In the News

Tiny gadget can help doctors retrieve sponges

By Sabine Vollmer
Special Correspondent

CHAPEL HILL — What's the difference between an RFO and a UFO? RFOs are more common.

Retained foreign objects, or RFOs, are instruments and tools that surgeons forget inside their patients. About one in every 5,500 patients who underwent surgery at the Mayo Clinic over a three-year period was wheeled into the recovery room with a forgotten object inside, according to a study published in the New England Journal of Medicine.

Surgeons forget clamps, screws, needles and broken guide wires in their patients. And controls often prove useless.


Rupp

The most common RFO is the surgical sponge, even though these sponges are manually counted before and after surgery. Studies have shown that in more than 80 percent of the cases where sponges are left inside patients, the manual counts in the operating rooms were correct.

"That's the crux," said Dr. Christopher Rupp, a gastrointestinal surgeon at UNC Health Care in Chapel Hill.

Doctors and private industry are seeking solutions. In an effort to eliminate counting errors, UNC Health Care teamed with RF Surgical Systems, a company near Seattle, in a study using microchipped surgical sponges. The microchip is the size of a rice grain. Sewn into the sponge, it sends out a radio frequency that a surgeon can pick up with a wand before the end of an operation.

Any microchipped sponge hiding in a patient gives off a beep that helps the surgeon avoid having to cut open the patient a second time.

Rupp is one of two surgeons leading the study at UNC. Interim results show the microchip speeds detection, cuts stress for the nurses and reduces the need for post-surgery X-rays, UNC reported last month at a surgeons' conference in Washington, D.C.

Final data is expected in the spring, Rupp said.

"This is the first time that somebody has done (a study) of this magnitude on RFOs," he said.

What makes surgical sponges so hard to find is what makes them so handy. They are pieces of cloth that surgeons can stuff inside a surgical wound. The sponges are used to hold organs out of the way or to soak up blood and other fluids. But as they do their job, many take on the color of their surroundings and blend in.

X-rays are necessary to find these sponges later on, and the Mayo Clinic has followed a policy to X-ray every patient after surgery. The microchip can help patients avoid this radioactive exposure, Rupp said.

The microchip also has the potential to save hospitals a lot of money, he said. In a few years, the Centers for Medicare and Medicaid and private insurers are expected to stop reimbursing hospitals for surgeries to retrieve RFOs.

sabine.vollmer.reporter@gmail.com

REACH OUT

We value reader comments and suggestions. Contact Ann Allen, SciTech editor:

aallen@charlotteobserver.com; 704-358-5150
SciTech, P.O. Box 30308,
Charlotte, NC 28230-0308
Online:
charlotteobserver.com/scitech
On Facebook: Search for "SciTech."


Allen

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Unlocking the future of cities

UNCC scientists work across disciplines to predict how urban areas will use open land

By Tyler Dukes
Special Correspondent

Ross Meentemeyer and his team want to peer into the future, and they plan to share their vision with the public.

As part of a three-year, $286,000 grant from the National Science Foundation, the group of scientists from UNC Charlotte is researching the complex relationship between the Queen City and its surrounding forest and pastoral lands. Using a combination of social, natural and computer science, they're working to build an interactive map-based simulation capable of showing the impact of future development and policy on land use.

It's a project requiring Meentemeyer's team to peel back multiple layers of cultural and economic values surrounding land in the South. The research will have implications beyond the Charlotte area.

"Ultimately, our goal is to understand under what kind of combination can urbanization, forest and farmland coexist," said Meentemeyer, a professor of geography and earth science. "There's really complex interactions there."

An interactive simulation

The team has already made some headway. Over the past three years, it has developed an interactive simulation in partnership with the Charlotte Visualization Center at UNCC. William Ribarsky, director of the center and one of the project's researchers, said the model is so far limited to comparing general land use between areas. Although it does have some predictive capability, he said the new research will expand the model's ability to reveal what the future holds for forests and green areas after factoring in policy changes and development.

Building a new interstate, for example, will put new pressure on the land around it, and predicting what could happen would be valuable to urban planners and the public.

"It will change what the future will be, so we have to run the simulation in the presence of that new feature," Ribarsky said. "We're setting things up so we can do this interactively, so it's a very powerful 'what if?' capability."

