

One Twin Committed the Crime — but Which One? A New DNA Test Can Finger the Culprit

A handful of criminal prosecutions have stalled because DNA tests cannot distinguish between suspects who are twins. Then scientists decided to create one.



By [Carl Zimmer](#)

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One night in November 1999, a 26-year-old woman was raped in a parking lot in Grand Rapids, Mich. Police officers managed to get the perpetrator's DNA from a semen sample, but it matched no one in their databases.

Detectives found no fingerprints at the scene and located no witnesses. The woman, who had been attacked from behind, could not offer a description. It looked like the rapist would never be found.

Five years later, there was a break in the case. A man serving time for another sexual offense submitted a DNA sample with his parole application. The sample matched DNA from the rape scene.

There was just one catch: The parolee had an identical twin, and standard DNA tests can't distinguish between identical twins. Prosecutors had no additional evidence to rule out one or the other. Because they couldn't press charges against either of the men, the case remains open nearly 20 years later.

But maybe not forever.

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In recent years, scientists have gained a clearer picture of the early development of the embryos of identical twins. Originating from a single fertilized egg, they later acquire unique genetic mutations. New advances in DNA sequencing are making it possible to pinpoint those mutations — and to tell identical twins apart.

This kind of test could well determine which of the brothers committed the rape. In a recently published study, researchers concluded that the technique is “a realistic option, fit for practical forensic casework.”

Forensic DNA testing arose in the 1990s, years before the first human genome was sequenced. Scientists found that they needed only tiny snippets of genetic material to tell people apart.

That's because our genomes are sprinkled with segments, known as short tandem repeats (STRs), that mutate much faster than the rest of our DNA. Because of this rapid changeability, these genetic bits tend to vary distinctively from person to person.

Researchers identified 13 STRs that were very effective in matching people to DNA samples. The probability of the STRs all being identical in two unrelated people is less than 1 in a trillion.

DNA testing became a standard legal tool for identifying criminal suspects and resolving paternity disputes. But for all its power, the test could not tell identical twins apart. And that led to some Kafkaesque impasses.

In 2004, for example, Holly Marie Adams won a paternity suit in Missouri against Raymon Miller for child support. A standard DNA test indicated he was the alleged father. Mr. Miller appealed the case because Ms. Adams had also had sex with his twin brother, Richard. A DNA test on Richard also yielded a match.

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“The results of blood tests performed on the two brothers demonstrated that both had a 99.999 percent probability of being the father,” Judge Phillip Garrison wrote. The court was forced to rely on other evidence — the timing of the woman’s pregnancy, for example — to decide that Raymon Miller was in fact the father.

Faced with such cases, forensic DNA experts tried something once thought impossible: building a test that could tell twins apart. The researchers took advantage of the fact that identical twins are not, in fact, genetically identical.

When a fertilized egg starts dividing, there’s a small chance each new cell will gain a new mutation. When the cells separate into twin embryos, one gets some of the mutant cells and the other gets the rest. Unique mutations will end up in cells throughout each twin’s body.

In the mid-2000s, scientists at the University of Hanover in Germany wondered if new STRs could arise in one twin and not the other. They developed a test to examine thousands of STRs instead of just 13.

It didn’t work. Their experimental test couldn’t tell identical twins apart. “Our attempts with STRs were probably totally naïve,” said Michael Krawczak, a geneticist who now teaches at Kiel University in Germany.

At the time, the costs of DNA sequencing were dropping drastically, raising another possibility. If a test could compare not just STRs but the entire genomes of twins, Dr. Krawczak and his colleagues wondered, could it tell them apart?

In 2012, the researchers offered some calculations suggesting that the answer was yes.

Imagine, they said, that a court heard a paternity dispute involving identical twins. Blood or saliva could be used to sequence the twins’ genomes. Researchers could look for genetic mutations that only one twin — the father — shared with the child.

But the scientists’ analysis also showed that such a test would have to be very precise and sensitive. Cells that will become sperm separate from other cells in an embryo early in development. Only a few mutations arise in a twin embryo before that separation.

The window for these key mutations is so narrow, in fact, that sometimes none will arise. In 20 percent of cases, the researchers concluded, twins would have no distinguishing mutations at all.

Such a test would be difficult, then — but it would also be definitive. Just a single mutation, confirmed by multiple analyses, would be enough to implicate one twin and exonerate the other.

