NC STATE RESEARCHERS are using everything from BLOW FLIES to CARPET FIBERS to SKULL MAPPING to advance forensic science.

by SYLVIA ADCOCK ’81
photo illustration by ROGER WINSTEAD ’87

THE BONES FROM A DISMEMBERED BODY FOUND IN TEXAS ARE AWAITING INSPECTION IN A LAB NEAR the 1911 Building. On Centennial Campus, a computer screen blips as it records information from extracted dye as researchers build a database to help crime scene investigators compare automobile fibers. In the basement of Brooks Hall, video game technology is put to a different use as a 3-D version of a crime scene appears on a screen. And just off Western Boulevard, an entomologist awaits a call from a prosecutor to testify in the case of a suspected serial killer.

If it sounds like CSI: NC State, there’s good reason for that. All across campus, researchers from different disciplines have teamed up to develop a forensics institute that is providing crucial help to law enforcement investigators. The institute will also establish a framework for students to delve into forensics, the application of scientific knowledge to physical evidence. The effort involves nearly every college on campus, from textiles to humanities to design to engineering, and researchers have garnered nearly $3 million in grants along the way.

“The university right now is poised to become a national, even global, leader in this area,” says Billy Oliver, an archeologist and teaching associate who helped set up the NC State Forensic Sciences Institute, which brings together researchers around campus, establishes courses at the graduate and undergraduate levels, and provides training and help to law enforcement officers.

Ann Ross, professor of anthropology; and Wes Watson, professor of entomology.
The expertise being put to use is wide-ranging. Textiles researchers are establishing a database to help investigators definitively link automobile fibers to crime scenes or suspects. NC State insect experts can pinpoint the time of death of a decomposing body by examining maggots, and soil scientists have linked suspects to a crime scene based on mica chips. Anthropology Professor Ann Ross has developed a computer software program using skull measurements to help identify the ethnic ancestry of a victim—an important tool in missing persons cases. At the College of Veterinary Medicine, two researchers are looking into identifying bacterial signatures left on fingerprints.

For students, the institute will mean more course offerings. With four undergraduate and two graduate courses in forensics, students can now minor in forensic sciences, but plans are underway to add a bachelor of science and a master’s program. The Forensic Sciences Institute was given the green light by the chancellor in December 2010 and awaits formal approval from the UNC Board of Trustees, which is likely within the next year. About 1,400 square feet in the College of Textiles building will be set aside for offices, meeting space and equipment such as a bone density scanner that can help determine if a child was malnourished or the victim of parental abuse. There’s even a combined-off crime scene used to train students to document evidence. Bloody footprint analysis is beside an overturned office chair. An open newspaper is on the desk, a FedEx packing slip is on the floor and blood is spattered on a wall. Oliver says that noting everything in the room is important—the date on the newspaper may give a clue as to the date of the offense, the footprints will tell what type of shoe the suspect wore and the pattern of blood can help investigators re-enact the struggle.

A special office provides a place where evidence from real-world crimes can be kept under lock and key. NC State faculty have been involved in helping to investigate more than 1,000 homicide and missing persons cases, most in North Carolina but some in other states as well. “Almost every major case you’ve read about in the news we’ve had some involvement with,” Oliver says.

The institute has its roots in a program formed by an agreement between the university and the N.C. Department of Cultural Resources’ state archaeologist’s office. Under the agreement, which expired in 2010, NC State experts teamed up with law enforcement to provide training programs and seminars as well as offer help in the scientific examination of evidence. One of the most popular seminars is “Discovery and Recovery,” where students study decomposing pig carcasses and learn how to document and map a crime scene, excavate a burial site and locate, identify and store trace evidence including hair, fibers, and insects. They also learn how to engage and locate specialized experts.

One of those specialized experts is Ross, an anthropology professor who studies the clues that bones leave behind. Ross is often called in to help scholars identify a skull. It was a cold case from 1998, an unidentified 10-year-old boy whose remains had been found off I-85 near Hillsborough. The boy’s gender and age had been determined. But were there other clues to this background?

Yes. NC State’s Ann Ross, professor of anthropology, used a skull-mapping technique she helped develop to determine that the boy was of Mesoamerican ancestry. Although the case has not yet been solved, such information can be crucial in homicide cases when the victim’s identity is unknown. For instance, if a victim can be identified by ancestry, a list of missing persons can be narrowed down to fit that background, and then other records from that list can be checked.

For years, the best instrument to measure a skull was a caliper. And, yes, they’re still in use. “But a caliper can only measure a linear distance,” says Ross. Placing a digitizer—a stylus about the size of a ball-point pen—on 33 landmark points of a skull will give XYZ coordinates that can be fed into a computer program. The computer program takes those coordinates and calculates the likely ethnic origin or ancestry based on known differences in skull measurements among various populations.

