

Testing Technology

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Crime Pays

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by Dana Hinesly

As growth in DNA forensics puts pressure on busy crime labs, they are turning to private facilities for analysis



From the nightly news to prime time, it's almost impossible to turn on the television without seeing something about how DNA solved a crime. More and more, today's criminal justice professionals are relying on the certainty that accompanies the technology, which often means they want DNA for every case.

This shift in focus translates to an increased workload for forensic technicians across the country. As government-regulated labs become inundated, they are turning to a growing crop of private facilities that are willing and able to help plow through the piles of waiting samples.

"Juries are expecting DNA on a lot of casework where it probably isn't necessary, such as when there is a lot of other good information coming from trace analysis or firearms, or even drug analysis," says Michael Portzer, supervisor of Forensic Services, NYSF Forensic Investigative Center (FIC). "In those situations in the past, DNA wouldn't have been necessary to convict,

but now the jury feels the investigation is not complete unless DNA is found."

Much of the hype surrounding DNA is a direct result of the impact it has made in the scientific community and potential that has yet to be realized.

Generating a DNA profile

What most people think of as DNA testing—the actual identification of certain genetic markers—actually takes place at the tail end of a long, involved process. The first step is sample collection.

"Following that, you identify the biological stain and extract the DNA from the bloodstain, which is then quantitated," says Curtis Knox, product manager, Genetic Identity, Promega Corp, Madison, Wis. "From there, we test for 13 to 16 different genetic markers and generate a DNA profile, which is literally just a series of numbers that indicate if a person matches the sample or doesn't."

That straightforward answer holds a great amount of appeal for law-enforcement agencies. It also allows for unbiased comparisons across regions. Once DNA is processed, results from many labs are entered into the Combined DNA Index System, or CODIS, which is overseen by the Federal Bureau of Investigation (FBI).

Launched in 1990 as a pilot project serving 14 state and local laboratories, it is a distributed database with three hierarchical levels: local, state, and national.

CODIS makes it possible for crime labs to share and exchange DNA profiles in any of those three tiers. The National DNA Index System, which includes data from all 50 states, currently holds more than 4 million profiles, in excess of 157,000 forensic profiles, and nearly 4 million convicted offender profiles.

Broad Use of DNA

The most immediate expansion of DNA's use is its inclusion in the investigations of a broader range of crimes. In fact, the Miami-Dade Police Department, the Palm Beach County Sheriff's Office, and the New York City Police Department are employing funds from the National Institute of Justice (NIJ) to begin collecting DNA evidence in nonviolent crimes.

"The role of DNA is increasing all the time in the forensic and criminal justice system. People are beginning to realize you can't be in a room without shedding DNA in some way," says Robert Barrett, vice president and general manager, Applied Markets division, Applied Biosystems, Foster City, Calif. "As the science comes along and as people are becoming more proficient, we will continue to see the technology also being used in these types of high-volume crimes."

Each year, more states are requiring that DNA samples be collected not only from convicted felons, but also from those

The President's DNA Initiative Gives \$1 Billion to Labs

The advancement of DNA technology has resulted in an onslaught of cases for forensic labs across the country. In an effort to help reduce the backlog, President Bush launched a DNA Initiative called Advancing Justice Through DNA Technology.

The 5-year, \$1 billion commitment, which began in 2003, is intended to improve the nation's capacity to use DNA evidence by

arrested in connection with crimes. Currently, the majority of regions have passed the edict strictly for crimes against a person—such as kidnapping, rape, or murder—but some states, such as Kansas, have plans to extend the mandatory DNA collection from anyone convicted of any felony.

These changes in the law will do nothing to relieve the growing pressure on crime labs already overwhelmed with hundreds, or often thousands, of samples in need of processing.

According to results of a mail-in survey of state and local crime labs released in 2004 by the NIJ, more than 500,000 unsolved cases with DNA evidence were waiting to be tested. Approximately one quarter of the responding labs attributed the backlog to staffing and funding constraints.

For most institutions, the biggest hurdle is time. Unlike what takes place through the magic of television, in reality a rape kit, for example, can take weeks or months to process.

"For us, there is always a backlog," says Warren Hull, forensic scientist IV, Forensic Investigation Center (FIC). A law recently went into effect for New York State that requires DNA samples to be collected from everyone released from prison. "The new law puts a lot more samples on our plate, and having adequate manpower is a challenge for us. Even though we have the funding, there's lag time between getting somebody trained and getting them hired."

The FIC is part of the New York State Police Forensic Science Laboratory System, which provides criminal justice agencies in New York with forensic capabilities and expert testimony.

Many state-run labs are turning to third-party, professional labs to get through cases, thanks to funding from grants provided by the DNA Initiative.

"Right now, there is so much impact on the crime labs that investigators aren't getting results in a timely manner. Often, they put DNA evidence into the system and it may—or may not—come back," says Larry Cisneros, vice president of marketing/sales for Crime Scene Technologies (CST) in San Diego. CST is a DNA forensics lab accredited by the American Society of Crime Laboratory Directors/Laboratory Accreditation Board, which enables it to process DNA evidence for law enforcement.

Working Toward a Fix

Labs like Applied Biosystems and Promega are working to provide labs with technology that will help increase throughput and shorten turnaround time, to help labs like NYSP FIC, where staffing struggles to keep pace with the caseload.

"What you're going to see are changes in how you get to that end point," Knox says. "Can you do it faster and more reliably, so you have fewer reruns, and with greater sensitivity, so you can use really small, tiny samples? That is where the advances are going to be."

