

You Are Not the Mother of Your Children

by

Stephen R. Cronin

Department of Biology and Chemistry
Ave Maria University, Ave Maria, FL



Part I – A Distraught Mother

“You have to help me keep my children,” she said. “They don’t believe they’re mine.”

“The court is threatening to take your children away?” Damian asked.

“Yes, they’re my children.”

“Is this a divorce? Why is the court trying to take your children?”

“No! My boyfriend and I are separated, but he doesn’t want custody. I applied for welfare, and the judge said they’re not my kids.”

“Ma’am, are your children adopted?”

“No! They’re mine. I’m their mother! I gave birth to them. But the court says DNA proves I’m not their mother.”

Damian paused for a moment, then replied. “Your DNA doesn’t match your children?”

“The test says it doesn’t, but I am. They keep asking me ‘Who’s their real mother?’ ‘Where did you get them?’ I got them from me. How can I give birth to someone else’s child?”

“Did they test you again?”

“Yes, but the tests must be wrong. They’re my kids.”

“Ma’am, I’m sorry but DNA evidence is very hard to contest in court.”

“Every darn lawyer I call says that,” she said with anger in her voice. “I gave birth to them. I’m their mother! The tests must be wrong.”

Damian didn’t answer immediately. But for some reason, he decided he could afford to continue the conversation even though challenging DNA evidence did not seem to be a good way to develop his reputation as a successful lawyer, especially if the re-tests gave the same result. Welfare cases generally didn’t help the bottom line either.

“Tell me what happened.” Damian reached for his notebook and prepared to listen.

Lillian had applied for welfare after separating from her longtime boyfriend, Dwayne. Per state law, the DNA of her two children was compared to Lillian’s DNA and Dwayne’s DNA to establish paternity. The law

was intended to prevent money being spent on children whose fathers could pay. Probably no one had ever thought of the test being a maternity test. The tests revealed each child shared roughly half of their DNA markers with their father, which Damian knew was the expected contribution of a father to his children's DNA. If Damian's knowledge was correct, the other half of the DNA should be from Lillian. But the children's DNA did not match Lillian's. According to Lillian, the tests showed that about a quarter of each child's DNA matched her DNA. She said welfare people kept asking here if they were her sister's children, or her daughter's, but she didn't have a sister and being only 22 she couldn't understand why the welfare agent thought she could be the kids' grandmother. They also asked whether she had undergone in vitro fertilization (IVF), or had acted as a surrogate mother for someone else. Lillian denied being a surrogate mother. According to Lillian, she and Dwayne had conceived the children (now 3 and 2 years old), and she had given birth to them as normal. She had the birth certificates to prove it.

Damian needed to talk to someone about the biology of reproduction, and see if there was any way a child could not get his mother's DNA. First he needed to refresh his understanding of how DNA was normally transmitted from mother to child.

Questions

1. Why must a mother's DNA match that of her biological children? Why would Damian expect half of the children's DNA to come from their mother? Why not 30% of it? Or 70% of the DNA?
2. What is the process by which DNA is transmitted to offspring? How does only half of the genetic material of the parent get transmitted to the child?
3. The welfare people asked Lillian a number of questions about where she got the children from. From their questions, it is clear they had formed several hypotheses as to why Lillian's DNA did not match the DNA of her children.
 - a. From the questions the welfare people asked, try to discern their hypotheses. List the hypotheses put forward as to how the children had DNA that did not match with Lillian's DNA.
 - b. For each hypothesis, how much of the DNA would you expect the children to share with Lillian? For instance, how much genetic material should an aunt expect to share with her nephews and nieces?
 - c. What hypotheses seem most likely to you? Least likely?
 - d. What other evidence would you need to support each hypothesis?
4. Do you think Lillian is telling the truth? Why or why not? Does the evidence support her claim?

Part II – A Strange Child

“Damian, I think I’ve found some research papers that might explain the case you told me about. My hypothesis is your client, the mother, is a chimera, a person with two genetically distinct sets of cells. Several children have been born who are genetic chimeras.”

Dr. Rajesh Vijayvergia was a professor of biology and certainly talked like one.

