MAKING DIAGNOSES MORE PERSONAL

New Center for Computational Imaging and Personalized Diagnostics develops computer-aided evaluations for diagnosis and prognosis predicitions.

A new center within the Department of Biomedical Engineering at the Case School of Engineering seeks to develop innovative ways to quantitatively describe disease morphology and subsequently build new predictors for distinguishing more and less aggressive forms of diseases, including tumors of the prostate, breast, pharynx and brain; lung inflammation; carotid plaque; and epilepsy. The 14-member center, which collaborates closely with the university's School of Medicine and the Case Comprehensive Cancer Center, also seeks to develop novel ways to perform image-guided interventions and to evaluate responses to treatment.

Founded by associate professor Anant Madabhushi, who joined the Case School of Engineering faculty from Rutgers University, the Center for Computational Imaging and Personalized Diagnostics is currently conducting research on more than 30 projects, including ones sponsored by the Department of Defense, NIH, NSF and University City Science Center's QED program.

NEWS AND BREAKTHROUGHS
FROM THE CASE SCHOOL OF ENGINEERING

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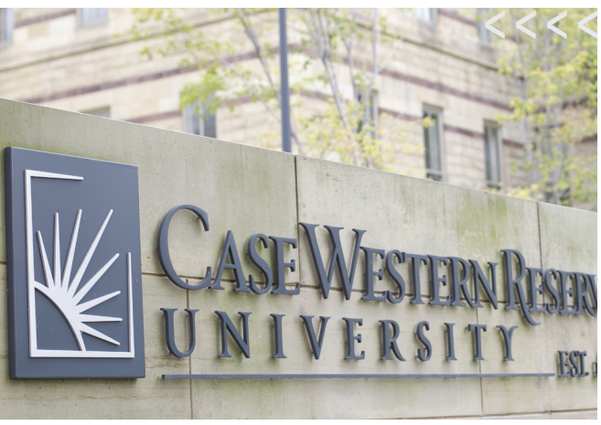
SPRING 2013



CSE LAUNCHES NEW MASTER'S PROGRAMS

Tracks in wireless health, fire science and engineering, and translational health technology offer advanced training for evolving workforce.

The Case School of Engineering has launched new master's degree programs that offer specific training in wireless health, fire science and engineering, and translational health technology. Full-time students can earn degrees in a year or less, and part-time students in two or three, depending on the program. The compact schedule caters to working engineers and scientists and is designed to help make pursuing an advanced degree more affordable.

The Translational Health Technology program begins this fall and is designed for science and engineering undergraduates who want to be project managers or run a startup, and for health care professionals who want to learn about turning ideas for biomedical treatments and technologies into real uses in a clinical practice.

The fire science and engineering master's, also beginning this fall, focuses on the scientific disciplines of combustion, found in mechanical engineering, and flammability, found in macromolecular science and engineering.

Wireless health takes advantage of the same technologies that enable people to connect and compute, work, watch TV and movies, shop, socialize and play games almost anywhere. But the focus is on developing devices to monitor and improve health. The first class of wireless health master's students graduates this May. Applications for all three programs are being accepted for fall.

The three new degrees were created based on input from more than 60 local and national companies and nonprofits.

>>> CATCHING THE WIND >>>>>>>>

CWRU engineers to design offshore wind farm.

Case School of Engineering is bringing more wind power innovation to Northeast Ohio. The school is partnering with LEEDCo as part of a regional team that won a $4-million grant from the U.S. Department of Energy (DOE) on the "Icebreaker" project to design a wind farm off the shores of Lake Erie.

Led by associate professor David Matthiesen, the Case School of Engineering team has been collecting and analyzing data on Lake Erie wind and ice conditions and will be assessing the geotechnical characteristics of the lakebed to determine ideal sites for the turbines and testing materials designed to keep blades ice-free. Their research is furthering the LEEDCo team's goal to identify innovative engineering methodologies that will lower the cost of offshore wind energy.

The DOE will fund the construction of three of seven competing proposals. Learn more at **engineering.case.edu/Lake-Erie-windfarm**.

DEAN HONORED BY ACADEMY OF RADIOLOGY RESEARCH

Case School of Engineering Dean Jeffrey L. Duerk was elected a Distinguished Investigator of the Academy of Radiology Research, an alliance of 27 professional imaging societies from around the world.

The award recognizes individuals for their accomplishments in the field of biomedical imaging research. This is the first year the award has been bestowed, and only 70 researchers from around the world were inducted into the inaugural class.

>>> GOING GREENER

$3.8M NSF grant to produce green energy technology from biomaterials.

Case Western Reserve's Ica Manas-Zloczower has won a $3.8-million grant from the National Science Foundation to lead an international effort to reduce oil dependency by incorporating biomaterials into sustainable energy technology like wind turbine blades and solar panels.

With the help of the five-year award from the NSF's Partnership for International Research and Education Award, scientists and engineers from eight universities will first try to improve the quality and performance of existing materials. They will then gradually replace unsustainable ingredients with those derived from plants, bacteria and fungi—renewable sources that reduce the environmental impact of production and disposal.