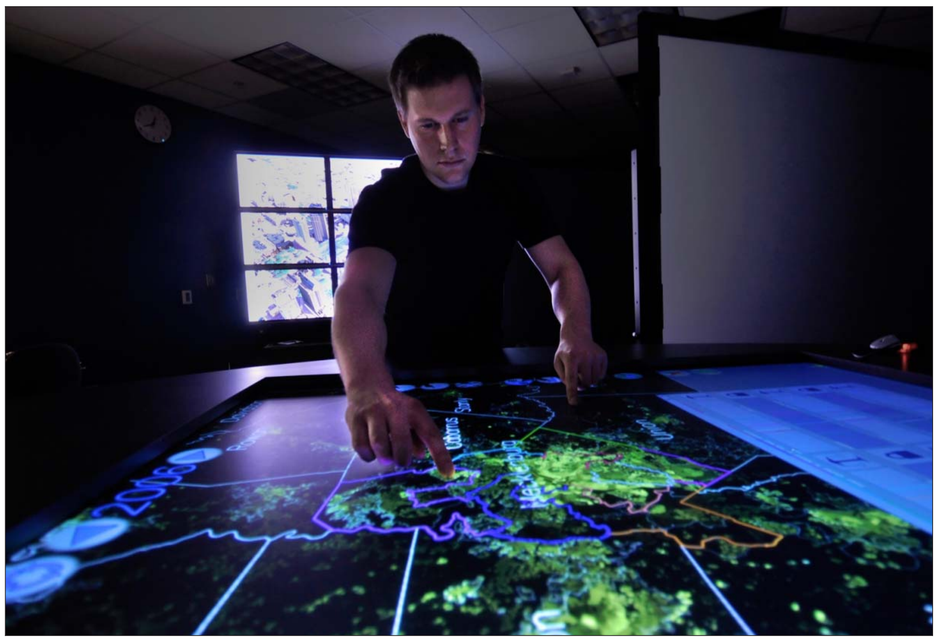
By allowing the public to explore those possibilities visually on anything from a laptop to a touch-screen table, the research team is hoping its work will mean more informed decisions about how people use the land around them.

"People have an understanding of what the present is. They have a pretty good understanding of what the past holds, especially if they've been in the area awhile," said team member Jean-Claude Thill, a professor of geography and earth sciences. "The future is much more difficult to predict or to forecast."

Crossing scientific lines

Although it's no easy task, putting together such predictions requires a group assembled from a variety of scientific fields.

"A lot of scientists have a specialty that they do very well. But to work on an interdisciplinary team, you have to have the right composition of scientists," Meentemeyer said.


PHOTOS BY T.ORTEGA GAINES - ogaines@charlotteobserver.com

Thomas Butkiewicz, a researcher at the Charlotte Visualization Center at UNCC, uses a multi-touch table that provides an interactive simulation for researchers. New studies will expand the model's ability to show what the future holds for forests and green areas.

Know your scientist

ROSS MEENTEMEYER
Age: 39.
Job: Professor of geography and executive director of the Center for Applied Geographic Information Science at UNC Charlotte.
Family: Wife Lisa and sons Asa, 11, and Aidan, 8.
Hobbies: Cycling, vegetable gardening, backcountry hiking.
Why science? "In everyday life, we all see changes in our environment and wonder if they are healthy or sustainable. Science is my way of doing something constructive about the problems we see, and sharing the answers in a way that advances our understanding and influences policy. And as a bonus, I also get to share that curiosity with my students."


A wall of monitors displays information at the visualization center.

As the research project's principal investigator and ecologist, Meentemeyer has to balance his dual roles of collecting data on the area's ecosystem and fitting together the pieces from other disciplines.

"We're not just bringing social scientists and natural scientists together, but we're trying to blur the lines between social science and natural science," Meentemeyer said. "That's what it takes to truly understand and study sustainability questions."

Particularly in the South, Thill said, understanding the social science element of land use is important.

"Obviously, North Carolina and a lot of the lands surrounding Charlotte, for instance, have been in the hands of the same families sometimes for generations," Thill said. "Certainly there is an attachment to the land, and I think it's something that sets apart the Southeast and the Southern culture from culture that is dominant in other parts of this country."

That's where Thill's training will come in handy. By surveying and interviewing landowners, he'll be able to learn more about their attitudes toward land use. The researchers even plan to use their existing visualization techniques to test how new policies and area development will affect landowners' values in the future.

"The advantage here is that it allows us to deal with a much fuller spectrum of possibilities, maybe scenarios and situations that have not been encountered yet," Thill said.

Unlocking useful knowledge

When computer scientists such as Ribarsky work that additional information into the refined computer model, it will help predict outcomes 10 to 20 years away. It's a form of computer-assisted reasoning Ribarsky said can be effective despite the sheer number of variables.

