland and short enough to minimize significant radiation dose to critical tissues near the periphery of the capsule. In order to capitalize on the well known tumor affinity of gold nanoparticles to tumor vasculature, Nanoparticle Biochem Inc (NBI), has developed proprietary technology that allows efficient conversion of radioactive gold-198 to its corresponding therapeutic nanoparticles with subsequent stabilization via conjugation with Gum Arabic protein matrix. As part of the SBIR Phase I effort, Nanoparticle Biochem Inc (NBI) has successfully completed detailed therapeutic efficacy studies in prostate tumor bearing mice and toxicity studies of the non radioactive surrogate of NBI 29 in pigs. Intratumoral injection of NBI's proprietary gold nanoparticle based injectable agent:  $^{198}\text{AuNP-GA}$  (NBI-29), has unequivocally demonstrated that over 90% of the injected dose remains in the tumor over a 24 hour (and longer) time period and that the agent effectively shrinks and suppresses the growth of prostate tumors in mice to such levels that are not commonly observed with any chemo or radiotherapeutic agent (Katti, Kannan and others in *Nanomedicine* Volume 6, Issue 2, Pages 201-209 April 2010; featured article on the cover page in April 2010 issue). No toxic side effects were noted for over 40 days of studies in mice and for over 120 days investigation in pigs (using the non radioactive surrogate). Limited Phase I clinical trial studies in client owned dogs with naturally occurring prostate tumors, which mimic androgen independent prostate tumors in men, have already provided unequivocal evidence on the realistic clinical potential of NBI 29 as a new generation nanotherapeutic agent for treating inoperable solid tumors. In order to clinically translate the therapeutic potential of NBI 29 for treating prostate tumor human patients, Nanoparticle Biochem Inc has recently entered into a joint product development effort with Shasun Pharmaceutical Company of India. Shasun-NBI LLC will focus product development efforts aimed at completion of toxicity/therapeutic efficacy in dogs to allow filing of an IND application with the US FDA to commence Phase I clinical trials in human prostate cancer patients. Product development efforts, incorporating platform nanotechnology of Shasun-NBI LLC, as outlined above, will be carried out in collaboration with internationally reputed group of interdisciplinary scientists, consultants and cancer therapy experts within the University of Missouri and chosen from other locations with expertise in (i) therapeutic isotope production; (ii) nanotechnology as it relates to applications in nanomedicine; (iii) tumor biology (iii) radiation/clinical and surgical oncology; (iii) medical physics and dosimetry; (iv) veterinarians with strong comparative oncology track record; and (v) conducting Phase I-III clinical trials leading to final approval by the US FDA

Implications for prospective investors in terms of the potential of Shasun-NBI LLC's 'Platform Nanotechnology' for the development of sophisticated therapy agents for treating hepatocellular and pancreatic cancers will be presented

**INVENTOR(S):** Kattesh V. Katti, *et al*

**CONTACT INFO:** Paul Hippenmeyer, Ph.D., M.B.A.; hippenmeyerp@missouri.edu; (573)-882-0470

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## LIFE SCIENCES ABSTRACT INDEX

- **A SYSTEM OF EFFICIENT, COST-EFFECTIVE, AND CUSTOMIZABLE VACCINES FOR USE WITH MULTIPLE VACCINE CANDIDATES**
- **NEW INHIBITOR SUPPRESSES FOOT-AND-MOUTH DISEASE (FMD)**
- **A NANOTECHNOLOGY-BASED ELECTROCHEMICAL DNA SENSING APPARATUS AND METHOD**
- **HIGH-THROUGHPUT WORKFLOW FOR PROFILING CROP SEED ALLERGENS**
- **ENGINEERED MINICHROMOSOMES IN PLANTS**
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### **A SYSTEM OF EFFICIENT, COST-EFFECTIVE, AND CUSTOMIZABLE VACCINES FOR USE WITH MULTIPLE VACCINE CANDIDATES**

Most vaccines created today are costly to produce. In addition, the creation of new vaccines to combat emerging diseases such as novel influenza strains such as 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 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 APPLICATIONS:**

- Vaccine development and production

**PATENT STATUS:** U.S. Patent Application No. 12/391,060

**INVENTOR(S):** George C. Stewart; Brian M. Thompson

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**NEW INHIBITOR SUPPRESSES FOOT-AND-MOUTH DISEASE (FMD)**

Foot-and-mouth Disease Virus (FMDV) is a positive stranded picornavirus that can infect cloven-hoofed animals, such as cattle, pigs and sheep, and lead to severe losses in livestock production. The delay in eradication or control of FMD is associated with billions of dollars in potential economic losses. Although antiviral drugs can have immediate prophylactic and/or therapeutic effects, there is currently no approved anti-viral therapy available to treat ongoing infections with FMDV or to protect animals from FMDV infection. Thus, an anti-viral drug has a strong market potential in agricultural states.

The current invention developed by researchers at the University of Missouri is a small molecule that inhibits the RNA polymerase activity of the FMDV 3Dpol. The molecule has demonstrated the suppression of virus production in FMDV-infected cells and is a strong candidate for the development of alternatives or supplementary options to contain future outbreaks of Foot-and-Mouth Disease.

**POTENTIAL AREAS OF APPLICATIONS:**

- Prevention of Foot-and-Mouth Disease
- Treatment of Foot-and-Mouth Disease

**PATENT STATUS:** Patent application in preparation

**INVENTOR(S):** Stefan G Sarafianos; Ryan Durk; Elizabeth Rieder

**CONTACT INFO:** Harriet F. Francis, MS, JD; francish@missouri.edu; 573.884.0374

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**A NANOTECHNOLOGY-BASED ELECTROCHEMICAL DNA SENSING APPARATUS AND METHOD**

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 detection and identification of viruses, and 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 and it is advantageous due to its reusability, its increased detection speed, and its specificity.

**POTENTIAL AREAS OF APPLICATIONS:**

- Recognition of bacteria, viruses and protozoans 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:** Provisional US patent filed in March 2008 and PCT in March 2009

**INVENTOR(S):** Charles A. Carson; Qingsong Yu; Hao Li

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Per Stromhaug, Ph.D., MBA; stromhaugpe@missouri.edu; 573.884.3553

**HIGH-THROUGHPUT WORKFLOW FOR PROFILING CROP SEED ALLERGENS**

Plant seeds provide a significant portion of the protein present in the human diet, but are also the major contributors of allergenic proteins that cause a majority of the reported cases of food-induced anaphylaxis in the U.S. It is estimated that as many as 12 million Americans have food allergies, and there is a need for better methods for analytical screening of foods, or protein phenotyping, particularly for the seed industry.

The current invention developed by researchers at the University of Missouri is a high-throughput, inexpensive workflow for quantifying prominent plant seed proteins. This was done by developing a mass spectrometry-based workflow beginning with intact, whole plant seed. The method does not require gel electrophoresis, antibodies, chemical labeling or *a priori* information about the seed to be analyzed.

**POTENTIAL AREAS OF APPLICATIONS:**

- Seed Regulatory and Biotechnology Industry

**PATENT STATUS:** Patent Application filed.

**INVENTORS:** Severin Stevenson; Jay Thelen

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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 in the future using engineered plant minichromosomes. Artificial chromosome platforms in maize were produced by telomere-mediated truncation while simultaneously adding sequences that will permit amendments to the chromosome indefinitely. Such engineered minichromosomes have the potential to 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. The collection of transgenes on minichromosomes might be combined with haploid breeding techniques to facilitate their transfer among diverse lines of a crop. A toolkit of lines that will permit additions and subtractions of genes from engineered minichromosomes is being assembled. Because of the near universality of the telomere sequence in the plant kingdom, engineered minichromosomes should be able to be produced easily in most plant species by this technique.