In addition to developing materials, the partner universities will develop new classes and online resources to help educate the next generation of scientists working in sustainability.

Learn more at **engineering.case.edu/PIRE-grant**.

A CLOSER LOOK

3-D stress maps zero in on heart defects.

Researchers at the Case School of Engineering have discovered how to create three-dimensional maps of stress in the developing heart—a key to understanding what factors trigger heart defects.

A team led by biomedical engineering associate professor Andrew Rollins modified an imaging technique called Doppler optical coherence tomography (OCT), which creates a 3-D image using reflections from an infrared laser in much the same way sonar uses sound waves to detect objects.

Researchers are using Doppler OCT to map shear stress—the force passing blood cells put on the endothelial cells that line a growing heart. Shear stress has been linked to changes in gene expression that result in defects—particularly those that occur in heart valves—but the precise connection has eluded scientists.

Rollins says alcohol exposure might affect shear stress by modulating the heart rate, but there could be other factors at work. His team is currently using the 3-D mapping technology to test the effects of alcohol and selective serotonin receptor inhibitors on shear stress in an embryonic biologic model. They hope to further refine the technique to uncover how alcohol, drugs and other factors trigger birth defects in humans.

Learn more at **engineering.case.edu/3D-stress-map**.

SMARTER STORAGE

ARPA-E grant helps researchers build a higher-capacity flow battery.

A more efficient flow battery designed by researchers at the Case School of Engineering could improve the efficiency of the power grid and accelerate the addition of renewable sources of power.

Chemical engineering professors Robert Savinell and Jesse Wainright have been fine-tuning their iron-and-water flow battery for more than a year. Now, with the help of a grant from the Department of Energy's Advanced Research Projects Agency – Energy (ARPA-E), they are maximizing the efficiency and utility of their "rustbelt" battery.

The key is a new battery architecture that pumps up the energy storage capacity and improves power density by replacing the conventional solid electrode with a conductive slurry that can convert chemical energy to electrical and vice-versa. The slurry can be stored in a separate tank and pumped in as needed, allowing the battery to provide steady power for longer stretches of time.

Learn more at **engineering.case.edu/ARPA-E-funds-flow-battery**.

INSPIRED BY NATURE

CWRU polymer scientists invent a more natural artificial lens.

Designed to more closely mimic the human eye, artificial lenses developed at the Case School of Engineering could improve vision for patients with eye disease as well as boost the performance of consumer vision products and surveillance equipment.

The new technology refracts light using gradient refractive index optics—or GRIN—the same mode of refraction used by human and fish eyes. Traditional artificial lenses refract light due to their contoured shape, whereas the GRIN lenses have the same contour plus additional internal light-bending abilities.

The team, led by professor Eric Baer, replicated nature's model by stacking thousands of transparent nanoscale polymer layers. The resulting lenses have many advantages, including a wider field of view and the ability to reduce the size and weight of the optic systems into which they are placed.

Case School of Engineering's undergraduate biomedical engineering program is ranked No. 8 in nation by *U.S. News & World Report*.

SMALL WONDERS

Researchers develop technology to mass-produce nanoscale electronics.

A team of engineers from Case Western Reserve has won a $1.2-million National Science Foundation grant to develop technology and techniques for mass-producing flexible nanoscale electronics.

Ultimately, scientists aim to build ultra-tiny devices for a variety of applications, including miniature wireless sensors that can be implanted under the skin, smart clothing and electronic paper. But the industry standard production method for the nano-sized components that will make up these devices—electron beam lithography—is expensive, time-consuming and not well suited for polymer-based devices.

The four-year project, led by electrical engineering and computer science associate professor Christian Zorman, will develop an alternative technique that uses microplasmas made from ionized argon gas to build wires and other structures narrower than a puff of smoke—less than 100 nanometers in diameter.

Learn more at **engineering.case.edu/flexible-nanoscale-electronics.**

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STUDENT STARTUPS SHINE

CWRU student-led startups are glowing at design competitions across the region.

Disease Diagnostic Group LLC—aimed at saving lives through faster, better and cheaper malaria diagnosis—recently won the 2013 LaunchTown Entrepreneurship Business Idea Competition at the University of Akron, and also placed ninth—out of 1,200 entries—at the Rice Business Plan Competition, the world's richest and largest business plan competition. The simple tool, constructed from refrigerator magnets and a laser pointer, was created by company CEO John R. Lewandowski, a master's in engineering and management student, and his brother Mark, a first-year student who plans to major in computer science and accounting.

Another student startup, electric-bicycle designers EcoSpinners, made it to the regionals of the Clean Energy Challenge in Chicago this April. EcoSpinners' bicycle can assist riders up hills or as they tire, over a range of about 100 miles with zero emissions, according to team leader Jean Zhao, a third-year chemical engineering major, and Justin Einstein, a master's of engineering and management student.

Both groups are continuing work on their inventions and hope to bring them to market.

BRIDGE REHAB

Two 13,000-pound wooden bridge trusses from an 86-year-old New Hampshire bridge recently burned by arson were reconstructed at Case Western Reserve to study rehabilitation techniques for this historic bridge design.

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