A CLOSER LOOK

BME researchers win NIH grant for artery imaging; score perfect 10 with NIH

A team of biomedical researchers from Case Western Reserve University and University Hospitals Case Medical Center hopes to give doctors an unprecedented look at stents in the living heart.

Every year, hundreds of thousands of stents are deployed in ischemic heart disease patients to restore blood flow in blocked arteries. While treatment has improved, a percentage of the tiny mesh devices still fail because of blood clots or continued plaque buildup.

With the help of a $1.7-million grant from the National Institutes of Health's National Heart, Lung and Blood Institute, the research team is pairing Optical Coherence Tomography (OCT) with high-speed computer analysis software that will allow clinicians to spot arterial trouble spots in minutes.

Collaborators on the proposal—which earned a perfect 10 from the NIH—include Case School of Engineering professors of biomedical engineering David Wilson and Andrew Rollins, and Hiram G. Bezerra, assistant professor of cardiology at Case Western Reserve School of Medicine and medical director of the Harrington Heart and Vascular Institute at UH.

NEWS AND BREAKTHROUGHS
FROM THE CASE SCHOOL OF ENGINEERING

SPRING 2014

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CASE WESTERN RESERVE WINS MULTIPLE ARPA-E AWARDS

Puts university among top five universities leading Department of Energy ARPA-E projects nationally.

Two research teams from Case Western Reserve University recently won funding from the U.S. Department of Energy's Advanced Research Projects Agency - Energy (ARPA-E), putting the university among the top five universities in the country leading ARPA-E grants.

One team, led by associate professor of chemical engineering Rohan Akolkar, is testing a new method for extracting titanium that is more efficient and could cut the cost of the precious metal by up to 60 percent. This process, called electrowinning, directly extracts titanium from molten titanium salts—essentially cutting out several energy-intensive steps required in conventional extraction methods.

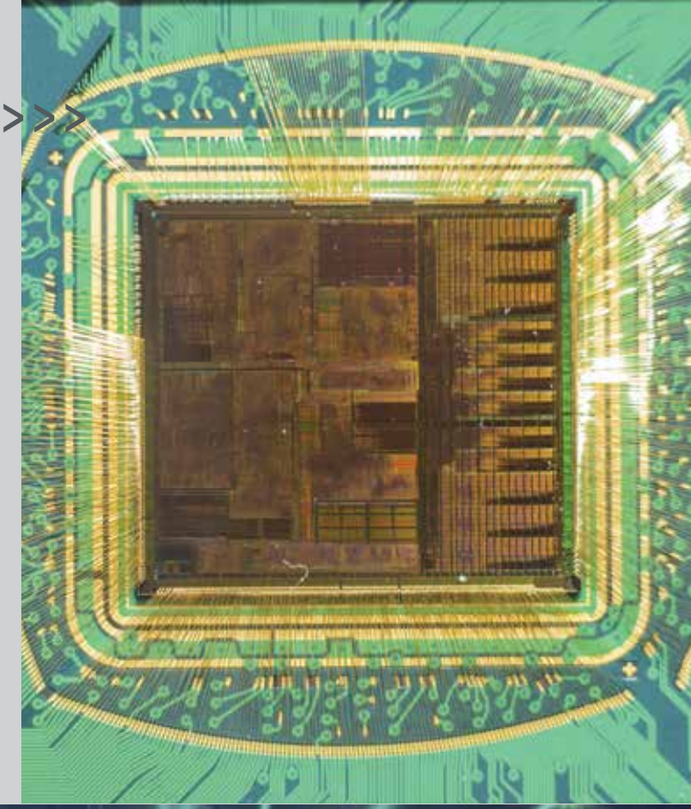
A second team led by associate professor of materials science David Matthiesen won renewed funding to continue its work on a cheaper, more eco-friendly material to make magnets for use in green energy technology like wind turbines and electric vehicles. They may have honed in on alternative material capable of producing magnetic powder that's about 80 percent cheaper than the neodymium-iron-boron powder that's currently used in the world's strongest magnets.

The university's other ARPA-E-funded initiatives include an iron-and-water flow battery, titanium-based capacitors and technology that can derive biofuel from algae.

Learn more at engineering.case.edu/ARPA-E-lead.

SUPER-SMALL SWITCHES

Nanoscale switches hold promise for energy-efficient electronics.

