

**BRACE YOURSELF**

A NEW KNEE BRACE THAT USES “SMART FLUIDS” to provide resistance could change post-injury rehabilitation for millions of people, making repetitive exercises simpler and the needed equipment lighter. Northeastern University mechanical engineer Constantinos Mavroidis and his collaborators have used electro-rheological fluids—materials whose viscosity changes in response to an electric field—to develop actuators that can provide controllable resistance with the flip of a switch. Grafting the actuators onto a standard knee brace converts it into a piece of exercise equipment, which could potentially replace bulky weight machines. And by using a computer to regulate the voltage applied to the actuators, the researchers can vary the brace’s resistance over time, making it smarter than traditional gym machines. Mavroidis would eventually like to license the technology for use in exercise equipment, but for now he’s concentrating on orthotics. An elbow brace should be finished by fall’s end, and Mavroidis has talked with Spaulding Rehabilitation Hospital in Boston, MA, about tests of the knee brace that could begin as early as this fall.



“Smart fluids” control this brace.

**ELFIN AERIAL**

A team at the University of Florida led by electrical engineer Kenneth O has built a tiny antenna that can send a radio signal across a room. Only three millimeters long and 100 micrometers wide, the antenna is the first of its size with so great a range—about five meters. The tiny antenna is an important step toward O’s goal of building an entire radio transceiver on a single microchip. The most likely applications for such radios, he says, are in cheap, robust sensor networks for security systems or for monitoring the safety of bridges or buildings; the radios would send data wirelessly from the sensors to a central monitoring computer. And one company has approached O about using the radios to make interactive toys. He hopes to have built prototypes of complete on-chip radios in about two years; in the meantime, his team is working to improve the antennas’ range to at least 20 meters.

**PHONE IT IN**

PUBLIC TOUCH-SCREEN DISPLAYS SUCH AS AIRPORT CHECK-IN KIOSKS AREN’T known for having versatile interfaces; they usually lack keyboards or pointing devices, limiting users to a few navigational buttons. But new software from High Energy Magic of Cambridge, England, turns a camera phone with a Bluetooth wire-



Circular symbols turn a camera phone into a wireless mouse.

less connection into a portable mouse and keyboard that can take full command of public displays, doing away with the old touch screen. Working with Intel’s Cambridge research lab, High Energy Magic has developed a set of circular symbols, similar in concept to bar codes, that can be displayed by public terminals. Camera phones loaded with the company’s software can translate the symbols into data. Once a phone locks onto one of the symbols, it uses the Bluetooth short-range wireless protocol to send information

about its size, position, and orientation to the computer running the display. The phone can then act as a mouse, manipulating on-screen controls such as scroll bars. The company plans to license the technology to businesses, such as travel agencies, that operate public kiosks.

**STENT AND DELIVER**

DRUG-COATED STENTS—WIRE-MESH TUBES used to prop open clogged arteries—are a boon for heart disease sufferers.

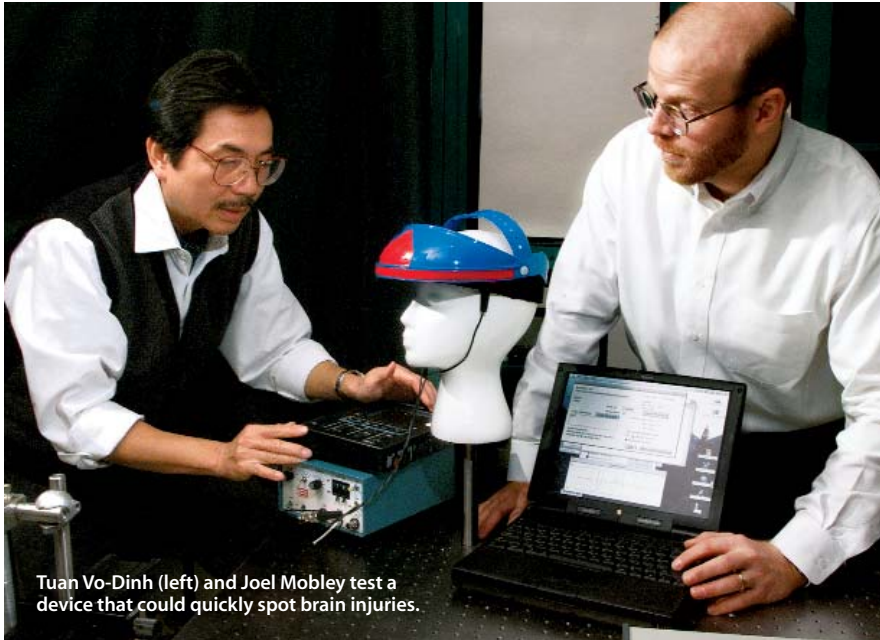
But in time, the body uses up the drug coating, which prevents scar tissue from blocking the artery again. Researchers at Drexel University in Philadelphia, PA, have developed a replenishable stent. Zachary Forbes, a biomedical engineering doctoral student, plated stents with a weak mag-



Nanoparticles carry drugs to the mesh fibers of a stent.

netic alloy. He and fellow grad student Benjamin Yellen then embedded the scar-preventing drugs in biodegradable magnetic nanospheres. To administer the drugs, doctors would inject the nanospheres and switch on an external magnetic field, causing the stent to capture the nanospheres. The scheme would let doctors readminister drugs throughout a patient’s (hopefully long) life, adjusting dosages or changing medication. Forbes and Yellen have formed Magnetic Bio-Systems to commercialize the invention.