"Even the people that hold these data don't necessarily understand them fully," Ribarsky said. "They know there's a lot of useful knowledge locked in there. What we're trying to do is unlock it."

Although the research focuses largely on Charlotte and its surrounding counties, the team expects its impact to extend farther. The region is just part of the "Charlanta" megalopolis, which extends to the Raleigh-Durham area and south to Atlanta. It's one of the country's largest so-called mega-regions by economy and population.

"This is an area that is collectively one of the most important economic centers in the country," Thill said. "The idea will be to look at how all of those areas that grew somewhat independently are progressively collecting in between and threatening the natural space."

It's an effort Thill said is especially important given the area's declining land density – the ratio of developed land to households – from World War II through the mid-'90s.

"For those decades, the Charlotte metropolitan area has become less and less efficient at using land," Thill said. "We've been more lax about it."

Since the '90s however, Thill said the intrinsic value of land seems to be increasing, as evidenced by higher-density developments such as townhouses and condos. Studying that change presents a unique opportunity, Ribarsky said.

"There's a general feeling that if you have urbanization around green areas, it's going to result in a lot of pressures for those areas to convert, become urbanized. But the particulars of that process and what the effects of different policies may be on that process is unknown," Ribarsky said. "We have a chance, using Charlotte as a test bed and using the powerful tools that we have already, to address that issue."

tyler.dukes@gmail.com

Science Briefs

» Remotely speaking, how hard is the moon?

RALEIGH — How do you test a building site if it's on the moon?

Engineers at N.C. State University can do it by using a small sample of soil to answer fundamental questions about how soil at a building site will interact with foundations. The key is a computer model they've designed.

"If you are going to build a large structure, you have to run a lot of tests on the building site to learn how the soil will behave in relation to the building's foundation," said Matt Evans, assistant professor of civil, construction and environmental engineering at NCSU and co-author of a paper describing the research. "How stable is it? How much might the foundation settle over time? Traditionally, that testing process involves a great deal of equipment, time and money."

Evans said his team used funding from the N.C. Space Grant to answer questions that are essential to the construction of buildings on the moon. The computer model uses a tiny soil sample to provide insights about the potential interface between the ground and the structure.

The model may also have applications closer to home, assessing soil conditions for remote building sites for military or research applications. — STAFF REPORTS

» Existing greenhouse rules OK, report says

DURHAM — Regulating greenhouse gases could be done smoothly and in a cost-effective manner under the existing Clean Air Act, according to a new report by Duke University's Nicholas Institute for Environmental Policy Solutions.

The Duke team outlined not only the potential for regulating greenhouse gases under the act, but forecast the possible legal challenges the agency could face when designing standards to help refineries, power plants and other facilities comply with the EPA's new rules for pollution control.

"There is a lot of concern on Capitol Hill that regulating greenhouse gases under the Clean Air Act would be a mess," said Jonas Monast, author and co-director of the Climate Change Policy Partnership at Duke. "Addressing climate change while maintaining political support requires a sensible, cost-effective approach. This report, developed following a gathering of Clean Air Act experts at the university, shows the EPA has the tools to strike that balance."

The Duke report, "Avoiding the Glorious Mess," by Monast, Tim Profeta and David Cooley, said the existing act allows the EPA to design a sector-based approach that could be tailored to different areas of the economy and expand on existing standards for controlling pollutants. — STAFF REPORTS

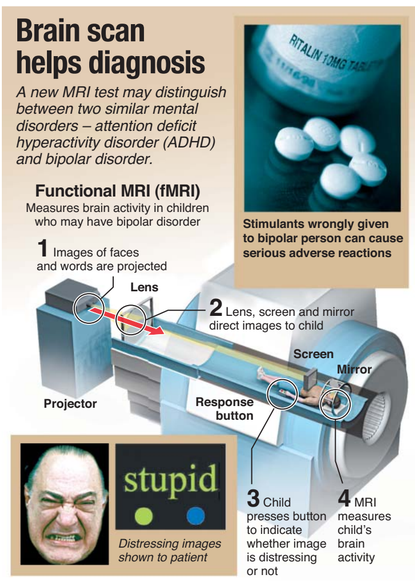
» A trove of species found in amber

An amber excavation in western India has led to the discovery of more than 700 ancient insects, arachnids and crustaceans, and many plant, floral and fungal remains.

"We have at least 100 new species of insects, possibly many more," said David Grimaldi, one of the study's authors and an entomologist at the American Museum of Natural History in New York.

