CYBER-SLUGS

Worm-like robot designed to go where people can't.

Case Western Reserve engineers and biologists have designed a worm-like robot that could wend its way through rubble as an emergency responder or sneak into buildings through pipes to gather intelligence.

Soft-bodied animals like worms are some of nature's best at navigating rough and rugged terrain. Translating this ability to robots could enhance their ability to go where people can't, says lead researcher and mechanical engineering professor Roger Quinn. The work illustrates how biology can inspire cutting-edge devices, according to biology professor Hillel Chiel, co-director of the project.

Researchers used a flexible braided mesh material and steel cable to replicate the smooth, fluid motion of the robot's counterparts in nature.

In addition to navigating through collapsed buildings and leaky water mains, researchers hope that a smaller-scale version of the hollow robot could even be used inside the body to take biopsies and help diagnose diseases like colon cancer.

NEWS AND BREAKTHROUGHS
FROM THE CASE SCHOOL OF ENGINEERING

SPRING 2012

next

ENGINEERING SCHOOL ANNOUNCES NEW DEAN, MAJOR GIFTS

Jeffrey L. Duerk oversees $11 million in gifts, including $5 million for Think[Box] program.

The Case School of Engineering is proud to announce the appointment of its new dean—former biomedical engineering department chair Jeffrey L. Duerk.

The school recently announced $11 million in new gifts under Duerk's leadership, with more than $5 million going to support the university's Think[Box] program, an initiative designed to provide space and resources to help students and researchers bring their ideas to life—and to market.

The gifts include the $5-million pledge for Think[Box] from university trustee Larry Sears and his wife, Sally Zlotnik Sears, an additional $500,000 for Think[Box] from an anonymous donor and other funds for scholarship support.

An accomplished scientist who earned his PhD at the School of Engineering, Duerk has been on the faculty since 1988. He has a successful record of securing significant research funding, including a landmark $20-million endowment for translational research between Case Western Reserve and the Wallace H. Coulter Foundation that supports the translation of academic research to patients via commercial products and treatments that address unmet clinical needs. The endowment resulted in large measure from Duerk's efforts encouraging innovative research among faculty and demonstrating the promise of that work to the Coulter Foundation.

"I am honored by the opportunity to lead a school with a long and proud legacy of impact and innovation," Duerk says. "I look forward to working closely with faculty, staff, students and alumni to capitalize on our existing strengths and identify new areas of promise."

CLIPS FUNDING RENEWED

$40 million over 10 years supports breakthroughs in polymer science.

Case Western Reserve's Center for Layered Polymeric Systems (CLiPS) has earned another five years of funding from the National Science Foundation (NSF). The renewal means that CliPs will have secured nearly $40 million in funding over 10 years.

The NSF established CLiPS as its first Science and Technology Center at Case Western Reserve with an initial $19-million grant in 2006. Its researchers use ultra-thin polymer layers to develop new materials and material systems for a range of applications, from bio-inspired lenses that could help solar panels capture more light to new capacitor films that increase energy storage density.

NSF Science and Technology Centers explore advanced research in technology through long-term interdisciplinary partnerships. The awards are highly selective—CLiPS was one of six centers established in 2006 out of more than 160 competitors. There are currently 17 active centers in the United States.

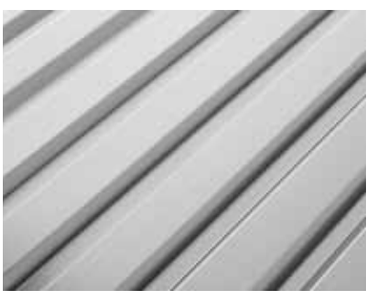
HONORS AND AWARDS

Meral Ozsoyoglu (Electrical Engineering and Computer Science) has been named a fellow at the Association for Computing Machinery—the first Case School of Engineering faculty member to be honored by the ACM.

The American Chemical Society (ACS) has named **Eric Baer** (Macromolecular Science and Engineering) as a fellow.

Ozan Akkus (Mechanical and Aerospace Engineering) has been elected as a fellow of the American Society of Mechanical Engineers and has received the J.R. Neff award from the Musculoskeletal Transplant Foundation.