**POTENTIAL AREAS OF APPLICATIONS:**

- Stack multiple transgenes on an independent chromosome with potentially no limit to number.
- Facilitate transfer of transgenes into different varieties of a crop species by combining them with haploid breeding procedures.

**PATENT STATUS:** U.S. Patent Application No. 11/746,558. PCT applications filed.

**INVENTOR(S):** James A. Birchler; Weichang Yu; Juan M. Vega

**CONTACT INFO:** Harriet F. Francis, MS, J.D.; francish@missouri.edu; 573.884.0374

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**INEXPENSIVE METHOD OF PURIFYING  $\delta$ -TOCOTRIENOL**

Researchers at the UMKC School of Medicine have developed a method of purifying  $\delta$ -tocotrienol to levels that were previously impossible to obtain. The purification methods that we have developed are much less expensive and time consuming than currently used methods. By using our extraction processes, scientists have been able to purify Annato seed extracts to 98% pure  $\delta$ -tocotrienol. This purity is obtained without almost no change in the percent yield recovery, making these methods a major breakthrough in the preparation of  $\delta$ -tocotrienol containing products.

**POTENTIAL AREAS OF APPLICATIONS:**

- This method can be used to inexpensively purify  $\delta$ -tocotrienol for use in a wide variety of products.

**INVENTOR(S):** Asaf A. Qureshi; Nilofer Qureshi; Christopher J. Papasian; Julia C. Reis; David C. Morrison

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**IMPROVING CROP NITROGEN RESPONSE AND PRODUCTION**

Nitrogen is the most limiting nutrient for crop growth and production. Also, increasing amounts of nitrogen fertilizers are being applied in the field, a practice that causes major environmental damage and increases costs for crop production.

Researchers at the University of Missouri-St. Louis and the Donald Danforth Plant Science Center have discovered a biotechnological manipulation to improve crop growth and yield under different levels of nitrogen. At low nitrogen levels, this manipulation has the potential to enhance nitrogen acquisition and crop growth, thus improving plant tolerance to poor nitrogen conditions. As adequate nitrogen levels, this methodology is expected to increase overall growth and seed production.

This invention includes methods for producing transgenic plants and seeds with altered expression of phospholipase D $\epsilon$  (PLD $\epsilon$ ), i.e., plants and seeds either overexpressing or underexpressing PLD $\epsilon$ ; increasing a plant's ability to capture and utilize nitrogen; increasing a plant's biomass production; and increasing the yield of a plant or increasing a plant's ability to grow under hyperosmotic stress.

**PATENT STATUS:** - U.S. Publication No. US-2010-0037351

**INVENTOR(S):** Xuemin "sam" wang, et al

**CONTACT INFO:** Tamara Wilgers; [wilgerst@umsl.edu](mailto:wilgerst@umsl.edu); 314-516-6884

**SCINOTE: REVOLUTIONIZE KNOWLEDGE SHARING FOR SCIENTISTS**

SciNote is a nonprofit company providing a unique software platform for nonprofit scientific research institutions and higher education in the greater Midwest area. The company will form partnerships with local universities and institutions. SciNote's goal is to provide an integrated system for scientists to stay up-to-date with knowledge, share expert evaluations of knowledge and sustain the accumulation of knowledge. SciNote hopes, in the future, that scientific research process can be much faster, productive and rewarding; and with that hope, we are aiming to become a nation-wide leader and first in place to provide such service to advance scientific discoveries.

Stay up-to-date to fast refreshing literatures everyday is a daunting task. Without knowing what the unknown is makes it impossible for anyone to know where to explore for the undiscovered. On the other hand, every great discovery is a manifestation of what we've already known. When faced with the old and the new, scientists often resort to expert opinions (e.g., published reviews) as to where the next gold mine of discovery is. Independent researchers such as academic faculties are used to isolated knowledge pools that they kept building along the period of careers. When it comes to find an advancing opportunity in their



career, attending professional conferences and colleague collaborations are often used to help generate the inspirations for the next move. In addition to the challenge to make the main focus of the research alive, as a typical research laboratory grows, constant personnel changes and project alterations make heritable knowledge base almost impossible.

The interdisciplinary nature of modern day research brings in yet another challenge: how to build a common ground for scientists with various focus areas? This common ground, by an ideal definition, should be a merge of the best expertise and the best interest. Creativity in discovery needs to be fostered in an environment with celebration of diversity, crystallized ideas, and enthusiasm. To succeed in interdisciplinary research must start with sharing of the minds. Only when minds are synced can resources and personnel be utilized to its maximum strength.

With the above-mentioned hurdles and challenge in our mission, SciNote can revolutionize how science was done with open source software that is user account based and Internet accessible. Think of the SciNote platform as “An iTunes for science with ‘Ping’.” What SciNote will provide is a truly live-feed knowledge-sharing device fully utilizes the cyber-speed and security feature of the Internet and software engineering. Sharing the knowledge will be as simple as a star ranking, or a comment message; sharing the initiatives will be as easy as a discussion topic, or an electronic invitation; and sharing the resource will be as intuitive as one click, or one download.

SciNote is in direct contact with day-to-day operation of a laboratory, an interdisciplinary center, or a research university. It is projected that within two years, 50% of the scientists in the covering area use our system as routine as they use Microsoft office.

Over time, SciNote will become the first and pioneering software service provider in revolutionize scientific discovery pipeline. The impact for scientific discovery and research funding generation will be immense. With close collaboration with both cutting edge software engineers and research institutions, SciNote is hope to become THE platform for science knowledge sharing and the only nonprofit company that is prestigiously recognized in a global scale.

**INVENTOR:** Zhe Zhang (Jenny) Ph.D.

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## **SCREENING AND ISOLATING EASTERN REDCEDAR PHYTOCHEMICALS FOR CREATING ECONOMIC OPPORTUNITIES IN MISSOURI**

Eastern Redcedar (ERC) is one of the most widely distributed tree species in Missouri. The ERC is an important source of bioactive secondary metabolites, but very few of these biologically active compounds have been identified, purified or commercialized. An interdisciplinary collaboration between MU scientists was initiated in 2007 to identify and isolate biologically active phytochemicals from ERC tissues for possible commercial application. Our team has identified and purified biologically active compounds from leaves (needles) and fruit of the ERC. Many of these isolated diterpenoids not only have shown strong anti-microbial activities against a wide range of pathogenic bacteria, but also strong inhibitory activities against melanin biosynthesis. Recently, the isolated tricyclic diterpenoids have been recognized as promising anti-inflammatory, anti-microbial, and skin whitening agents by cosmetic and pharmaceutical industries. The objectives of the proposed study are to: 1) isolate and characterize the biologically active phytochemicals, and 2) elucidate chemical structures of active compounds and their associated mode of actions. The first of these compounds to be characterized is the purified bioactive diterpenoid. The purified bioactive diterpenoid was found to have a significant inhibitory effect on the growth of all Gram positive pathogens tested. This inhibition of Gram positive bacteria is likely due to action on the cell division machinery, for affected cells elongate without proper separation. Additional compounds have activity on fungal agents, as well as potential anti-melanin activities. The knowledge generated from our research will provide the

opportunities to turn abundant, low-value, renewable materials from the ERC into a lucrative, high technology industry in Missouri.