COURTESY OF HIGH ENERGY MAGIC (PHONE); ZACH FORBES (STENT); JASON NIKITZUK (BRACE)



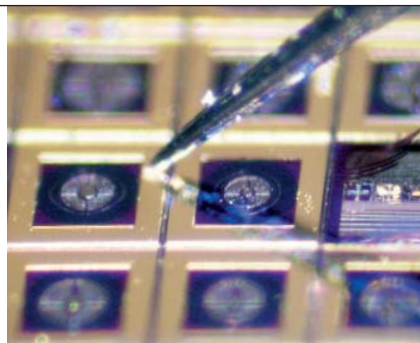
Tuan Vo-Dinh (left) and Joel Mobley test a device that could quickly spot brain injuries.

## HEAD CHECK

ACCIDENT VICTIMS COULD BENEFIT FROM A NEW TECHNOLOGY THAT HELPS paramedics assess brain injury during the crucial first minutes after a blow to the head. Researchers at the Oak Ridge National Laboratory have developed a portable, non-invasive device that uses ultrasound to detect bleeding in the brain. Existing ultrasound technologies produce high-resolution images but require expensive equipment and highly trained personnel. This device, in contrast, doesn't produce an image at all: it simply compares how each side of the brain reflects ultrasound waves and alerts the operator if there are asymmetries or abnormal signals. "We're not trying to replace fancy imaging at hospitals," says Joel Mobley, a researcher who helped develop the technology and now works at the U.S. Army Research Laboratory in Adelphi, MD. "We want to give first responders critical information on what's going on inside the head, so they know where the patient should be taken." Oak Ridge's Tuan Vo-Dinh estimates that it will take one to three years to get the technology licensed and earn U.S. Food and Drug Administration approval.

## LIGHT BOOSTER

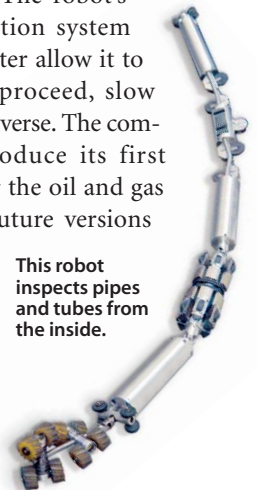
A NEW DEVICE DESIGNED BY GARRETT Cole and Qi Chen at the University of California, Santa Barbara, could help bring fiber-optic connections—and the massive doses of bandwidth they provide—to home Internet users. The device is an inexpensive amplifier that could be used to boost data signals in the critical "last mile" of fiber-optic cable running between a home or neighborhood and the telecom backbone. One of the major hurdles in telecommunications has been the cost of existing amplifiers, such as the sophisticated devices used in the backbone. But the new amplifier can be fabricated the same way computer chips are, without any mechanical assembly, so it promises to be much cheaper. What's more, it's tunable, like a radio dial, so it can compensate for changes in light frequency that confound other inexpensive amplifiers. If a company were to show interest, says Cole, it should take only a few years to develop a commercial device.



Cheap, tunable optical amplifiers like these could help bring fiber-optic connections home.

## INSPECTOR BOT

AN AUTONOMOUS ROBOT COULD SOON save businesses millions of dollars in the inspection of pipelines. Houston-based itRobotics is developing a robot that can travel tether-free, without operator intervention, for kilometers inside tubing and small-diameter pipes, making inspections cheaper and easier and detecting some flaws that aren't detectable from the outside. The trainlike prototype, designed for pipes five to six centimeters across, pulls one or more carts loaded with sensors that detect changes in, for example, magnetic flux, which can indicate wall thinning or cracks. The robot's proprietary locomotion system and onboard computer allow it to decide whether to proceed, slow down, stop, or even reverse. The company plans to introduce its first inspection robot, for the oil and gas industry, this fall. Future versions could inspect plant equipment such as the boilers and heat exchangers found in refineries, chemical plants, and desalination plants.



This robot inspects pipes and tubes from the inside.

## AUTOMATIC HIGHLIGHTS

Don't have time to watch your favorite team? At Microsoft Research Asia in Beijing, China, computer scientists Hongjiang Zhang, Yufei Ma, and Gu Xu have developed software that automatically generates highlight reels from video of sports programs. Import the video onto a PC, and computer vision algorithms recognize objects on the screen, like balls or people. The software then identifies key events, such as the ball going through a basketball hoop or into a soccer goal. "Sport has grammar," says Zhang, and the computer can use that grammar to organize its summary of a game's important plays. Related software can also edit TV programs into segments of interest, such as news and weather forecasts, so the viewer doesn't have to watch an entire broadcast. It's all still being tested, but Zhang says these features could be part of Microsoft home entertainment software within a few years—in time, perhaps, for the 2008 Olympics. Look out, ESPN.