Getting a bone marrow transplant could give you new DNA, too

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Q: Does a bone marrow transplant change your DNA?

A: Well, sort of, but probably not in the way you are imagining. Still, such transplants have led to some mighty interesting real-life cases for forensic scientists trying to sniff out the truth. Here's why:

As you probably know, certain cancers and other diseases may cripple your own bone marrow's stem cells so that they cannot produce healthy blood cells. This can lead to an allogenic bone marrow (or stem cell) transplant in which your own stem cells are killed off and replaced by a matched donor's healthy stem cells that can turn out equally healthy blood cells.

This cure, however, comes at a price: The stem cells you receive have the donor's DNA—and so will the white blood cells it produces. You have become what science calls a genetic chimera. In Greek mythology, the Chimera was a fire-breathing monster with a lion head, goat in the middle and snake bringing up the rear. You, on the other hand, now have your own DNA in the vast majority of your cells, but your donor's DNA in your blood.

But, scientists have discovered, it might not stop there. Research has found indications of donor DNA in nail cells and urine. Still other studies have suggested donor DNA migrating into the epithelial cells that line the mouth and other cavities and organs.

As a side note, you might find it fascinating that this dual-DNA "chimerism" can be present at birth in rare cases even without a transplant. Congenital chimerism is thought to happen when fraternal twin embryos for some reason join early in pregnancy to form one fetus.

"In a way it is the inverse of identical twinning, when one egg splits into two," says Brianne Kirkpatrick, a certified genetic counselor who runs WatershedDNA.com. "Congenital chimerism has only been documented in a few cases."

But whether congenital or acquired, it can cause all sorts of problems for both the chimeric person and the legal community. Take the 2002 case of Lydia Fairchild. When Fairchild, a mother of two with a third on the way, separated from her husband, she sued for child support but was understandably astounded to find that genetic testing showed she was not the children's mother. After she gave birth, more tests indicated that she was a surrogate carrier, not the baby's true mother.

How could this possibly be? The answer came when a lawyer who knew of a chimeric woman in Boston suggested to Fairchild's lawyer that he may have a similar case on his hands. Sure enough, while the DNA from her skin and hair did not match her children's, the DNA from Fairchild's cervix did. Unbeknownst to her, she was carrying two sets of DNA.

Similar problems have cropped up in true criminal cases, according to Abirami Chidambaram at the Alaska State Scientifc Crime Detection Laboratory in Anchorage. After a serious sexual assault, semen was collected at the crime scene, and the DNA matched the semen from a known criminal in the database. Just one problem: That criminal was in jail at the time of the assault. That's when further investigation found that the inmate had received a bone marrow transplant from his brother years earlier. The first test had actually found his brother's DNA.

"So, his blood DNA profile was the same as his brother's DNA profile," said Dr. Azita Alizadeh, a former genetics researcher at Stanford. "But his cheek swab DNA profile was different. This case ... points out the small risk that potential marrow donors take by having their DNA profile turning up in a crime database if the recipient later commits a crime. But this risk is probably better than the alternative."

It also proves why if you're thinking of ordering a DNA profile, you should do it before a stem cell transplant.

"As a bone marrow recipient, your blood cells will contain the DNA from your marrow donor, while your epithelial cells contain your own DNA," 23and Me advised one potential customer. "The combination frequently results in analysis failure. In the event that the analysis was successful, it still would be unclear whether the results were based on DNA from you or from your donor."

So far, I can find little to suggest that donor DNA actually combines with own genome, either in whole or part. Still, I can probably anticipate your next question: Will a simple blood transfusion cause the same problems? Not according to Michelle Gong, an assistant professor at the Mount Sinai School of Medicine.

"Studies have shown that donor DNA in blood transfusion recipients persists for a number of days, sometimes longer," she told Gizmodo.com. "But its presence is unlikely to alter genetic tests significantly."

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