**INVENTOR(S):** Chun-Ho Lin; Brian M. Thompson; Hsin-Yeh Hsieh; Robert J. Kremer; Robert N. Lerch; Michael A. Gold and Harold E. Garrett

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#### **REMOVAL OF TOXIC CONTAMINATES FROM POLLUTED SOIL AND WATER VIA BIOREMEDIATION UTILIZING BACILLUS SPORES**

Atrazine, a widely used herbicide in North America, is one of the known pollutants that pose a potential threat to human health. The addition of naturally occurring degradative bacteria that can remediate these pollutants has been promising. The soil bacterium *Pseudomonas* sp. strain ADP produces the enzyme AtzA which modifies atrazine to the benign hydroatrazine. However, the current use of bacteria in bioremediation is limited. These bacteria need to compete for nutrients with the native populations of microorganisms in the contaminated soil to survive and to maintain a degradative population. Bacterial endospores are naturally resistant to harmful environments, such as acidic soil, heat, and dessication; and have the ability to persist in soil for long periods of time. We wanted to utilize the *Bacillus* spore as a vehicle to deliver degradative enzymes, such as AtzA, into the soil and allow the tethered enzymes to persist over time. We utilized two methods for the tethering of enzymes to the spore surface. The first method being a genetic fusion of degradative enzymes to the exosporium of *Bacillus* endospores, and the second method being a chemical linkage to the outer layers of the *Bacillus* exosporium.

**INVENTOR(S):** Brian M. Thompson; George C. Stewart; and Chun-Ho Lin

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## AWARDS

### **FACULTY ENTREPRENEUR OF THE YEAR AWARD 2010**

*This award honors a faculty member for a record of entrepreneurial innovation that demonstrates commercial utility, contributes to the public welfare and brings visibility to the university.*

#### ***Peter Sutovsky***

Peter Sutovsky is an associate in the Division of Animal Sciences at the University of Missouri-Columbia's College of Agriculture, Food and Natural Resources. He is a nationally and internationally recognized leading scientist in sperm cellular and molecular physiology.

For more than a decade, Sutovsky has focused on novel testing for diagnosing male infertility, measuring fertility in large animals and improving the pregnancy outcome of assisted reproduction. His bio-tech company, AndroLogika LLC., provides new tools for fertility markers. Sutovsky is also one of a handful of researchers working toward marketing a device that would allow law enforcement and laboratory scientists to determine within minutes whether a piece of evidence from a rape kit contains semen.

Writes one nominator of Sutovsky's: "Sutovsky continues to contribute in a superior and tangible manner toward the public and translational missions of the University of Missouri-Columbia. His ability to take a discovery that transcends the public in a meaningful way is a much sought after and coveted skill. This is only achieved by a few that truly hold the entrepreneurial spirit."

### **STUDENT ENTREPRENEUR OF THE YEAR AWARDS 2010**

*These awards honor students at one of the University of Missouri's four campuses who have shown entrepreneurial talent.*

#### ***Michael Orlando, Jr., Colby Hall and RJ Miller***

Michael Orlando, Jr., Colby Hall and RJ Miller received their bachelor's degrees from Missouri University of Science and Technology in 2009 and have founded Interdisciplinary Design Collaborative LLC., which draws on the talents of Missouri S&T students to address specific business opportunities. Such opportunities have included developing algorithms for energy sensor technologies, high-definition video production and creating the iPhone app BarCodeScan, which allows customers to enter a product's barcode on their phone to receive further information about the product.

Their company has employed more than 40 Missouri S&T students and has drawn recognition from campus leaders and state and national legislators. According to Missouri S&T Chancellor John F. Carney III, "As undergraduates, Michael, RJ and Colby have hit a grand slam with their business. They saw the weak job market and took action...When I see what IDC is doing, I see the exuberance of youth embracing today's technologies and applying their knowledge in a way that will create true wealth while sharing the opportunity with others."

## MU START-UP COMPANY WINS NASA AWARD



[www.ADROITMOTION.COM](http://www.ADROITMOTION.COM)

Life Science Business Incubator  
1601 S. Providence Rd  
Columbia, MO 65211  
Phone: 573-884-5234  
[info@adroitmotion.com](mailto:info@adroitmotion.com)

### *Adroit Motion wins NASA Earth/Space Engineering Innovation Prize at the Rice Business Plan Competition 2010*

Adroit Motion, LLC is a medical device company founded on technology developed at the University of Missouri on hydraulically actuated instruments for minimally invasive surgery. More than 3 million laparoscopic procedures are performed annually in the US. The US laparoscopic hand instrument market exceeds \$200 million, has a 10% cumulative annual growth rate, and there is a growing demand for precise and ergonomic laparoscopic devices.

#### Technology

Our patent-pending Aqua-cision™ technology is a hydraulic direct-drive system, non-electromechanical, that offers revolutionary, ergonomic hand control with greater range of motion and seven degrees-of-freedom. The result is superior products with maximum precision and surgeon comfort.

#### Products

We expect FDA approval for the Affex™ articulating hand instrument in Q3 2011 and plan to begin product sales in Q1 2012.

Features include:

- Seven degrees of freedom
- Multiple points of articulation
- Comfortable, intuitive hand-held interface
- Reusable, custom handpiece
- Disposable, interchangeable shaft/tip
- Haptic feedback



**Founders Anthony Harris, Rebecca Rone, Xandra Sifuentes, and Brad Snow**

## US PATENTS ISSUED TO UNIVERSITY OF MISSOURI — FY 2010 (July 1st 2009 - June 30th 2010)

7,471,887	NOVEL MALE FERTILITY ASSAY <i>Peter Sutovsky</i>
7,563,567	USE OF ECIST MICROARRAYS IN AN INTEGRATED METHOD FOR ASSESSING DNA METHYLATION, GENE EXPRESSION AND HISTONE ACETYLATION <i>Tim Hui-Ming Huang, Huidong Shi</i>
7,575,861	COMPOSITIONS AND METHOD FOR ACCURATE EARLY PREGNANCY DIAGNOSIS <i>Matthew C Lucy, Nagappan Mathialagan</i>
7,585,509	ERBB-2 RECEPTOR TARGETING PEPTIDE <i>Thomas P. Quinn, Natalia Karasseva</i>
7,589,171	POLYAMIDES FOR TREATING HUMAN PAPILLOMAVIRUS <i>James K. Bashkin, Kevin J. Koeller</i>
7,601,126	LAMENESS EVALUATION SYSTEMS AND METHODS <i>Kevin G. Keegan, Frank Pai</i>
7,601,425	CORROSION RESISTANT COATINGS CONTAINING CARBON <i>Scott A. Hayes, Pu Yu, James O. Stoffer, Eric Morris, Thomas J. O'Keefe</i>
7,601,886	PRODUCTION OF TRANSGENIC PLANTS WITH INCREASED SEED YIELD <i>Jia Li, John C. Walker, Jiangqi Wen</i>
7,603,004	NEURAL NETWORK DEMODULATORS FOR BRAGG OPTICAL SENSORS <i>Rohit Dua, Steve E. Watkins, Donald C. Wunsch</i>
7,608,478	ON-CHIP IGNITER AND METHOD OF MANUFACTURE <i>Shantanu Bhattacharya, Yuanfang Gao, Shubhra Gangopadhyay, Rajesh V. Shende, Steven J. Apperson</i>
7,611,691	COMPOUNDS FOR TREATMENT OF COPPER OVERLOAD <i>Kavita V. Katti, Raghuraman Kannan, Stan Casteel, Kattesh V. Katti</i>
7,615,229	MUTANTS OF THE P4 PROTEIN OF NONTYPABLE HAEMOPHILUS INFLUENZAE WITH REDUCED ENZYMATIC ACTIVITY <i>Thomas J. Reilly, Arnold L. Smith</i>
7,618,582	CONTINUOUS STEEL PRODUCTION AND APPARATUS <i>Kent D. Peaslee, Jorg Peter, David G.C. Robertson</i>
7,648,675	REACTION SINTERED ZIRCONIUM CARBIDE/TUNGSTEN COMPOSITE BODIES AND A METHOD OF PRODUCING SAME <i>Shi Zhang, Greg Hilmas, Bill Farenholtz</i>
7,649,359	ELECTROSTATIC THIN FILM CHEMICAL AND BIOLOGICAL SENSOR <i>Mark A. Prelas, Tushar K. Ghosh, Robert V. Tompson, Dabir Viswanath, Sudarshan K. Loyalka</i>
7,651,966	ALKALINE RESISTANT PHOSPHATE GLASSES AND METHOD OF PREPARATION AND USE THEREOF <i>Richard K. Brow, Delbert E. Day, Signo Tadeu Dos Reis</i>
7,663,004	METHOD OF PRODUCING LOWER ALCOHOLS FROM GLYCEROL <i>Galen Suppes, William Rusty Sutterlin, Mohanprasad A. Dasari</i>
7,666,626	MUTANTS OF THE P4 PROTEIN OF NONTYPABLE HAEMOPHILUS INFLUENZAE WITH REDUCED ENZYMATIC ACTIVITY <i>Arnold L. Smith, Thomas J. Reilly</i>
7,670,844	SUPPORTED MOLECULAR BIOFLUID VISCOSITY SENSORS FOR IN-VITRO AND IN-VIVO USE <i>Mark A. Haidekker, Sheila A. Grant</i>
7,686,452	APPARATUS AND METHOD FOR ASSESSING VISUAL SUPPRESSION <i>Carl Bassi, Michael G. Howe, Wayne Garver</i>
7,689,016	AUTOMATIC DETECTION OF CRITICAL DERMOCOPY FEATURES FOR MALIGNANT MELANOMA DIAGNOSIS <i>Randy Moss, William V. Stoecker, R. Joe Stanley, Xiaoho Chen, Kapil Gupta, Bijaya Shrestha, Pavani Jella</i>
7,693,369	HOLLOW CORE OPTICAL RING RESONATOR SENSOR, SENSING METHODS, AND METHODS OF FABRICATION <i>Xudong Fan, Ian White, Hesam Oveys</i>
7,695,450	MULTIPLE LUMEN CATHETER FOR HEMODIALYSIS <i>Zbylut J. Twardowski, John C. Van Stone, W. Kirt Nichols,</i>
7,696,370	SOY-BASED POLYOLS <i>Galen Suppes, Fu-Hung Hsieh, Yuan-Chan Tu, Pimphan Kiatsimku, Zuleica Lozada, Arnold A. Lubguban</i>