Ross doesn’t use the term “race,” but rather talks about ancestry and “breeding populations.” And she is quick to throw out terms such as “Hispanic,” which she says are meaningless in her work. But differences in cranial structure among population groups can be measured, and those distinctions can give investigators more information in identifying a body. For instance, the position of the cheek bones in relation to other facial bones can help determine whether a skull is of Asian or European ancestry.
itself," Griffis says. "It doesn't require extraction of the dye."

"They loved how it could change color chemistry, they remembered that one former student had gone on to work with hair and fiber evidence at the FBI." Today, Hinks and his team are using dyed fiber samples to develop a database showing the molecular structure of the dye used in the fiber of each model car. This will mean that when investigators are looking at fibers from an automobile, they could be able to definitively say which model of car it came from rather than just comparing the color and type of fiber. Coming across the books in the library, Hinks says, was "a classic example of serendipity in science and the value of having an interdisciplinary college like the College of Textiles."
In some research areas, experts from different colleges are teaming up. Michael Young in the College of Engineering and Tim Buie ’88, ’98 MR from the College of Design are collaborating to develop 3-D computerized crime scenes complete with avatars that allow investigators to re-enact a crime. Buie says Hinks and Oliver approached him and said, “How would you like to get involved in something that involves blood spatter, crime scenes and forensic work?” Buie says he replied, “You had me at blood spatter.”

Ross says she loves getting the opportunity to work with scientists in other disciplines. “The most exciting part is that this is a truly multi-disciplinary, inter-disciplinary group and we work so well together,” Ross says. “We’re crossing so many departmental—not just departmental, but college—boundaries.”

The need for more research universities like NC State to be involved in forensic science was underscored in a 2009 report from the National Academy of Sciences, “Strengthening Forensic Science in the United States: A Path Forward.” The report noted, “Many forensic degree programs are found at small colleges or universities with few graduate programs in science. The lack of research funding has discouraged universities in the United States from developing research-based forensic degrees.”

NC State’s efforts to pull together resources, obtain grants and use research scientists to change the way evidence is studied is good that that may be changing, said Michael Risinger, professor of law at N.C. State University, and Rich Rutkowsk, a forensic scientist with the Department of Transportation. “Everyone wants to get involved, and the need for research has increased.”

Buie, who is working with R. Michael Young, an assistant professor of industrial design, has worked on computerized crime scenes that allow investigators to re-enact a crime scene virtually. Buie and other researchers are working on techniques to help forensic scientists virtually recreate a crime scene in 3-D. The system would then allow investigators from different locations to enter the virtual crime scene, complete with tagged evidence, without leaving their offices.

“You will be able to visualize the entire scene, identify the type of weapons used and virtually reconstruct the crime,” says Buie, who is working with R. Michael Young, associate professor of engineering.

Here’s how it works: Crime scene investigators, who usually document a scene by taking photographs and writing reports, would bring a 3-D laser scanner to the crime scene. The device scans the scene and creates a 3-D model that can be used to create virtual crime scenes, which can be accessed through the Internet.

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im Buie ’88, ’98 MR works in an office lined with drawings of scary-looking creatures from Savage Skies, a game he designed while working in the video game industry before returning to NC State as an assistant professor of industrial design.

But the avatars he works on these days are anything but fun and games. Buie and other researchers are working on techniques to help forensic scientists virtually recreate a crime scene in 3-D. The system would then allow investigators from different locations to enter the virtual crime scene, complete with tagged evidence, without leaving their offices.

“It will allow investigators from around the country—or around the world—to collaborate and discuss a crime scene in real time,” says Buie, who is working with R. Michael Young, associate professor of engineering.

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Young said he was surprised to learn that detectives often don’t visit the crime scene often working instead off photographs and reports. But the tool allows investigators to bring up a scene and look at it in a hologram display. “They can even jump in it and move around,” Young says.

Buie, who works on the visual side of the project, can create avatars to match the height and build of a real witness, perpetrator or victim—he even made one to match an investigator visiting from Fayetteville, N.C. Once in place, the avatars can help investigators re-enact a crime, or check out a witness’ story to see what the witness could have observed from a particular vantage point.

The work, funded by a $1.4 million grant from the National Science Foundation’s Cyber-Enabled Discovery and Innovation program, is similar to designing a video game, Buie says. “The tools we use are primarily video game tools, but the workflow is very similar,” he says. “It’s the content that is a little bit different.”

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