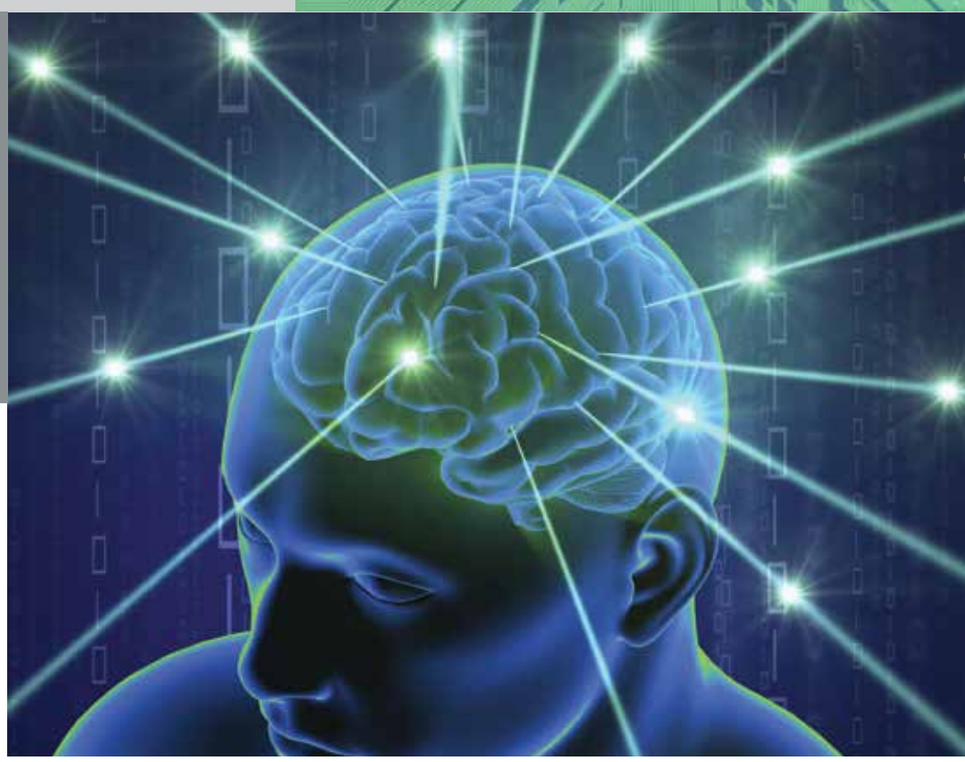


Researchers at Case Western Reserve University have built nanoscale electromechanical switches that operate more energy efficiently than those now used by the billions in computers, tablets and smart phones.

Philip Feng, professor of electrical engineering and computer science, and his team used silicon carbide to construct the ultra-tiny switch. Its only moving part is about one cubic micron in volume—more than a thousand times smaller than devices made in today's mainstream microelectromechanical systems (MEMS). Its nanoscale size means the switch can flip faster. Feng's switch is also much lighter than its transistor-based counterparts and it doesn't suffer from the energy-wasting current leakage that plagues today's smallest electronics.

Learn more at engineering.case.edu/switches-IEDM-2013.

Robert F. Kirsch is appointed chair of the Department of Biomedical Engineering.



MRI-GUIDED HEART CATHETER

Driven by magnetic forces, the device could provide real-time images of beating heart.

Researchers at Case Western Reserve University have developed a robotic, MRI-guided catheter that could help doctors navigate through the heart's chambers in real time.

The research team, led by M. Cenk Cavusoglu, professor of electrical engineering and computer science, will use a $1.3-million grant from the National Institutes of Health to refine the technology over the next four years.

Researchers hope the device will be able to improve ablation treatment for atrial fibrillation.

Learn more at engineering.case.edu/robotic-heart-catheter.

BETTER BRAIN IMPLANTS

BME researchers win $1.8M from NIH to fight implant failure.

Designed to root out intruders, the immune system is a strong defense against disease, but is also a hurdle to successful biomedical implants like brain-computer interfaces.

These devices use electrodes implanted in the surface layers of the brain to connect patients to machines to achieve a variety of outcomes, from restoring movement to paralyzed muscles to recording brain activity.

Brain cells sustain damage when any electrode is implanted. This damage activates the body's immune response, which causes pro-inflammatory molecules to accumulate around the implant site, further damaging surrounding cells and compromising the device.

A research team led by assistant professor of biomedical engineering Jeffrey Capadona won a $1.8-million grant from the National Institutes of Health to study ways to increase the lifespan of brain-computer interfaces. They've identified an innate immunity pathway that appears to dominate the brain's negative response to the implants. They'll investigate how inhibition of that pathway, either genetically or with an experimental drug, could limit damage and improve the longevity of implants.

Learn more at engineering.case.edu/NIH-brain-implants.

NO PRESSURE NANODIAMONDS

Researchers use plasma to grow nanodiamonds in the lab.

Growing diamonds the natural way takes a couple billion years, colossal pressure and volcanic heat. Researchers at Case Western Reserve University have found a way to produce synthetic nanodiamonds at atmospheric pressure and near-room temperature.

