

# DISCOVER

## Who's Your Daddy?

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WHEN CELEBRITY HAIRSTYLIST Andre Chreky was hit with a paternity suit by a woman he had not been involved with for years, he was certain he couldn't lose. Paternity tests are DNA tests, he thought, and DNA tests never lie. So he unhesitatingly submitted a swab of cells. To his shock, he was positively identified as the father, with a 99.99 percent certainty.

But last April, after a two-year legal battle that cost Chreky \$800,000, the Fairfax, Virginia, circuit court found that human error in the testing was probable and that the DNA results were incorrect.

"It hurt my family; my business," Chreky says. "My life will never be the same."

DNA testing is thought of as definitive. If there is a match between two samples, then identification is certain. Some DNA experts place the probability of an error at one in a billion. But recent cases in which paternity tests were proven to be inaccurate suggest the odds may be much less certain.

Only a millionth of a person's genetic sequence is examined in a DNA test, but that tiny portion includes more than a dozen locations with unique repeating sequences. The sequences are laid out in black-and-white strips (left) to form patterns more individual than fingerprints (which, interestingly, have never been proven to be unique). A so-called paternity index is calculated using the number of matches between two sets of DNA as well as the likelihood of matches within a subject's ethnic group. If the resulting index is 300, for example, the odds that the person is not the father are 1 in 300. That figure is then recalculated using a simple probability equation to deliver a percentage that is more understandable in a courtroom. If the report comes back with an index of 300, the probability that the person is the father is 99.67 percent. The index does not include the possibility of error, genetic anomaly, or mitigating circumstances.

"Paternity testing is a human endeavor, and it is complicated," says [Karl Reich](#), scientific director of Independent Forensics of Illinois, a DNA research and analysis laboratory. "Nobody really knows the human-error frequency, and the question is: Can you find these errors and reduce them to a statistically meaningful level?"

In the case of Chreky, the judge ruled that LabCorp, one of the largest paternity labs in the country, had performed "shoddy" work. An employee testified that during his 10-hour

shift, he issued an average of one paternity report every four minutes. Mislabeling, misinterpretation, and switched samples are not factored into the probabilities.

"Every time there is a transfer point, errors can occur," says William Thompson, a criminologist at the University of California at Irvine. "Errors are embarrassing, and labs are not forthcoming about them. But we know that they do occur."

Human error was not the cause of Lydia Fairchild's unexpected maternity test results in 2003. A mother of two at the time, Fairchild submitted her DNA to establish maternity when applying for welfare, says Alan Tindell, her former lawyer. But the results that came back said she was not the biological mother of her children, placing her in danger of losing them. When she gave birth to a third child with DNA that did not match her own, Tindell says, judges and lawyers involved in the case were stunned.

Fairchild could not be reached for comment, but Tindell says she seems to have two sets of DNA. One set matched poorly with her children's DNA, as if she were their aunt. Fairchild may be a tetragametic chimera. A chimera is any animal with more than one set of genetically distinct cells, each set originating from a different fertilized egg. Fairchild's body could be the result of the fusion of two nonidentical embryos, which can occur at the earliest stage of development. Different parts of her body could have come from different cell lines. The eggs that produced her children may have been spawned from tissues that came from one of those cell lines; the DNA taken from her mouth for testing would have been from a different cell line.

Human bodies are imperfect machines in which a range of biology can take place. Fused embryos may be rare, but cell swapping and genetic mutation are as natural as crooked teeth or double-jointed fingers. During pregnancy, mother and fetus may swap blood cells, and twins in utero often do so. A recent autopsy study suggests that swapped cells can migrate to organs and transdifferentiate, residing peacefully with normal cells in the kidneys, liver, heart, or any other organ.

For a paternity test to fail, the gonad producing the egg or sperm must contain tissues that are genetically different from the blood or tissue tested. Whether a gonad and a test site will match is pure chance. As far as anybody knows, the genetically different tissues in a human chimera materialize as unpredictably as the orange, black, and white patches on the coat of a calico cat. Many of the known cases of human tetragametic chimerism have been discovered because the person was born with patchwork skin, or with different eye colors, or as a hermaphrodite. Others have no visible signs.

"For all we know, there could be chimeras out there who aren't recognized because the condition hasn't caused them any problems," says Lynne Uhl, a pathologist at Beth Israel Deaconess Medical Center at Harvard University.

Twins researcher Charles Boklage, a biologist at East Carolina University, says chimerism is underdiagnosed: "The great majority of people who are spontaneous chimeras will never be detected by any means whatever. It's a spooky thing. It's very

difficult to find when it's there." He estimates that about 15 percent of people were conceived alongside a twin who was then lost. As multiple conceptions grow with the rising popularity of fertility drugs, the percent of the population with double DNA may increase.

Simple genetic mutations that take place during mitosis can also cause a discrepancy in DNA test comparisons. "When a fertilized egg divides, there's a chance that one of the repeats gets lost or increases," says Reich. "That's a mutation, and it does not show up in the parent. It's much more common than anyone thought."

Mark Stolorow, executive director of one of the largest and oldest genetic testing companies, Orchid Cellmark, says that years of experimentation have perfected testing. "We have selected sites that are reasonably stable," he says. "The mutation rate for any one location is less than 1 percent." About 300,000 paternity tests are conducted each year in the United States.

"Every particular DNA variation that you can think of is in the population and at a reasonable frequency," says Reich. "So in the case of paternity testing, you can never be sure that a man is excluded unless you look at every genetic element. But you can't."

Thompson, who says DNA testing is very reliable, warns that "even a low rate of error can significantly undermine confidence in the results if you are doing hundreds of thousands of these tests."

"What particularly disturbs me," Judge David T. Stitt stated in the summary of the Chreky case, "is that most of the people coming through our system, particularly criminal defendants, do not have the resources to mount the kind of challenge to the DNA test results as was done in this case. . . . DNA test results are typically accepted at face value by the court in criminal and civil cases."