The University of California, Irvine's William Thompson is considered the leading U.S. authority on DNA laboratory error. The leading cause of false DNA database matches is cross-contamination, he says.

DNA: It isn't foolproof forensic science

By Maura Dolan
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In 2004, a New Jersey prosecutor announced that DNA had solved the mystery of who killed Jane Durrua, an eighth-grader who was raped, beaten and strangled 36 years earlier.

"Through DNA, we put a face to the killer of Jane Durrua, and that face belongs to Jerry Bellamy," prosecutor John Kaye said.

The killer, however, turned out to be someone else.

Two years after Bellamy's arrest, investigators discovered that evidence from the murder scene had been contaminated by DNA from Bellamy, whose genetic sample was being tested at the same lab in an unrelated case. He was freed. Another man ultimately was arrested but died before trial.

DNA has proved itself by far the most effective and reliable forensic science. Over the past two decades, it has solved crimes once thought unsolvable, brought elusive murderers and rapists to justice years after their misdeeds and exonerated innocent people. In courtrooms and in the popular imagination, it often is seen as unassailable.

But as the United States rushes to take advantage of DNA's powers, it is becoming clear that genetic sleuthing has significant limitations:

■ Although best known for clearing the wrongfully convicted, DNA evidence has linked innocent people to crimes. In the lab, it can be contaminated or mislabeled; samples can be switched. In the courtroom, its significance has been overstated by lawyers or misunderstood by jurors.

■ The rush to collect DNA and build databases has in some cases overwhelmed the ability of investigators to process the evidence and follow up on promising leads. Some crime labs have huge backlogs of untested evidence, including thousands of rape evidence kits. In some cases, criminals who might have been caught have offended again.

■ Debates have flared over civil rights and privacy, presaging possible constitutional challenges to DNA collection and storage. Critics object, for instance, to storing DNA from people arrested but not convicted of crimes and from suspected illegal immigrants.

In Britain, which has the most aggressive approach to forensic DNA, a legal backlash has occurred.

The European High Court of Human Rights recently ruled that the country's indefinite storage of DNA from arrested people violated privacy rights. Britain has until March to submit plans for destroying samples or to make a case for keeping them.

In the United States, authorities are plunging ahead with a dramatic databank expansion.

A California law passed in 2004 will permit authorities, starting in January, to store DNA from anyone arrested on suspicion of felonies and serious misdemeanors, even if they are not ultimately convicted.

California's database is expected to swell by about 300,000 DNA profiles next year, bringing the total to 1.4 million.

The FBI's national database, which contains 6.4 million profiles, is projected to add about 1.3 million annually from federal arrestees and illegal immigrants alone.

When the California law, Proposition 69, passed, it widely was believed that the innocent had nothing to fear, said William Thompson, a criminology professor at the University of California, Irvine, who is considered the leading U.S. authority on DNA laboratory error.

Now, he said, "when you look at all the errors that have come to light around the world — and we're only finding the tip of the iceberg — it really raises concerns about how many people you want to have in a database. There are certainly doubts in my mind whether I would want to be in one."

The leading cause of false DNA database matches is cross-contamination, Thompson said.

The risk of DNA contamination has "greatly increased" as scientists have learned how to obtain DNA profiles from one-billionth of a gram of genetic material, according to a report last year by the Nuffield Council on Bioethics in London, a group that examines developments in biology and medicine.

"The results may therefore be misleading, and yet they could be presented as powerful evidence in a courtroom. This makes it vital that defendants are not convicted on a DNA match alone," the report said.

Indeed, wrongful incriminations from DNA evidence have pierced the science's image of infallibility. When Alan Nelson, father of a woman who had been murdered with her daughter in Australia, learned earlier this year that the wrong man had been arrested because of sample contamination, he was incredulous: "I thought the DNA was 100 percent perfect," Nelson told an Australian newspaper.

Even the most scrupulous analyst can err when interpreting complex DNA "mixtures" — samples that contain DNA from more than one person — which turn up more frequently as labs use more sensitive tests.

"If you show 10 colleagues a mixture, you will probably end up with 10 different answers," Peter Gill, then a chief scientist with Britain's Forensic Science Service, said at a symposium in 2005.

Even Alec Jeffreys, the British geneticist whose discovery led to DNA profiling, is dismayed by the number of juveniles and innocent people in the database. He figured DNA would be a "last resort" crime-fighting tool.

"I couldn't have been more wrong," he said.