Dr. Krawczak’s thought experiment captured the imaginations of researchers at Eurofins Scientific, a laboratory testing company headquartered in Brussels. They decided to give the method a try.

They found a pair of twin brothers willing to volunteer their DNA, as well as the DNA of one twin’s child and his wife. The researchers sequenced each person’s whole genome and found enough mutations to tell the child’s father from its uncle.

The Eurofins team published this proof of concept in 2014. Soon the news reached David Deakin, an assistant district attorney in Boston, who had been working for years on a rape case against a man named Dwayne McNair.

Mr. McNair had come under suspicion for two rapes in 2004. In 2007, police managed to get DNA from a cigarette Mr. McNair cast away, and the STRs were a match to sample from both crime scenes.

But then detectives discovered that Mr. McNair had a twin brother, Dwight. Mr. Deakin got a court order for a new DNA test, hoping the McNair brothers were fraternal twins.

“No such luck,” said Mr. Deakin.

Try as they might, investigators couldn’t firmly determine which of the identical brothers had participated in the rapes. The case stalled until 2010, when detectives tracked down the second rapist in both crimes, Anwar Thomas.

As part of his plea deal, Mr. Thomas agreed to identify Dwayne McNair as the other rapist. He had known the McNair twins since high school and said he had no trouble telling them apart. But Mr. Deakin would have nothing to offer a jury to prove Mr. Thomas was telling the truth.

Then Mr. Deakin learned of the Eurofins test. It would be expensive — \$100,000 — but Mr. Deakin became convinced it could seal the case.

“We were persuaded their science was sound,” he said.

Mr. Deakin had to drop the charges against Mr. McNair to make time for the test. After three months, the Eurofins team came back with a conclusion: DNA samples from the rapes matched Dwayne McNair, not Dwight.

Based on a statistical analysis by Dr. Krawczak, Mr. Deakin told the court that it was two billion times more likely that the rapist's DNA belonged to Dwayne McNair than to his brother.

Armed with the new results, Mr. Deakin re-indicted Mr. McNair in September 2014. His lawyers filed a motion to exclude the Eurofins test from evidence. They argued that it was too new and too little studied to be reliable.

After hearing expert witnesses for both sides, Judge Linda Giles ruled that the test was based on valid scientific principles. But it had yet to be replicated by any other lab or to be laid out in sufficient detail in a peer-reviewed journal article.

“Although the court has the utmost respect for the ability of jurors to comprehend complicated scientific principles, they would not have the luxury of many days of rumination, as this gatekeeper has needed, to untie this Gordian knot,” she wrote in a decision handed down in April 2017.

“So we were out of luck and back where we started,” said Mr. Deakin.

The decision was not just a disappointment to Mr. Deakin. Prosecutors in Michigan had been considering using the technique to distinguish between the twins in the Grand Rapids rape case. Now they decided against it.

In Boston, the case continued, with a conventional DNA test narrowing the suspects to the twins and the testimony of Mr. Thomas specifically against Dwayne McNair.

That turned out to be enough. Mr. McNair was found guilty in January 2018 and sentenced to 16 years in prison.

Since Eurofins published the initial test in 2014, only one other court has asked the company to test twins — in a civil paternity case in Germany, according to Burkhard Rolf, director of DNA forensic services at Eurofins.

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Dr. Rolf, Dr. Krawczak and their colleagues decided to write up a mathematically detailed account of their methods. The journal PLOS Genetics accepted the paper, but then required them to remove details about the McNair rape case and the German paternity case before publishing it.

Chris Becker, the prosecuting attorney of Kent County, Mich., said that the publication of the paper is a step in the right direction — but not enough for him to make arrests in the Grand Rapids rape case.

Steven A. McCarroll, a geneticist at Harvard Medical School who was not involved in the research, said that the one way to make people more confident in the new method would be to demonstrate its accuracy on a large number of twins.

“It would be really nice to know that we could do this kind of analysis over and over and over again and never get it wrong,” he said.

Mr. Deakin, the Boston prosecutor, was optimistic that such research could lead to its adoption by the courts. “If five or six labs did it, and four or five them reproduced the results and there were no negative results, I think you could you could get it in pretty easily almost anywhere,” he said.

Dr. Krawczak and his colleagues estimate roughly 1 percent of crime cases and paternity disputes may involve identical twins.

“It’s not something that’s going to happen every day in every laboratory,” said Dr. Krawczak. “But once people become aware of this, there may be a lot of cold cases that come back to life.”

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