Andrew Rollins and **Mark Griswold** (Biomedical Engineering) have been named fellows of the American Institute for Medical and Biological Engineers.



DOD GRANTS FUND MATERIALS RESEARCH

Funding focuses on amorphous metals and aluminum alloys.

John J. Lewandowski, professor of materials science and engineering and director of the Center for Mechanical Characterization of Materials, has received three grants from the U.S. Department of Defense totaling more than $1.38 million.

Two grants—one from the Army and the other from the Defense Threat Reduction Agency—focus on amorphous metals, like metallic glass. These materials boast exceptional strength and corrosion resistance, making them ideal for use in various defense application systems. The third grant, from the Navy, targets the performance of aluminum alloys under extreme conditions.

INSPIRED BY NATURE

Researchers study natural systems to improve computer vision.

Electrical engineering and computer science researcher Mike Lewicki has received a $1.8 million four-year grant from the National Science Foundation to study how vision works in nature and apply that information to computer systems.

While the human brain effortlessly perceives the complex world around it, computers can't quite mimic the same behavior. Lewicki is working along with colleagues at the University of Texas at Austin and the University of California at Berkeley to better understand how human brains process and interpret vast amounts of visual information by studying motion in natural scenes. A better understanding of the science behind perception could help computer engineers design programs that "see" more naturally.

>>>OVERDRIVE>>>>>>

Drive simulators put researchers behind the wheel.

At the Case School of Engineering's driving simulation lab, researchers study everything from distracted driving to technology that prevents dozing off behind the wheel—all in computer-simulated safety.

The Department of Civil Engineering is home to two high-fidelity drive simulators, including one with a 360-degree wraparound display powered by nine different computers. The display is programmable for a host of variables, like weather and road conditions, other vehicles, pedestrians and even virtual animals to avoid. In addition to providing a realistic test environment, the simulators track and record driver data, like pressure applied to the gas or breaks and degrees turned by the steering wheel.

The lab's director, associate professor of civil engineering Xiong "Bill" Yu, is currently using the simulator to test sensors that detect and alert drowsy drivers.

ENGINEERS DEVELOP PLASMA ELECTRODE

Stable plasma discharges could create new opportunities for battery and fuel cell design.

Engineers at the Case School of Engineering have made an electrochemical cell that uses a plasma for an electrode, instead of solid pieces of metal.

"Plasmas are a source of electrons for many applications, but plasmas formed at ambient conditions are normally sparks that are uncontrolled, unstable and destructive," says Mohan Sankaran, chemical engineering professor and senior author of the paper. "We've developed a microplasma source that is stable at atmospheric pressure and room temperature, which allows us to study and control the transfer of electrons across the interface of a plasma and an electrolyte solution."

The research team filled an electrochemical cell with electrolyte solutions. In the cathode side, they pumped argon gas through a stainless steel tube placed above a solution of potassium ferricyanide and potassium chloride buffer. When a microplasma formed between the tube and solution surface, they found that ferricyanide was converted to ferrocyanide by electrochemical reduction. The technology may open new pathways for battery and fuel-cell design, making fuel from water or carbon dioxide and synthesizing nanomaterials and polymers.

ENGINEERING REPLACEMENT CARTILAGE<<<<<<

New technology creates stiffer cartilage fast.

A discovery at the Case School of Engineering puts researchers a step closer to developing implantable replacement cartilage, holding promise for knees, shoulders, ears and noses damaged by osteoarthritis, sports injuries and accidents.

The school's biomedical engineers permeated self-assembling sheets of mesenchymal stem cells with tiny beads filled with growth factor. The sheets formed thicker, stiffer cartilage than sheets that lacked this growth factor delivery technology.

Because this approach incorporates signals that promote cartilage formation into the sheets, they could be implanted into patients more quickly than cartilage grown with more traditional techniques, according to biomedical engineering professor Eben Alsberg, the study's senior author.

STUDENT FOCUS

ENGINEERING SOLUTIONS

Students put design skills to work in Senegal.