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7,700,831	METHOD FOR INDUCING RESISTANCE TO FUNGAL INFECTION IN TRANSGENIC PLANTS USING PLANT DEFENSE PEPTIDES <i>James T. English, Francis Schmidt, Gary Stacey, Zhiwei Fang</i>
7,705,084	WATER BORNE FILM-FORMING COMPOSITIONS <i>Michael R. Van De Mark, Nantana Jiratumnukul</i>
7,723,247	METHOD FOR PRESSURELESSLY SINTERING OF ZIRCONIUM DIBORIDE/SILICON CARBIDE BODIES TO HIGH DENISITIES <i>Shi Zhang, Greg Hilmas, William G. Fahrenholtz</i>
7,732,033	SEALANTS FOR STRUCTURAL MEMBER JOINTS AND METHODS OF USING SAME <i>David C. Van Aken, Yoshi Kato</i>
7,744,876	TREATMENT OF TYPE 1 DIABETES BEFORE AND AFTER EXPRESSION OF PREDISPOSITION MARKERS <i>Habib Zaghouan, i Randal Keith Gregg</i>
7,746,084	IMPEDANCE MEASUREMENT USING LINE TO LINE CURRENT INJECTION <i>Jing Huang, K.A. Corzine</i>
7,746,266	MICROWAVE AND MILLIMETER WAVE IMAGING SYSTEM <i>Reza Zoughi, Mohamed Ahmed AbouKhoussa, Mohammad T. Ghasr, Sergiy Kharkivskiy, David Pommerenke</i>
7,747,418	COMPUTER AIDED DENTAL BAR DESIGN <i>Ming C. Leu, Amit Gawate</i>

## UNIVERSITY OF MISSOURI EMPLOYEES LISTED AS INVENTORS ON US PATENT APPLICATIONS — FY 2010 (July 1st 2009 - June 30th 2010)

### *University of Missouri - Columbia*

- |                         |                          |                            |
|-------------------------|--------------------------|----------------------------|
| ▪ Ramak R. Amjad        | ▪ Bill N. Day            | ▪ Bradley A. Hubbard       |
| ▪ Derek T. Anderson     | ▪ Shu Ding               | ▪ Robert H. Luke Iii       |
| ▪ Steven J. Apperson    | ▪ James L. Cook Dvm      | ▪ Raghuraman Kannan        |
| ▪ Shashanka P. Ashili   | ▪ James T. English       | ▪ Natalia Karasseva        |
| ▪ Ulus X. Atasoy        | ▪ Steve Eubanks          | ▪ Kattesh K. Katti         |
| ▪ Sharon Bachman        | ▪ Roger Clayton Fales    | ▪ Kavita V. Katti          |
| ▪ Tanvi S. Banerjee     | ▪ Zhiwei Fang            | ▪ Vijaya Kattumuri         |
| ▪ Breton F. Barrier     | ▪ Nicole Marie Fearing   | ▪ Timothy Keim             |
| ▪ James D. Benson       | ▪ Elena Florea           | ▪ James Keller             |
| ▪ Andrey Bezmelnitsyn   | ▪ Gabor Forgacs          | ▪ Pimphan Kiatsimku        |
| ▪ Kristin Bilyeu        | ▪ Keshab Gangopadhyay    | ▪ Karl M. Kochendorfer     |
| ▪ Evan J. Boote         | ▪ Shubhra Gangopadhyay   | ▪ Rajesh Kumar             |
| ▪ Jacob Burress         | ▪ Changlu Gao            | ▪ Keiichi Kuroki           |
| ▪ Robert Calaluca       | ▪ Bridget Garner         | ▪ Jae W. Kwon              |
| ▪ Stan Casteel          | ▪ Timothy M. Geiger      | ▪ Jeong-Dong Lee           |
| ▪ Meng Chen             | ▪ Kate L. George         | ▪ Mark Lee                 |
| ▪ Peng Cheng            | ▪ Tushar K. Ghosh        | ▪ Hao Li                   |
| ▪ Dustin Christiansen   | ▪ Sheila A. Grant        | ▪ Mengshi Lin              |
| ▪ Robert Churchill      | ▪ Jonathan Green         | ▪ Zuleica Lozada           |
| ▪ Gary G. Clark         | ▪ Randal Keith Gregg     | ▪ Arnold A. Lubguban       |
| ▪ Jared S. Coberly      | ▪ Vitaly Gruzdev         | ▪ Hongbin Ma               |
| ▪ Stephen H. Colbert    | ▪ Li-Qun (Andrew) Gu     | ▪ Francoise Marga          |
| ▪ Cristi Reeves Cook    | ▪ Matt Gubin             | ▪ Tod C. McCauley          |
| ▪ James L. Cook         | ▪ Rainer Dane A. Guevara | ▪ Devin McCormack          |
| ▪ Corey Renee Costello  | ▪ Zachary Hafez          | ▪ Adrian E. Mendez         |
| ▪ John Critser          | ▪ Xu Han                 | ▪ Melissa Goellner Mitchum |
| ▪ Paul S. Dale          | ▪ Anthony N. Harris      | ▪ H Dennis Mollman         |
| ▪ Mohanprasad A. Dasari | ▪ Terra C. Holdeman      | ▪ Henry Nguyen             |
| ▪ J Wade Davis          | ▪ Fu-Hung Hsieh          | ▪ Perngjin Frank Pai       |