The discovery holds promise for uses in a number of technological and industrial applications, from ultrafine diamond powder coatings for advanced plastics to biomedical implants to drug-delivery devices.

The key to the new technique is a microscale plasma. Project leader Mohan Sankaran, associate professor of chemical engineering, describes the process as relatively simple—flowing mixtures of ethanol vapor and hydrogen gas through the microplasma leads to gas dissociation and the formation of diamond nanoparticles.

Learn more at engineering.case.edu/nanodiamonds.

MASS-PRODUCING NANOPARTICLES

NSF grant to help researchers streamline manufacturing process.

A team of researchers from Case Western Reserve has received a grant from the National Science Foundation's Division of Civil, Mechanical and Manufacturing Innovation to streamline the manufacturing and assembly of nanoparticles.

Nicole Steinmetz, assistant professor of biomedical engineering, and Rigoberto Advincula, professor of macromolecular science and engineering, are focusing on two-sided particles known as Janus particles.

These two-faced molecules have a number of potential applications, including drug delivery and electronics. The researchers hope to simplify the manufacturing process so that pharmaceutical developers, electronics manufacturers and other businesses can take advantage of the particles' benefits.

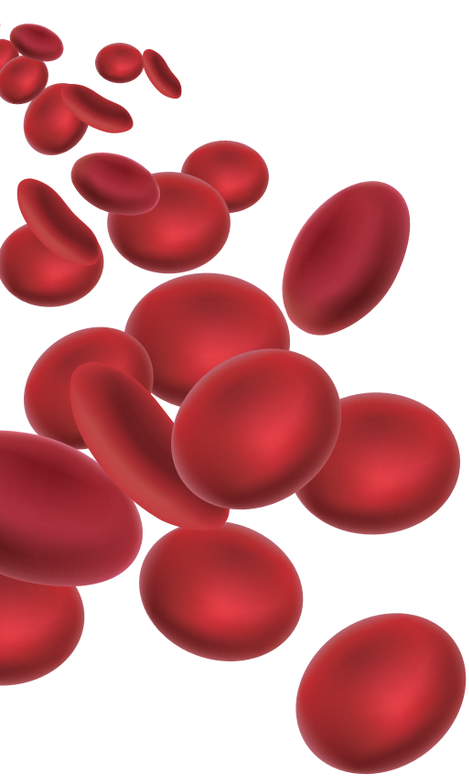
GEO-TECH UPGRADE

Renovated geotechnical lab announced.

A gift from the Rollin M. Gerstacker Foundation will fund the renovation of the geotechnical lab in the Department of Civil Engineering and name the space in honor of alumnus and philanthropist Frank Gerace.

Gerace graduated with a degree in civil engineering in 1948 and went on to a successful career in the construction industry. He continued to devote time and resources in service of his alma mater, including providing for the civil engineering department's strong wall.

Renovations to the new Francis Edward Gerace Geotechnical Laboratory are scheduled to begin this academic year.



FIGHTING SICKLE CELL DISEASE

Researchers win Doris Duke Foundation grant to develop a quicker test.

In sickle cell disease, a patient's red blood cells change into sickles or crescents that stick together and block the flow of healthy cells, causing pain and swelling.

A team of researchers from Case Western Reserve University is developing a test that could detect these changes before the painful episode starts, which could help prevent the crisis entirely and monitor patients more effectively.

Project leader Umut Gurkan, assistant professor of mechanical and aerospace engineering, and his team won a grant from the Doris Duke Foundation to design an at-home test that will provide patients and their doctors information about the physical properties of their red blood cells in minutes.

Learn more at engineering .case.edu/Gurkan-Doris-Duke.

PRODUCT PLACEMENT

Student entrepreneurs show off bright ideas at mega trade show.

Seven student companies from Case Western Reserve University showcased their products in front of more than 150,000 people—including potential partners and investors—at the International Consumer Electronics Show (CES) in Las Vegas in January.

The young entrepreneurs were located in a new section of the CES exhibit hall dedicated to higher education, and the Case Western Reserve booth was dominated by students and student-made products.

The Case Western Reserve companies on display included Carbon Origins, which designs rockets and other systems to carry payloads into sub-orbital space; Disease Diagnostic Group LLC, which is field-testing a hand-held malaria detection device; EcoSpinners, which is producing a fuel-cell-powered electric bike; EveryKey, which created a wireless wristband that can unlock phones, tablets, bike locks or other personal property; Sprav Water LLC, which developed a smart water meter for showers; and Widdle, an app that helps clean up social networks.

GOING GLOBAL

Chemical engineering professor Daniel Lacks and a team of graduate students traveled to Myanmar to teach an intensive two-week course in International Engineering Entrepreneurship—the first U.S. college class taught in Myanmar in the country's history, according to the U.S. State Department.

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UMC-2856_2014w

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