Much promise comes from increased automation that can get techs the results they need in a much shorter time frame.

"This is similar to what the clinical lab went through in the late 1970s and '80s, when laboratory testing volumes first increased and automation started having an impact," Barrett says. "We need to come out with products that help the laboratory be more efficient and to process the samples rapidly."

Promega produces, and Applied Biosystems is in the process of developing, software known as "expert systems" that automate the process of analyzing and interpreting data prior to uploading it into the CODIS database—a procedure now done manually.

eliminating casework and convicted offender backlogs, funding research and development, improving crime lab capacity, providing training for all stakeholders in the criminal justice system, and conducting testing to identify the missing and protect the innocent.

"The president's DNA initiative has had a significant impact, because the majority of funding for DNA testing in the US at the present time is coming from the federal government," says Robert Barrett, vice president and general manager, Applied Markets division, Applied Biosystems. "Some states are beginning to look at ways to become independent of that, but the president's DNA initiative is a huge source of funding."

Applied Biosystems has played a very active role in supporting the process. One avenue has been educating different state governments to give them the information they need to obtain the available funding. Such awards are helping the forensic community to work through their caseload by adding new equipment and retaining the services of third-party labs.

"Because of the time constraints placed on crime labs, they will often choose whatever area of collection they can analyze in the fastest time," says Larry Cisneros, vice president of marketing/sales for Crime Scene Technologies, San Diego. As a result, investigators aren't always able to receive the depth of research they prefer in the desired time frame. "That's one benefit for investigators to utilize a private DNA lab," he says.

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"The software doesn't do DNA matching; it is intended for labs that do databasing, where they are literally typing thousands of convicted offenders every month or year," Knox says. "It's very time-consuming, and there is the potential for reviewer fatigue, so this type of software really improves the speed and quality at which they can do that data review."

There is also the possibility that the DNA testing will follow a path similar to that set by clinical labs, with significant effort being put toward bringing the results closer to where the sample is taken. In hospitals, that evolution is taking the form of point-of-care testing systems; when looking at DNA, it could provide detectives important evidence immediately following a crime.

"As the technology becomes used more, we talk about it being used as an investigative tool as well as a prosecutorial tool," Barrett says. "If we can bring DNA technology closer to the crime scene, it becomes more applicable to the investigation."

Not only could on-site DNA testing be helpful for law-enforcement professionals, but it could prove to be life-altering for those wrongly accused of a crime.

"We're very proud of our ability to help labs get these things done, because the end results are critical, not just for convicting someone who is guilty, but also for those who are innocent," Knox says. "There are still a lot of people who really have this attitude that DNA is just a prosecutorial tool, and it's not; it is very much a tool for truth."

Contents of a Crime Lab

The recent wave of crime-solving television dramas has certainly put the spotlight on forensic technicians and the important work they're doing with the human genome. But as glamorous as it is, DNA doesn't deserve all of the credit. Many of the systems that are considered staples on a tech's workbench are still workhorses in the crime lab.

"At the Forensic Investigation Center, we have a full-service lab," Hull says. "We handle drug chemistry, firearms, latent prints, questioned documents, toxicology, and trace evidence."

The equipment varies by division, but gas chromatography/mass spectrometry (GC/MS) is a common method used to identify trace elements in materials or on human beings.

A GC/MS works by analyzing mixtures of vapors. Gas chromatography sorts individual molecules, and a computer identifies the compound's molecular weight. Systems compare the resulting information to a library of known mass spectra to categorize the substance.

Trace evidence is a wide range of evidence that includes hairs and fibers, explosives, glass, tire impressions, and physical matches. To analyze this evidence, technicians work with a variety of instruments, including scanning electron microscopes, which use energy-dispersive x-ray to identify and quantify elements.

Forensics Expansion

Along with high-tech equipment and outside professionals, part of the solution for overworked forensic labs is to expand their staff. The highly specialized field, however, makes that something of a challenge.

There isn't a national certification of DNA forensic analysts, so guidelines are set by the particular agency doing the hiring. Any CODIS laboratory, however, will adhere to guidelines established by the FBI that allow that lab's results to be included in the national database.

"The minimum requirement from the Scientific Working Group on DNA Analysis Methods (SWGDM) committee is 6 months minimum training for a forensic scientist," says Lisa Lane Schade, global marketing manager, Human Identification group (Applied Markets division), Applied Biosystems. SWGDM is a group comprised of thought leaders and laboratories across the United States that upload to CODIS.

The transition to forensics may be easier for clinical lab technicians with extensive molecular science experience. Even so, most clinical laboratorians will need to further their education with courses focusing on the area of forensics that holds the most interest.

"There are really two different areas which determines the sort of background you need," Hull says. "There is a chemistry side of forensics and a biological science side." The bio-sciences section includes DNA processing. "For the chemistry, basically any degree in chemistry—or one of the natural sciences, such as biology—would be beneficial."

Hull, who has been working in the field for more than 30 years, counsels interested parties that the forensics work on television is not what takes place in most crime labs.

"There is a perception is that we go out in the field and come back in and do the work, but that's not how it is for most lab



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systems," he says. "You have to be a trooper or a member of the State Police to get into that aspect of it." However, he doesn't think the extra attention has been a bad thing for the industry. "There's been an increase in interest in people wanting to get into this field because of those shows, so there has been a positive spin, because it's increased awareness of a different application of science."

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