- Nicole A. Patino
- Peter Pfeifer
- Tung Anh Pham
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- Mihail Popescu
- Mark A. Prelas
- Sachidevi Puttaswamy
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- Archana Ramaswamy
- Bruce Ramshaw
- Marilyn Rantz
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- Peter Sutovsky
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- Jay J. Thelen
- Rajagopalan Thiruvengadathan
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- Robert V. Tompson
- Yuan-Chan Tu
- Babu Valliyodan
- Ebby Varghese

- William D. Verbarq
- John A. Viator
- Tri D. Vuong
- Tongtawee Wacharasindhu
- Fang Wang
- Shuang Wang
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- Sancai Xie
- Qingsong Yu
- Habib Zaghouni
- Chongbei Zhao

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- Natalia Bondarenko
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- Roger Brown
- Joseph Tobias Case
- Naveen Chandrasekaran
- Chariklia Soritiou-Leventis
- Genda Chen
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- Grzegorz Galecki
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- Xue Han
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- Judy D. Wall
- Xiaojiang Wang
- Zhi Zhou
- Reza Zoughi

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- Kevin J. Koeller
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- Vassiliy Tsytarev
- Zhi Xu

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- Matthew Begemann
- Evan J. Boote
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- Genda Chen
- Robert Churchill
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- Cathy S. Cutler
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- James Drewniak
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- Jonathan A. Green
- Ben Griffith
- Scott A. Hayes
- Ali Hussam
- Nantana Jiratumnukul
- Raghuraman Kannan
- Kattesh V. Katti
- Kavita K. Katti
- Kevin G. Keegan
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- David W. Larsen
- Hao Li
- Mengshi Lin
- Matthew C. Lucy
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- Michael G. Maurizi
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- Kim Wise
- Sancai Xie
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- Qingsong Yu

## UNIVERSITY OF MISSOURI RESEARCHERS WITH GRANTS OF MORE THAN \$1 MILLION – FY2010

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- George E. Davis
- Michael John Davis
- Natashua R. Davis
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- James Dejong
- Alexei Demchenko
- David D. Diamond
- Donald Harrison Burke-Aguero



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  - Keith Stine
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  - Richard W. Tsika
  - Gwendolyn Y. Turner
  - Steffen Thomas Vojta
  - Wynn A. Volkert
  - Judy Davis Wall
  - Xuemin Wang
  - Gary A. Weisman
  - William Thomas Wells
  - Stephen Richard Wyatt
  - Yun Sheng Xu
  - Shui Qing Ye
  - Habib Zaghouani
  - Cuihua Zhang
  - Zhanyuan Zhang

## UNIVERSITY OF MISSOURI INVENTION DISCLOSURES – FY2010

- A NOVEL PROTEIN TARGET FOR ANTICANCER THERAPEUTICS  
*Xiaoqin Zou; Shengyou Huang; Salman M. Hyder; Yayun Liang; Sam Z. Ginter*
- SEQUENCE-BASED MOLECULAR DIAGNOSTICS OF ASIAN SOYBEAN RUST WITHIN THE US AND ABROAD  
*Gary Stacey; Xuecheng Zhang*
- A FUEL CELL POWERED BY HYDROGEN OR OTHER FUELS PRODUCED FROM RADIOLYSIS OF WATER, CO<sub>2</sub> OR OTHER SUBSTRATES USING NUCLEAR SOURCES *Mark A. Prelas; Robert V. Tompson; Tushar K. Ghosh*
- APPLICATIONS OF NANO-OXIDANTS, NANO-THERMITES, AND NANO-CATALYSTS IN THERMOCHEMICAL CONVERSION *William A. Jacoby; Shubhra Gangopadhyay; Steven J. Apperson; Keshab Gangopadhyay; Rajagopalan Thiruvengadathan; Daniel Tappmeyer*
- ALTERATIONS IN RNA BINDING PROTEINS TREAT BREAST CANCER *Robert Calaluze; Ulus X. Atasoy; Matt Gubin*
- NEW METHOD OF MAKING AN IRRADIATED MOLYBDENUM TC-99M GEL GENERATOR  
*Delbert E. Day; GARY J. EHRHARDT; Leonard H. Manson III*
- GENETIC PROFILING OF PATIENTS TO PREDICT THE OCCURENCE OF VENTRAL HERNIAS  
*Robert Calaluze; Bruce Ramshaw; Sharon L. Bachman; Ulus X. Atasoy; J Wade Davis*
- ENGINEERING FULLY BIOLOGICAL NERVE GRAFT  
*Gabor Forgacs; Francoise Marga; Dustin Christiansen; Stephen H. Colbert; Bradley A. Hubbard*
- HYBRID INTEGRATED THERMAL ELECTRIC AND EJECTOR ACTIVE COOLING SYSTEM  
*Hongbin Bill Ma; Peng Cheng*
- IN-LABELED PEPTIDE FOR MELANOMA DETECTION *Yubin Miao*
- EMBEDDED KIOSKS FOR MEDICAL APPLICATION *Ali Hussam*
- RESTRICTACCESS - A PORTABLE MEANS OF SECURING AND RESTRICTING EQUIPMENT ACCESS *Luis Occena; Michael A. Klote*
- METHOD AND APPARATUS FOR PLANT DROUGHT STRESS MEASUREMENT *Jinglu Tan; Ya Guo*
- PRODUCTION OF CHEMICALLY PURE OS RADIONUCLIDES OR TARGETS  
*Hendrik Engelbrecht; Stacy L. Wilder; Cathy S. Cutler; Leonard H. Manson III*
- NEW INHIBITOR SUPPRESSES REPLICATION OF FOOT-AND-MOUTH-DISEASE-VIRUS BY TARGETING THE VIRAL 3DPOL RNA-DEPENDENT RNA POLYMERASE *Stefan Sarafianos; Elizabeth Rieder; Ryan Durk*
- POLYAMIDE (PA) THIN FILM COMPOSITE (TFC) ON PLASMA-MODIFIED POLYVINYLIDENE FLOURIDE (PVDF)  
*Baolin Deng; Eun-Sik Kim*
- ENHANCED THIN DISK LASER PERFORMANCE WITH NEAR ISOTHERMAL CONTROL  
*Hongbin Bill Ma; Douglas E. Smith; Vitaly Gruzdev*
- METHOD AND PROCEDURE FOR HERBICIDE MEASUREMENT *Jinglu Tan; Ya Guo*
- METHOD FOR IMPROVEMENT OF ULTRAVIOLET LIGHT SUSCEPTIBILITY OF GENES  
*Chris N. Papageorgio; Kevin Andrew Lease*
- THE DISPLAY OF HETEROLOGOUS BIOMOLECULES ON THE OUTER SURFACE OF INACTIVATED BACILLUS ENDOSPORES *Daniel E. Hassett; Curtis J. Pritzl*
- ADMINISTRATION OF INHALED STEM CELLS FOR TREATMENT OF PULMONARY DISEASES *Rajiv Dhand*
- DETECTING MICRORNA (MIRNA) USING NANOPURE SINGLE MOLECULE DETECTOR  
*Li-qun (Andrew) Gu; Yong Wang*
- UNIDIRECTIONAL FLAT-PLATE OSCILLATING HEAT PIPE *Hongbin Bill Ma; Scott Thompson*
- GENES ASSOCIATED WITH SEED OIL AND FATTY ACIDS MODULATION *Henry Thien Nguyen; Rajesh Kumar*
- INTUITIVE LAPAROSCOPIC HAND PIECE *Anthony N. Harris; Jonathan R. Thompson; Rebecca J. Rone*
- TIRE CARBON *Galen J. Suppes*
- TARGETED GOLD NANOCONJUGATES AS X-RAY CONTRAST AGENTS FOR MOLECULAR IMAGING OF PROSTATE CANCER *Kattesh V. Katti; Kannan Raghuraman; Evan J. Boote; Nripen Chanda; Ajit Prakash Zambre; Cathy S. Cutler; Ravi Shukla*
- PANCREATIC CANCER IMAGING AND THERAPY USING EGFR PEPTIDE CONJUGATED GOLD NANOPARTICLES  
*Kattesh V. Katti; Kannan Raghuraman; Evan J. Boote; John A. Viator; Nripen Chanda; Ajit Prakash Zambre; Ravi Shukla*

