

QUICK TAKES

Quick Takes

@MANUFACTURING WORKS: IEI THEME

Over the next year, the Institute for Emerging Issues at NC State will examine how communities can take advantage of the state's new manufacturing opportunities.

The theme, @Manufacturing Works, is not only for the 28th annual Emerging Issues Forum, to be held Feb. 11-12 at the Raleigh Convention Center, but also for ongoing discussions, explains Anita Brown-Graham, institute director. "The new trends toward higher paying, more skilled manufacturing jobs have the potential of doing great things for North Carolina — if we make the right investments."

Innovative new processes — including many developed and/or adapted by NC State researchers and alumni — are bringing offshore jobs back to the state, and creating highly skilled, high-wage jobs associated with manufacturing.

The February forum will feature Chris Anderson, of *Wired Magazine* and author of the upcoming book *Makers: The New Industrial Revolution*. Earlier events will include the BB&T Emerging Leaders Discovery Forum on Nov. 13 as part of Triangle Entrepreneurship Week.

IEI also offers the third annual Prize for Innovations. Applications are due Nov. 16 for high school and college teams to design a product or tool that will benefit their community. Winning teams will receive \$5,000 to put towards making their idea a reality, as well as a consultation with Louis Foreman, founder of Eventys and CEO of Edison Nation.

MAPPING AGGRESSION

A roadmap to areas of the brain associated with affective aggression — impulsive violent displays without prior planning or deliberation — in mice may help identify therapies for humans suffering from disorders that lead to impulsive violence.

Affective aggression is thought to be caused by aberrant perceptions of, and consequent responses to, threat. Unlike defensive aggression or premeditated aggression used by predators, it could be considered maladaptive.

NC State neurobiologist Troy Ghashghaei in the College of Veterinary Medicine used mice that had been specially bred for affective aggression by his research associate Derrick L. Nehrenberg, Ghashghaei and former undergraduate student Atif Sheikh located regions in the mouse brain that either were switched on or off when the mice displayed affective aggression.

"The brain works by using clusters of neurons that cross-communicate at extremely rapid rates, much like a computer," Ghashghaei explains. "One region will process a stimulus, and then that region sends messages to other clusters within the brain, like circuits within a computer. We looked at how the switches flipped in the brains of aggressive mice, and compared that with the brains of completely nonaggressive mice in the same setting, to see how the two processed the situation differently."

The regions of the brain that were involved in affective aggression in the mice are similar across all mammalian species.



"With the brain, just knowing where to start looking is huge," Ghashghaei says of the finding published online in *Brain Structure and Function*.

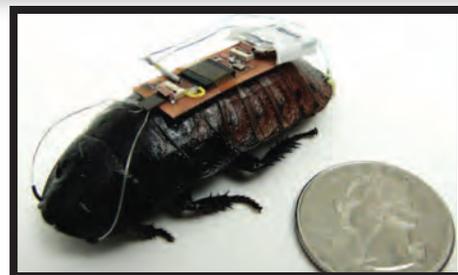
ROACHES TO THE RESCUE

A miniature robot would be perfect for dangerous jobs like searching a disaster site for survivors. But building small-scale robots that can perform in such uncertain, dynamic conditions is extremely difficult, says NC State electrical engineer Alper Bozhurt.

So Bozhurt and his colleagues have developed a technique that uses an electronic interface to remotely control, or steer, cockroaches.

The new technique works by embedding a low-cost, lightweight, commercially available chip with a wireless receiver and transmitter onto each roach. They used Madagascar hissing cockroaches.

Weighing less than a gram, the cockroach backpack also contains a microcontroller that monitors the interface between the implanted electrodes and the tissue to avoid potential neural damage.



The microcontroller serves as electronic reins, injecting small charges into the roach's neural tissue. The charges trick the roach to think that its antennae are in contact with a physical barrier, thus steering it in the opposite direction. See for yourself at: go.ncsu.edu/roachbiobot.

RODENT ROBBERS SPREAD SEEDS

There's no honor among thieves when it comes to rodent robbers — a good thing for tropical trees.

Results of a yearlong study in Panama, published online in *Proceedings of the National Academy of Sciences*, suggest that thieving rodents helped the black palm tree survive by taking over the seed-spreading role of the mighty mastodon and other extinct elephant-like creatures that are thought to have eaten these large seeds.