“Here’s an example from one of the papers. In 1980, a child was born with ambiguous genitalia and they found the child was a true hermaphrodite, had both testicular and ovarian tissue, male and female at the same time. They found that the male parts of the child had an X and a Y chromosome, and the female parts of the child had two X’s. Importantly, a comparison of the autosomal DNA (the non-sex chromosomes) showed that the DNA from the male cells was different from the female cells. So the child had two complete sets of DNA in different cells: Some cells with one set of chromosomes and genetically male, and the other cells with the other set of chromosomes and genetically female.”

“Rajesh, can you translate for me?” asked Damian.

“Yes, yes. Genetically the child looked like a fusion of two different genetic individuals. Like fraternal twins that grew together to form one person, instead of growing separately.”

“So, how does this relate to my case?”

“I know what you are thinking. Your client has two children, not one, and both are perfectly normal. My hypothesis is your client, the mother, is a chimera. She is her own fraternal twin.”

“Rajesh, as far as I know my client’s sex isn’t ambiguous.”

“I know, I know. The child I was telling you about attracted attention because he/she was half male and half female. A person with two sets of cells that were both genetically female might not attract any attention at all. She would grow and develop like any other woman. If you didn’t look at her DNA, you would never know. When they tested DNA from her cheek cells they found one set of DNA, but I think other parts of her are composed of a different cell line, one with DNA distinct from that of her cheek cells. If this cell line contributed the DNA to her oocytes, then her children would have inherited that DNA, not the DNA seen in her cheek cells. That could explain why the mother’s DNA test doesn’t match with her children’s.”

“Is there any way we can find out if you’re right?”

“Yes, I think we can try.”

Questions

1. What is a chimera?
2. What are fraternal twins, and how do they normally occur? How much of their DNA would you expect fraternal twins to share?
3. Why does Dr. Vijayvergia think the mother (Lillian) can be a chimera and not appear abnormal?
4. How could Dr. Vijayvergia’s hypothesis be tested? What could you do to find out if Lillian was a chimera?

Part III – Epilogue: But How Does It Happen?

After carefully analyzing DNA sampled from different parts of Lillian's body, Dr. Vijayvergia and his graduate students found that Lillian was indeed chimeric. They were not been able to sample her ovarian tissue, since that would have required an invasive surgery. However, hair follicles from a patch of skin on her left leg reliably yielded DNA that differed from her cheek cell DNA, and matched the DNA of her children. Lillian had retained custody of her children, and in a twist worthy of the tabloids, the court case had brought her and her boyfriend back together. Indeed, the whole story was reported in the *National Enquirer* and several other magazines. News shows interviewed Lillian, and Dr. Vijayvergia was interviewed for a documentary on the *Discovery Health* cable channel.

But for Dr. Vijayvergia, the biological questions remained: How did it happen? Could the occurrence of chimeric individuals be explained by some exceptional event in the process of gamete formation or fertilization? What hypotheses could explain the formation of chimeras?

Questions

1. Using your knowledge of the normal process of gametogenesis and fertilization, formulate several alternative hypotheses as to how a chimeric individual could form.

After formulating your hypotheses, read the article by Dewald, Haymond, Spurbeck, and Moore: "Origin of chi46,XX/46,XY Chimersim in a Human True Hermaphrodite," *Science* 207:321–323 1980.

Answer the following questions based on the article. To answer the questions, you will probably need to look up some of the terms in a medical dictionary.

2. In the first paragraph, what ways do the authors suggest whole body chimeras could form?
3. Use a textbook or other reliable source of information to find out what is currently known about polar bodies. What are polar bodies? When do they form? According to current understanding, what happens to polar bodies?
4. The authors note that almost all chimeras known at the time of the study had sexual abnormalities, such as true hermaphroditism (presence of both male and female reproductive organs). What reason do they hypothesize for the scarcity of known cases of chimerism without sexual abnormalities?
5. According to the fourth paragraph, what was done surgically to the child? What consequences would this have for the child's future development?
6. The authors conclude that the child formed from the fusion of a fertilized embryo, fused with the product of a separately fertilized polar body from the second meiotic division.
 - a. What evidence do they have that supports this interpretation?
 - b. What evidence do they have that argues against the other hypotheses listed in the first paragraph?

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