- HUMAN AND CANINE OSTEOARTHRITIS BIOMARKER PANELS  
*Aaron M. Stoker; James L. Cook DVM; Keiichi Kuroki; Bridget Garner; Cristi Reeves Cook*
- CHONDROAL AND OSTEOCHONDROAL ALLOGRAFT PRESERVATION SYSTEM *James L. Cook DVM*
- VORINOSTAT FOR TREATING CORNEAL SCARRING *Rajiv R. Mohan*
- THREE-DIMENSIONAL VARIABLE HEADLOSS STORM WATER REDISTRIBUTION DEVICE *Kathleen Trauth*
- HELICAL CONSERVATIVE SHOULDER PROSTHESIS *Matt Smith*
- PEPTIDES THAT PROTECT SOYBEAN FROM THE FUNGAL RUST PATHOGEN, PHAKOPSORA PACHYRHIZI  
*James Schoelz; Francis Schmidt; James T. English; Zhiwei Fang*
- SUPPRESSION OF HBV REPLICATION BY A SPECIFIC ANTI-VIRAL COMPOUND *Stefan Sarafianos*
- STEERABLE EPIDURAL CATHETER *Nicole A. Patino; William D. Verbar; Zachary Hafez; Ebby Varghese*
- HIGH-THROUGHPUT WORKFLOW FOR PROFILING CROP SEED PROTEINS  
*Jay J. Thelen; Severin Ernest Stevenson*
- ENDOSCOPIC TISSUE RETRACTION TOOL FOR NATURAL ORIFICE SURGERY  
*Sheila A. Grant; Brent W. Miedema; David Alan Grant; Klaus Thaler*
- GUILLOTINE ENDOSCOPE TOOL *Sheila A. Grant; Brent W. Miedema; David Alan Grant; Klaus Thaler*
- S07-2680, S07-3666, S07-5049, S07-5117, S07-5151 , S07-15722RR- SOYBEAN  
*Henry Thien Nguyen; James Allen Wrather; James Grover Shannon*
- THREE-DIMENSIONAL MULTI-OSCILLATING HEAT PIPE HEAT SPREADER *Hongbin Bill Ma*
- LOCI ASSOCIATED WITH INFECTION OF MYCOBACTERIUM AVIUM SUBSPECIES PARATUBERCULOSIS IN CATTLE  
*Jeremy Francis Taylor*
- DEVELOPMENT OF SOYBEAN SS93-3901 VARIETY *David A. Sleper*
- A TOMBUSVIRUS P19 PROTEIN THAT ENHANCES AND SUSTAINS EXPRESSION OF PHARMACEUTICAL PROTEINS IN NICOTIANA SPECIES WITHOUT TRIGGERING A HYPERSENSITIVE DEFENSE RESPONSE  
*Carlos Angel; James Schoelz*
- A NICOTIANA HYBRID FOR PRODUCTION OF PHARMACEUTICAL PROTEINS *Carlos Angel; James Schoelz*
- APPARATUS AND PROCESS FOR EXTRACTION OF OIL FROM WHOLE SOYBEANS  
*William A. Jacoby; Roger Clayton Fales*
- LARGE SCALE PRODUCTION OF COPPER OXIDE NANORODS, OPTIMIZATION OF PROCESS PARAMETERS AND SYNTHESIS OF CUO AND OTHER NANOOXIDE-BASED NANOTHERMITES WITH REDUCED AND TUNABLE ELECTROSTATIC DISCHARGE SENSITIVITY  
*Shubhra Gangopadhyay; Steven J. Apperson; Keshab Gangopadhyay; Rajagopalan Thiruvengadathan*
- SOYBEAN GENE PROMOTERS UPREGULATED IN FEEDING CELLS INDUCED BY THE SOYBEAN CYST NEMATODE, HETERODERA GLYCINES *Melissa Goellner Mitchum; Pramod Kandoth; Greg Yeckel*
- RATCHETING STAPLE FOR SURGICAL APPLICATIONS  
*Nicole A. Patino; William D. Verbar; Zachary Hafez; Brad Snow*
- THE RECOMBIKIT; A UNIVERSAL KIT FOR FAST INSERTION OF OLIGONUCLEOTIDES INTO VECTORS OR CHROMOSOMES *Mark Oliver Palmier; Kent N. Strodtman*
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- FABRICATION OF SERS-ACTIVE SUBSTRATES WITH CONTROLLABLE MEASUREMENT CONSISTENCY  
*Qingsong Yu; Hao Li; Mengshi Lin*
- TIGHT CONNECTOR FOR SEPARABLE PERITONEAL CATHETER  
*Ramesh Khanna; W. Kirt Nichols; Zblut J. Twardowski*
- CERVICAL SPINE CLAMP *Nicole A. Patino; William D. Verbar; Zachary Hafez; H Dennis Mollman*
- PROGRESS CHEX- PERFORMANCE EVALUATION SYSTEM *Carla M. Allen; Vamsi Kanuri; Wei Du*
- POSITIVE DOG TRAINING DEVICE *Rebecca Ann Johnson*
- CONTINUOUS BLOOD VESSEL PATENCY MONITOR  
*Perngjin Frank Pai; Nicole A. Patino; William D. Verbar; Zachary Hafez*
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*Nicole A. Patino; William D. Verbar; Zachary Hafez*
- MONOCLONAL ANTIBODY CLONE 4B7 *Chris L. Lorson*
- INFORMATION VALET PROJECT-CIRCULATE DISCOVERY ENGINE AND TOOLBAR
- A NOVEL PLANT PRODUCT FOR THE TREATMENT OF OBESITY AND OBESITY ASSOCIATED METABOLIC COMPLICATIONS *James Perfield PhD*