OPPOSITE PAGE, top: NC State has developed techniques for mass customization in the textile industry. OPPOSITE PAGE, bottom: Cockroaches may become sentinels of safety, using NC State technology. THIS PAGE: Rodents raiding neighbors' seed caches have helped black palm trees survive.



"The question is how this tree managed to survive for 10,000 years if its seed dispersers are extinct," says zoologist Roland Kays, of NC State and the N.C. Museum of Natural Sciences. The international team found that agoutis, rainforest rodents, repeatedly stole from neighbors' underground seed caches. That pilfering moved some black palm seeds far enough from the mother tree to create favorable conditions for germination.

"We knew that these rodents would bury the seeds, but we had no idea that there would be this constant digging up of the seed, moving it and burying it, over and over again," says Kays, a member of the Smithsonian Tropical Research Institute.

Funded by the National Science Foundation, the study used tags on agoutis, video surveillance of seed caches and tiny motion-activated transmitters attached to seeds.

HOMEWORK: WATCH A VIDEO

Curriculum specialist Lodge McCammon at the Friday Institute for Educational Innovation at NC State is helping middle- and high-school teachers to replace classroom lectures with engaging activities.

Teachers videotape lectures. Students can watch as many times as they need, in lieu of traditional homework.

McCammon points out that the teaching program, which he calls the FIZZ learning framework, where the FI stands for Friday Institute, leads to higher-ordered thinking skills.

Award-winning teacher Meredith Cheatham at Exploris Middle School in Raleigh is among those who learned the technique from McCammon.

"Having the majority of lecture

happening at home leaves much more time for problem-solving and practice during class," she says. "When lessons are flipped, you have time for group activities, problems that explore deeper concepts, and mathematical discussions."

Students enjoy the new classroom style too: "The homework in the classroom was nice because you could work with other people and the teacher was nearby if you needed help."

CHANGES IN THE COLLEGES

NC State has new leadership at several colleges this year, and plans for a new College of Sciences in 2013. Three new deans arrived in 2012:

College of Natural Resources Dean Mary Catherine Watzin is former dean of the Rubenstein School of Environment and Natural Resources at the University of Vermont.

College of Veterinary Medicine Dean D. Paul Lunn is former head of the Department of Clinical Sciences at Colorado State University's College of Veterinary Medicine and Biomedical Sciences.

College of Agriculture and Life Sciences Dean Richard Linton is former chair of the Department of Food Science and Technology at The Ohio State University.

The new College of Sciences is set to replace the College of Physical and Mathematical Sciences in July. The new college will encompass physical/chemical sciences, mathematical and statistical sciences, biological sciences, and earth system sciences.

MEASURING UP TO DISCOVERY

Picture a turtle the size of a Smart car, with a shell large enough to double as a kiddie pool. Paleontologists at NC State have found just such a specimen — the fossilized remains of a 60-million-year-old South American giant that lived in what is now Colombia.

The turtle, *Carbonemys cofrinii*, or "coal turtle," is part of a group of side-necked turtles known as pelomedusoids. The fossil was discovered in a coal mine that was part of northern Colombia's Cerrejón formation. The specimen's skull measures 24 centimeters, roughly the size of an NFL football, and the shell measures 172 centimeters, or about 5 feet 7 inches. That's the height of Edwin Cadena, the doctoral student who discovered the fossil.

In addition to the turtle's huge size, the fossil also shows that this turtle had massive jaws that would have enabled the omnivore to eat anything nearby — from mollusks to smaller turtles or even crocodiles.

The paleontologists' findings appear in the *Journal of Systematic Palaeontology*. Carlos Jaramillo from the Smithsonian Tropical Research Institute in Panama and Jonathan Bloch from the Florida Museum of Natural History contributed to the work. The research was funded by grants from the Smithsonian Institute and the National Science Foundation.

RESPONDING TO CARBON CHANGES

In a surprising finding, NC State researchers have shown that certain underground organisms thought to promote chemical interactions that make the soil store carbon actually play a more

continued

complex, dual role when atmospheric carbon levels rise.

In findings published in *Science*, the researchers show that important and common soil microscopic organisms, arbuscular mycorrhizal fungi (AMF), play a role in sequestering carbon below ground, trapping it from escaping into the atmosphere as a greenhouse gas.

The study also shows, elevated levels of atmospheric carbon dioxide increase a number of underground decomposing interactions that cause carbon to be released back into the atmosphere as a greenhouse gas. This release essentially offsets any carbon sink benefits.