The specimens are estimated to be about 50 million to 53 million years old, from sometime between the late Paleocene and early Eocene Epochs. The area was then a lush tropical rain forest, similar to the forests found today in Borneo and other parts of Southeast Asia.

Researchers from the United States, Germany and India reported these findings in the Proceedings of the National Academy of Sciences.
— NEW YORK TIMES



Blog of the Week

LAB RAT

Astonishing, multitalented little bacteria

By T. DeLene Beeland
Special Correspondent

S.E. Gould, 22, writes the blog Lab Rat (http://labrat.fieldofscience.com) and tweets as @labratting. Questions and answers have been edited.


Gould

Q. *Your blog is a tad cryptic about who and where you are. Are you a university student?*

I'm a graduate student working as a research assistant in the pathology department at the University of Cambridge. I graduated from Cambridge in June 2010 with a degree in biochemistry. I'm currently applying for a Ph.D.

Q. *You recently wrote a post about how scientists made a light bulb that glowed with genes isolated from a species of bacteria that live in squid. How does this work?*

The glowing light bulb is the work of the Cambridge iGEM team (http://2010.igem.org/Team:Cambridge). It was made by isolating the genes for bioluminescence in the squid bacteria and expressing them in E. coli, a bacteria commonly used in the laboratory. The E. coli was grown on solid agar medium, which was mashed up and put in liquid culture. The liquid culture with floating chunks of agar was then put into the empty light bulb shape. There are five genes used to form the bioluminescence; these code for the enzyme luciferase, which is used to produce light.

Q. *Why do you find bacteria so interesting?*

Bacteria have to do everything a multicellular organism has to do: eat, move, sense their surroundings, communicate with each other and so on, but they only have a single cell in which to do it. I'm also interested in bacteria as a synthetic biology system – how by altering their DNA, bacteria can be turned into sensor systems, or little factories for generating important substances such as antibiotics. Bacteria have a lot of genetic diversity as well. You can find bacteria that will do almost anything you want, from eating concrete to producing plastic. I think they have a huge potential both for providing resources and for helping solve problems brought about by human pollution.

Q. *Do you see your blog as an outreach tool to general audiences, or is it intended for biochemists and molecular biologists?*

I originally started the blog hoping to communicate interesting science to a wide audience. I have a feeling at the moment, though, that it's mostly science students who read it.

T. DeLene Beeland: scwriter.db@gmail.com

In the News

Mining blamed for stream damage

Duke biologist compares undisturbed waterways with those near mountaintop strip mining operations.

By Sam Harris
Special Correspondent

As thunderous explosions ripple through Appalachian highlands, falling forests and tumbling rock expose the "black gold" that supplies our enormous electricity demand.

The controversial practice of mountaintop mining, in which coal companies reshape mountain landscapes to tap into the vast energy resources of Appalachia, has significantly affected regions in West Virginia, Virginia and Kentucky. But the exact degree of environmental change attributed to this form of strip mining has long been contentious.

Research from Duke University biologist Emily Bernhardt and her colleagues may help shed light on the role of mountaintop mining in environmental degradation.

Bernhardt's team has compared satellite images of mining activity with databases of stream biodiversity, water quality and conductivity – a measurement of ionic concentration that, when elevated, indicates poor stream health.

"Even at very low levels of mining, we found a dramatic impact on water quality and stream composition," Bernhardt said.

Her findings show a direct link between strip mining and environmental degradation. Conductivity levels in undisturbed areas were drastically lower than those found in streams surrounded by mining operations, and even urban development had less harmful impacts to surrounding streams than mining.

Though mining seems to be at fault, industry leaders – including the National Mining Association – contend that measurements of conductivity should not be the sole metric by which mining is judged against other uses of the land.

"Conductivity should not be used as an exclusive tool for isolating impacts from mining activity from the many other sources or factors that may impact water quality," says association spokesman Luke Popovich.

Even if mining is not solely at fault, its effects are cause for serious concern, the Duke team found. Often, when mines have been reclaimed and operations shut down, destructive legacies linger.

"We have not found evidence that the chemical and biological effects are abating, even one to two decades after mine reclamation," Bernhardt says.


2008 GETTY FILE PHOTO

This mining operation in West Virginia shows a mountaintop sheared off to get to coal seams. Debris is often moved to river valleys.

Sam Harris: wsh53@aol.com

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» And NASA has a club for kids: **www.nasa.gov/audience/forkids/kidsclub/flash/index.html**

» If you have a favorite science or technology site, let us know. Send an e-mail to aallen@charlotteobserver.com.