- SENSOR FOR DETECTION OF LUTEINIZING HORMONE IN BODY FLUIDS  
*Kattesh V. Katti; Raghuraman Kannan; Ajit Prakash Zambre; Ravi Shukla*
- SIMULTANEOUS GENE AND RADIATION THERAPY *Ethan Ruvaine Balkin; Michael Robert Lewis*
- MULTIPLEX DIAMOND-BASED NEUTRON AND GAMMA RAY SPECTROSCOPIC DETECTION SYSTEM  
*Mark A. Prelas; Eric Lukosi*
- MEMS BASED COULTER COUNTER FOR CELL COUNTING AND SIZING USING MULTIPLE ELECTRODES  
*John K. Critser; Mahmoud Almasri; James D. Benson; Yifan Wu*
- ISOLATION OF SUSPENDED PATHOLOGICAL ANALYTES USING TWO PHASE FLOW AFTER PHOTOACOUSTIC DETECTION *John A. Viator; Shramik Sengupta; Scott Holan; Christine Mary O'Brien; Sagar Gupta; Jeff Mosley; Kyle Rood*
- CYST NEMATODE GENE PRODUCTS PROTECT PLANTS FROM ENVIRONMENTAL STRESS  
*Melissa Goellner Mitchum*
- AN IMPROVED METHOD FOR DETECTING SUPERHETERODYNE AND HOMODYNE RECEIVERS BY MANIPULATING THEIR INCIDENTAL-RF EMISSIONS USING AN EXTERNAL STIMULATION  
*Daryl Beetner; Steven L. Grant; Shao Peng; Andrew Conrad; Colin Stagner; Natalia Bondarenko*
- BIOACTIVE WOUND CARE MATERIAL FOR USE IN MAMMALS *Delbert E. Day; Steven B. Jung*
- MATERIALS THAT PROMOTE VASCULAR GROWTH IN MAMMALS *Delbert E. Day; Steven B. Jung*
- USE OF "FOG" TO CONTROL H1N1 VIRUS *Shubhender Kapila; Virgil J. Flanigan*
- LONG CARBON FIBERS FOR BLAST RESISTANT CONCRETE *Jeffery Scott Volz*
- DIRECT IN-PLANTA CHEMICAL ANALYSIS SUBSURFACE CONTAMINATION DELINEATION *Joel G. Burken*
- MINIATURIZED (BIO)CHEMICAL DETECTION SYSTEMS WITH OPTOELECTRONIC COMPONENTS  
*Chang-Soo Kim; Jong Won Park*
- DUAL-LOADED DIPOLE *Reza Zoughi; Kristin Donnell*
- DISSOLUTION AND SELF ASSEMBLY FROM NANOSTRUCTURED PRECURSORS VIA ULTRASONICATION  
*Nicholas Leventis*
- POLYMER NANOENCAPSULATED ENTANGLED NANO-WORM-LIKE AEROGELS FOR ENERGY ABSORPTION IN PERSONNEL AND VEHICLE ARMOR *Nicholas Leventis*
- FORCED IMBIBITION FOR ENHANCED OIL RECOVERY THROUGH COUPLING PARTICLE GEL AND SURFACTANT TREATMENT *Baojun Bai; Yongfu Wu*
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*Ganesh K. Venayagamoorthy; Ahemd Yousuf Saber*
- PROCESS FOR THE SYNTHESIS OF 2-HYDROXYBUTYROLACTONE  
*Shubhender Kapila; Rachadaporn Seemsnahannop; Shiva Garg*
- MICROWAVE HIGH-RESOLUTION IMAGING OF WIND TURBINE BLADES *Sergiy Kharkivskiy; Reza Zoughi*
- SYNTHESIS OF MONOLITHIC POROUS SILICON CARBIDE FROM POLYACRYLONITRILE CROSSLINKED SILICA AEROGELS *Nicholas Leventis; Chariklia Sotiriou-Leventis; Naveen Chandrasekaran; Anand Ghanashyam Sadekar*
- SELF-SWIRLING UPDATE FOR INGOT TEEMING OR FOUNDRY FILLING PROCESS *Lifeng Zhang*
- PHYSICAL SMS PARSER *Bryan Glass*
- FLUORINATED COMPOUND WITH KINASE INHIBITOR ACTIVITY *Prakash Reddy Reddy; Nanditha G. Nair*
- IMPROVEMENTS TO AUTOMATIC DETECTION OF CRITICAL DERMOSCOPY FEATURES FOR MALIGNANT MELANOMA DIAGNOSIS *William V. Stoecker; Randy Moss*
- NEW ADDITIVE MANUFACTURING PROCESS FOR MIXING TOUGH METALS WITH CERAMIC MATERIALS  
*Greg Hilmas; Ming C. Leu*
- KA-BAND (35.5 GHZ) IMAGES OF POLES OBTAINED USING A NOVEL STANDING WAVE REFLECTOMETER WITH AN ELECTRONIC PHASE SHIFTER *Sergiy Kharkivskiy; Reza Zoughi; Mohamed Ahmed AbouKhoua*
- DEPTH CUT CONTROL WITH ABRASIVE WATERJETS: POCKET OUTLINING *Grzegorz Galecki*
- COXAIL CABLE SENSOR *Hai Xiao; Tao Wei; Jun Fan; Songping Wu*
- THE JIKAR-RAGSDALL INDEX (JRI) *Kenneth Martin Ragsdell; Vivek Kulinchandra Jikar*
- A METHOD FOR PRODUCING BIOCOMPATIBLE GLASSES THAT REACT TO FORM BIOLOGICALLY USEFUL MATERIALS *Delbert E. Day; Steven B. Jung*

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*Sergiy Kharkivskiy; Reza Zoughi; Mohammad Tayeb Ahmed*
- PORTABLE INSTRUMENT FOR MEASURING AND TRACKING LIGHT-EMITTING DIODE LUMINOUS OUTPUT FROM TRAFFIC SIGNALS *Suzanna Long*
- A NOVEL SMART AND INTELLIGENT MATERIAL FOR BOTH CONFORMANCE AND MOBILITY CONTROL---A SINGLE PROCESS TO COMBINE GEL TREATMENT AND POLYMER FLOODING FOR ENHANCED OIL RECOVERY *Baojun Bai; Tingji Tang*
- NEURAL NETWORKS AND ADAPTIVE CRITIC DESIGNS FOR POWER SYSTEM STABILIZERS USING WIDE AREA INFORMATION *Ganesh K. Venayagamoorthy*
- MECHANICAL DEVICE FOR POST TENSIONING OF GFRP BARS FOR MASONARY TYPE RETROFIT  
*Antonio Nanni; Piyong Yu; Pedro Silva*
- METHOD FOR WELDING CONDUCTIVE CERAMIC MATERIALS AND COMPOSITES  
*Greg Hilmas; William G. Fahrenholtz; Jeremy Lee Watts; Harlan James Brown-Shaklee*
- OCULAR SURFACE ANALYZER *Mark Kahrhoff; John Crane; Edward Jarka*
- EXTERNAL OPTICAL ADAPTER FOR FTIR (10UMC002, 10UMS004, 10UMS006 AND 10UMS007) *Zhi Xu*
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- HIGH EFFICIENCY SOLID STATE NEUTRON DETECTOR AND SPECTROMETER *Anthony N. Caruso*
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- EYE HANDBOOK *Ron K. (Ken) Lord; Rohit Krishna*
- USE OF DENTIN MATRIX PROTEIN 1 LACZ FOR SCREENING DRUGS IN BONE AND TEETH *Jian Feng*
- DEVELOPMENT OF A SYSTEM FOR DIRECT AND IMMEDIATE NOTIFICATION OF CRITICAL DATA FOR PATIENT CARE *Gary Gaddis; Vijay Kumar; Uttam Garg; Mukut Sharma*
- CELL LINES TO STUDY REGULATION OF BONE FORMATION *Lynda Bonewald; Stacey Woo*
- SYSTEM FOR DIRECT AND IMMEDIATE NOTIFICATION OF CRITICAL DATA FOR PATIENT CARE  
*Vijay Kumar; Mukut Sharma; Garry Gaddis*
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- IMPROVED GROUPS FOR MODULATING THE PROPERTIES OF NUCLEIC ACIDS  
*Samit Shah; Simon H. Friedman; Piyush Jain*
- SYNERGISTIC EFFECTS OF SUPPLEMENTS AND FLAVONOIDS ON NITROUS OXIDE AND CARDIOVASCULAR RISK FACTORS *Asaf Qureshi; Julia Reis; Christopher Papsian; David Morrison*
- SIRNA AGAINST IKKE FOR BREAST CANCER THERAPY *Kun Cheng; Bin Qin*
- PROCESS FOR PURIFYING TOCOTRIENOL *Asaf Qureshi*
- PRESSURE SENSING, WIRELESSLY OPERATED PUMP FOR THE CONTROL OF INTRAOCULAR PRESSURE  
*Rohit Krishna; Peter Koulen; Walter, D. Leon-Salas*
- INJECTABLE AND ATTACHABLE WIRELESSLY OPERATED PRESSURE SENSOR FOR OCULAR APPLICATIONS  
*Rohit Krishna; Peter Koulen; Walter, D. Leon-Salas*



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**University-affiliated entrepreneurs and early stage companies:**

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Take our novel innovations from the laboratory to the marketplace  
with help from the University of Missouri System.