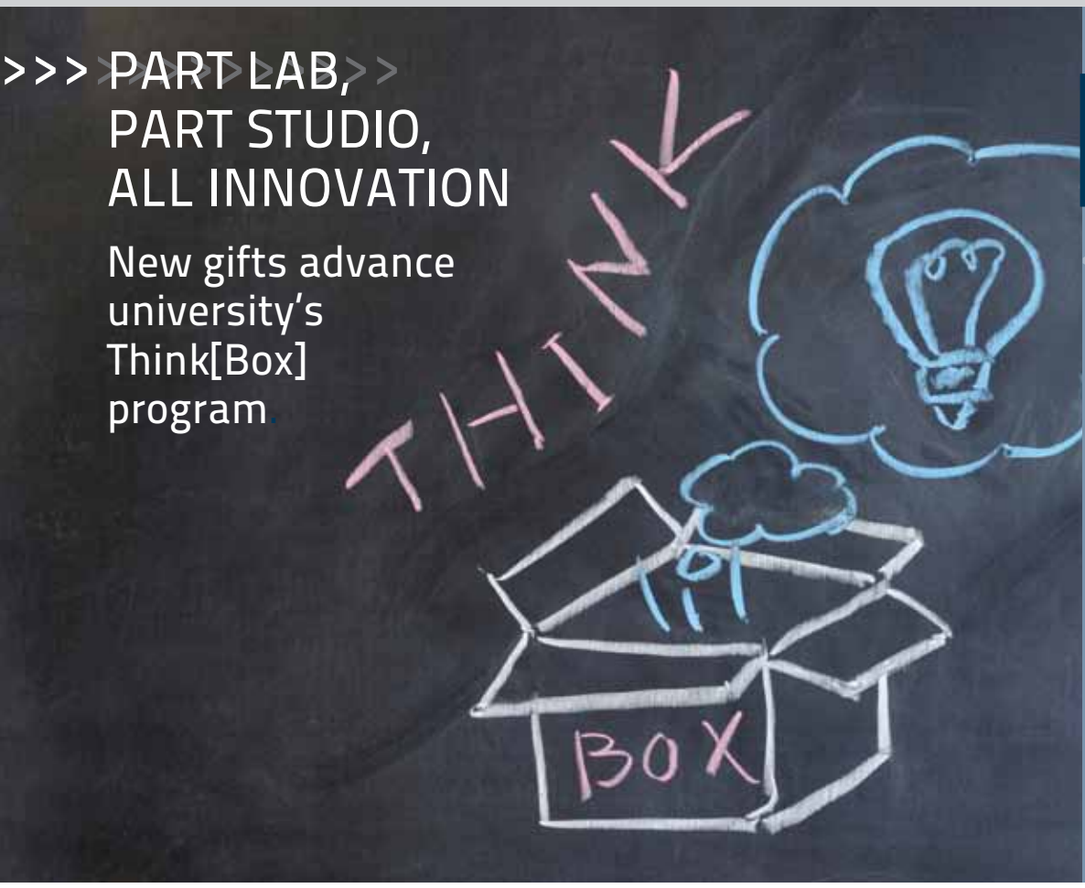
Five senior chemical engineering majors are using their engineering know-how to make life a little easier for residents of a remote village in Senegal.

The students—Robert Armstrong, Timothy Hunt, Andrew Maibach, Mallory Miller and Sean Mulligan—traveled with chemical engineering professor Daniel Lacks and postdoctoral researcher Mamadou Sow to a village in rural Senegal where Sow's cousin is a teacher. They met with villagers to learn about local culture and the challenges of daily life without electricity or running water.

They learned that many residents rely on cell phones, but with no access to electricity, they have to make a daylong trip to the nearest city just to charge their batteries. The students are designing low-cost devices that convert mechanical energy to electrical in order to power the phones—and make life a bit easier for residents.

PART LAB, PART STUDIO, ALL INNOVATION

New gifts advance university's Think[Box] program.



next

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10900 Euclid Avenue
Cleveland, Ohio 44106-7220

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