"We showed that the fungi previously thought to control carbon in the soil can increase carbon decomposition when atmospheric carbon dioxide levels are elevated," says NC State plant pathologist Shuijin Hu, corresponding author of the paper. "But if we effectively manage the nitrogen transformation process in the soil, we have a chance to manage carbon sequestration in the soil."

The study was funded by the U.S. Department of Agriculture.

HOSTING SCIENCE WRITERS

Five NC State experts are among a national lineup for the New Horizons in Science briefing of the Council for the Advancement of Science Writing.

The Research Triangle — including universities, agencies and research centers — is hosting Science Writers 2012 from Oct. 26 to 30. The event also includes the National Association of Science Writers conference.

"North Carolina is working hard to turn its research into products, technologies and jobs, and so you'll see much applied science on the New Horizons program," explains Rosalind Reid, program director.

NC State researchers invited to present briefings are: Elizabeth Loba on using fat-derived stem cells to build bone and tissue; Fred Gould on evolution-based genetic pest control; Anne Collins McLaughlin on using games to keep brains healthy; Matthew Breen on how studies with dogs are accelerating human cancer research; and Joseph DeSimone on making new nanotherapeutics. Loba and DeSimone have dual appointments with UNC-Chapel Hill.

In addition to overall co-sponsorship, NC State is hosting tours and a session on Centennial Campus, where small groups will share meals with researchers from NC State, UNC-CH, Duke, RTI International and other partners. For the full agenda, check www.sciencewriters2012.org.

Also, the Science Online annual meeting will return to NC State in 2013. The gathering draws bloggers, researchers, citizen scientists, authors and journalists. Details are at www.scienceonlinenow.org.

WOOD FORMATION REGULATED

NC State researchers studying molecular changes inside tree cells as wood is formed have discovered a new phenomenon in plants.

Vincent Chiang, co-director of NC State's Forest Biotechnology Group, describes the finding as the long-

sought path to understanding the regulation of wood formation.

The team found that one member of a family of proteins called transcription factors took control of a cascade of genes involved in forming wood, which includes a substance called lignin that binds fibers together and gives wood its strength. The controller protein regulated gene expression on multiple levels, preventing abnormal or stunted plant growth. It did so in a novel way.

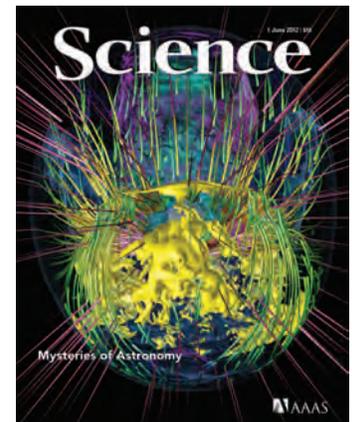
"This is nothing that's been observed before in plants," Chiang says. His team first produced a transgenic tree with reduced lignin. High lignin levels are desirable for lumber, but lignin is removed when making paper or manufacturing biofuels.

The research was funded by the U.S. Department of Energy. The findings were published online in *Proceedings of the National Academy of Sciences*.

COGNITIVE BENEFIT FROM VIDEO GAMING

For some older adults, the online video game World of Warcraft, or WoW, may provide more than just escapist adventure. NC State researchers have found that playing WoW boosted cognitive functioning for older adults — particularly those adults who had scored poorly on cognitive ability tests before playing the game.

"We chose World of Warcraft because it has attributes we felt may produce benefits. It is a cognitively challenging game in a socially interactive environment that presents users with novel situations," says psychologist Anne McLaughlin, co-author of a paper on the study. "We found there were improvements, but it depended on



SIMULATING A SUPERNOVA

John Blondin's simulation of a core-collapse supernova illustrated Mysteries of Astronomy articles in Science magazine's June 2012 issue. He heads the NC State Department of Physics. In the image, the tubes represent the paths of gases falling into the supernova as they are deflected by an accretion shockwave. The colors are indicative of gas velocity.

VISUALIZATION BY HONGFENG YU AND KWAN-LIU MA, OF THE UNIVERSITY OF CALIFORNIA-DAVIS.

each participant's baseline cognitive functioning level."

"We saw significant improvement in both spatial ability and focus for participants who scored low on the initial baseline tests," she added.

Pre- and post-game testing showed no change for participants on memory.

Lead author of the paper is Laura Whitlock, an NC State doctoral student. The research was supported by NC State's College of Humanities and Social Sciences.