The Enterprise Investment Program plans to invest \$5 million  
to help startup and early stage companies further develop  
and commercialize university technologies.

**ACCEPTING APPLICATIONS OCT. 1 TO DEC. 31**

FOR MORE INFORMATION VISIT [umeip.com](http://umeip.com)



# 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 the Mizzou Advantage.

The purpose of the 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, 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 is strongly positioned to make a difference in the world in these areas by discovering new knowledge, creating technology, strengthening economic development, educating people and delivering services'*

– MU Provost Brian Foster

More information: Contact Meg Phillips, Mizzou Advantage Program Coordinator at 573-884-6197 or e-mail [mizzouadvantage@missouri.edu](mailto:mizzouadvantage@missouri.edu).

[MizzouAdvantage.missouri.edu](http://MizzouAdvantage.missouri.edu)



Updated 8-10-2010



Welcome to the Office of Research, a proud sponsor of the 2010 Missouri Technology Expo. MU has been growing at record rates for the past few years, and the spirit of innovation and discovery are at the heart of this success. This Expo is an important part of that progress, and an opportunity to celebrate our successes and collaborations in the commercial marketplace.

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.

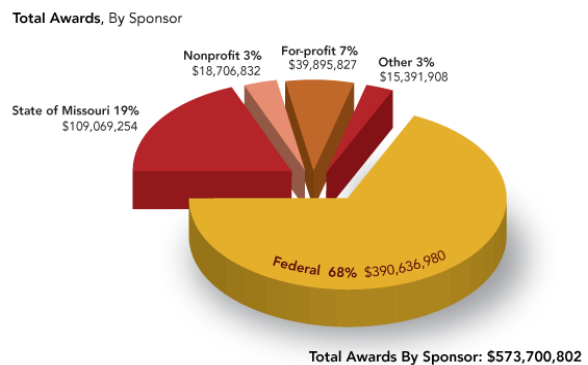
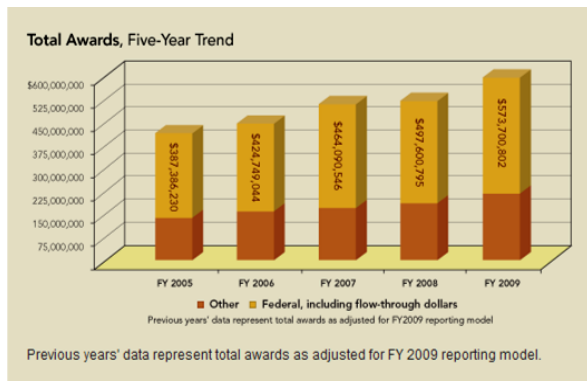
The Office of Research has dedicated staff who work hard to support three main goals:

- 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 and all of the institution's 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.

The Office of Research performs several functions to meet these objectives. These include 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, 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. These Centers collectively offer over a four-to-one return on investment, and do over \$55M in business each year.

Studies have shown that MU research creates millions in economic development dollars, funds that contribute to the creation and retention of thousands of Missouri jobs. The University has estimated, for example, that the \$750 million in economic activity generated by MU last year was roughly equivalent to 75 companies with revenues of \$10 million each.







University of Missouri  
 Office of Technology Management  
 and Industry Relations  
*Creating value for tomorrow*

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](mailto: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 been 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 the inventors to collect all necessary documentation, docket patent actions, manages financial records, and provides general support to the OTMIR team. The staff handles all NDAs and MTAs, 190 and 247, respectively, in FY2009.



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**INTELLECTUAL PROPERTY AND LICENSING UNITS (IPLUs)** are strategically located in proximity to the faculty within their area of expertise. The IPLUs work with the inventors to analyze their inventions for novelty, intellectual property protection, market potential, and to identify commercialization strategies. 106 disclosures were analyzed by the IPLUs in FY2009, 31 licenses and options were executed, and more than \$10M in revenue was generated for MU.

**AGRICULTURE-LIFE SCIENCES**  
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**Recruiting**  
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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](http://www.missouribusiness.net)

The **Missouri Small Business and Technology Development Centers** assist entrepreneur 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.

**University of Missouri-Columbia Statistics – Fiscal Years 2007-2009**

**The Central Region results (the entire Business Development Program result in parenthesis):**

- Sales increases totaling \$79 million (total in network \$436.7 million)
- Investments totaling \$49.6 million (total in network \$322.7 million)
- 6,255 jobs created or retained (total in network 30,249 jobs created or retained)
- Procurement awards totaling \$274.8 million (total in network \$970.3 million)
- SBIR/STTR/Other research awards totaling \$5.7 million (total in network \$21.9 million)
- We assisted 1,784 clients (a total of 11,171 clients in network )
- We educated 3,900 training participants (a total of 42,774 training participants in network)

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



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### PRESIDENT

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### What is REDI?

Organized in 1988 to promote positive economic expansion in Columbia and Boone County, REDI is a nonprofit, public/private partnership that works to provide increased economic opportunities for the area while maintaining a high quality of life. To join, contact J. Michael Brooks @jmbrooks@gocolumbiainc.com and visit our website: www.columbiaredi.com.

### What Area Companies has REDI Assisted?

Working towards new business recruitment, existing business retention and expansion and new business start-ups, REDI has helped numerous area companies. Just a few of the many area companies that have located or expanded here with REDI's assistance include:

■ IBM - On May 17, 2010 IBM officials announced they will be locating a technology service delivery center on LeMone Industrial Blvd. The operation will employ up to 800 by the end of 2012.

■ ABC Laboratories, Inc. - In 2010 the company announced a \$4.2 million expansion for its laboratory space located at its original campus.

■ NEWSY.COM - Media Convergence Group LLC - started an internet based multi-perspective news service in Columbia in 2008. REDI used Flexible Incentives to assist.

■ PetScreen, Ltd - Located US headquarters at the MU Life Sciences Business Incubator in 2009. REDI used Flexible Incentives to assist.

■ Immunophotonics - Located in the MU Life Science Business Incubator, Immunophotonics offers a new form of cancer treatment and was awarded REDI's Flexible Incentive funding in 2009. Human trials begin in 2011 at the Ellis Fischel Cancer Hospital.

REDI seeks businesses that complement Columbia's existing quality of life. A typical REDI target is a company that needs a highly skilled labor force and a central US location on an interstate, as well as a company that wants to be in a community known for its excellent quality of life.

Many techniques are used to find the right companies for Columbia, including joint marketing with the University of Missouri, promoting the unique strategic advantages and working as members with KCADC, MEDC, and IEDC. REDI works closely with the Missouri Partnership and participates in trade shows and marketing trips.

### REDI Meetings Fiscal Year 2011

REDI Board Meetings are open to the public. Board meetings are scheduled for the second Wednesday of the month at 11:30 a.m. The meeting location is posted on the events page of www.columbiaredi.com. Plan to join us. Scheduled meetings and events are:

- October 7, 2010 - Missouri Technology Expo - Panelists
- October 13, 2010 - Board Meeting
- November 10, 2010 - Board Meeting
- December 8, 2010 - Board Meeting
- January 12, 2011 - Board Meeting
- February 4, 2011 - Entrepreneurs' Summit
- February 9, 2011 - Board Meeting
- March 9, 2011 - Board Meeting
- April 13, 2011 - Board Meeting
- May 11, 2011 - Board Meeting
- June 8, 2011 - Board Meeting
- July 13, 2011 - Board Meeting
- August 2, 2011 - Annual Investors' Meeting
- September 9, 2011 - Board Meeting