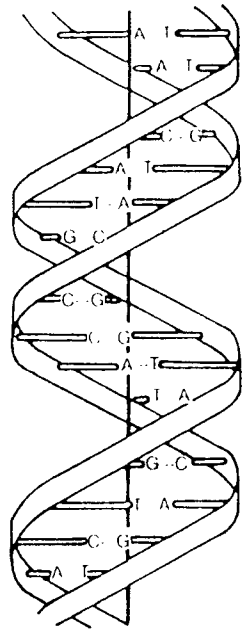
IDENTIFYING CRIMINAL SUSPECTS BY GENETIC SAMPLES

by Simson L. Garfinkel

Police departments around the country are turning to genetic testing for proving identity and obtaining convictions at the same time that courts are raising questions about the methodologies of the testing. More than a dozen police labs are now set up to conduct the genetic identification test, often (mistakenly) called "DNA fingerprinting." More are on the way. "The FBI has trained more than 240 crime-laboratory technicians from 80 different agencies," says John Hicks, assistant director of the FBI Laboratory in Washington. "Within one year, you will see a tremendous increase in the number of laboratories that are on-line."



The FBI is also laying the groundwork for a national data bank of DNA information from crime scenes and convicted felons. Regional data banks are already springing up, usually with federal funding; King County in Washington State was recently granted $100,000 to explore the use of data banking in solving sexual-assault cases. California and Virginia, which seem to be the most advanced states, collect blood samples from felons before they are released; six other states have pending legislation. In the future, DNA analyses of blood or semen at a crime scene can be matched with those on file in the data bank and a suspect can be identified.

How the Technique Works

Every cell of our bodies contains a complete copy of our genetic code. Although most of the human genome is surprisingly similar from person to person, about one percent differs between individuals. The DNA identification test finds these differences.

In the test, deoxyribonucleic acid (DNA) is chemically extracted from a small number of cells in a sample about the size of a dime. The long DNA molecules are then cut into tiny fragments with special chemicals called restriction enzymes. The restriction enzymes cut the DNA only where specific patterns of the genetic code occur. These patterns occur at different places in the DNA of different persons.

Next the fragments are sorted by size using a technique called gel electrophoresis and then transferred onto a nylon membrane. The DNA fragments are then treated with radioactive probes. The probes stick to some DNA fragments but not to others. A piece of X-ray film is put on top of the membrane; wherever the probes stick, a spot is produced on the film. Typically, each probe produces two spots: one for the genetic contribution of each parent. By measuring the position of the spot on the film, lab technicians can infer the molecular weight of the fragment that matched the particular probe.

In the actual DNA test, four probes are used; the more probes, the more certain the match.

DNA-ID systems were developed in the 1980s by two companies: Lifecodes (Valhalla, N.Y.) and Cellmark (Rockville, Md.). At Lifecodes, the DNA test was first used as a paternity test in early 1986, according to Dr. Michael Baird, the company's director

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of research. The test was applied to forensics later that year. Lab results from Cellmark and Lifecodes cannot be compared because the companies use different sets of restriction enzymes and genetic probes.

In 1986 the FBI began its own research into DNA testing. The bureau developed its own set of enzymes and probes, often borrowing from the work at both Cellmark and Lifecodes. The FBI is encouraging other law enforcement agencies to use its enzymes and probes, to facilitate the creation of a national databank.

Since DNA testing was first used in a British murder case in 1987, it has been used in 400 court cases in 45 states and in at least 15 countries. It is accepted as evidence in about 38 states, although at least seven state appeals courts, most recently in Massachusetts, have questioned the methodology, if not the validity, of the technique itself.

Chance of a Mismatch

Critics mainly focus on the possibility of a mismatch. As with blood types, there is no way to prove that two identical DNA prints came from the same person, even though a match is probable.

To calculate the chance of a false match, it is necessary to know the frequency of the particular genetic characteristics in the population being tested. Critics argue that the FBI, Cellmark, and Lifecodes haven't done that.

"They've rushed to the courts with this, instead of doing the real hard groundwork that they need to make a good system," says Richard Lewontin, professor of population biology at Harvard.

"One of the questions has to do with differences in geographic locations within a genetic pool," says Nachama L. Wilker, executive director for the Council for Responsible Genetics in Cambridge, Mass. "How much distinction can you make in a small town?"

DNA testing is not cheap -- $1000 for a kit, $500 in lab fees, plus perhaps $1200 in daily expert-witness fees. The high cost means that DNA tests may not be as widely available to defendants for proving innocence as they are to prosecutors for establishing guilt. But Lifecode's Michael Baird says, "If the person is innocent, DNA is the best friend that they are going to have."

Women's groups and groups fighting sexual assault favor databanks to help identify suspects. Some propose extracting DNA information at birth, as part of routine blood tests, and keeping it on file. But an FBI chemist, Bruce Budowle, argues that the technology may change and the massive collection of "fingerprints" may be worthless. Thus, some people recommend that entire blood samples of convicts be frozen. This would permit blood analyses for a whole range of purposes. Private companies, especially insurance companies, might then push to get access to this massive file of personal genetic characteristics.