

Beyond Birth: A Child's Cells May Help or Harm the Mother Long after Delivery

In addition to all of the nutrients flowing from mother to fetus, some of the developing child's cells pass back into the mother's body. New research shows how this fetal microchimerism may affect long-term health

By Nancy Shute | Friday, April 30, 2010 | 1 comments

A pregnant woman knows she is shaping her child's future from the moment of conception. But she might not realize that the baby is already talking back. Mother and child are engaged in a silent chemical conversation throughout pregnancy, with bits of genetic material and cells passing not only from mother to child but also from child to mother. Scientists increasingly think these silent signals from the fetus may influence a mother's risk of cancer, rheumatoid arthritis and other diseases, even decades after she has given birth.

We've known for more than a century that cells from a pregnant woman can make their way through the placenta to an unborn child. Identical twins also can exchange these microchimeric cells through their shared placenta. But it was a surprise when researchers at Stanford University, found a few cells with Y sex chromosomes in a pregnant woman's blood in 1979; those cells had to have come from her son, since women have only X chromosomes.

It turns out that all pregnant women carry some fetal cells and DNA, with up to 6 percent of the free-floating DNA in the mother's blood plasma coming from the fetus. After the baby is born, those numbers plummet but some cells remain. In 1996, Diana Bianchi, a geneticist at Tufts Medical Center, found male fetal cells in a mother's blood 27 years after she had given birth.

Evidence is building that those fetal cells aren't just lounging around in Mom; in fact, they might be active participants in a mother's health. But as research in this new field accumulates, so too do the perplexing contradictions about these rare alien elements.



PIECES OF YOU: During pregnancy, cells from the fetus enter the mother's body, and some stick around for decades. What affect to these microscopic traces of a child have on the mother's health?

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This image, based on medical imaging and computer rendering by the Visual MD, shows the interconnectedness of mother and baby, revealing the many opportunities for fetal cells to pass into the mother.

Scientists investigating fetal microchimerism first explored the cells' role in autoimmune diseases, which are much more common in women. They found fetal cells in the skin of women with scleroderma and in the spleens of women with systemic sclerosis, both autoimmune diseases. More recent studies suggest that fetal cells may actually protect women against autoimmune disorders, such as rheumatoid arthritis. These effects might be caused by the mother's immune response to the child's cells.

"With cancer, there's evidence both ways," says Bianchi, who is now researching how fetal DNA and RNA in a mother's blood could be used for prenatal testing. (The goal is to replace invasive tests like amniocentesis for genetic disorders such as Down's syndrome.) Motherhood reduces a woman's risk of having breast cancer later, and mothers with breast cancer have lower levels of fetal cells in their blood than do mothers without cancer. The immune response triggered by fetal cells might help the body detect cancer cells later in life. Fetal cells have, however, been found in cervical cancers but not in the cervical tissue of women without the cancer. Like cancer cells, some fetal cells can reproduce indefinitely, and studies in mice have found lingering fetal cells congregating in lung tumors. Researchers don't know what fetal cells are doing in tumors, but they aren't prepared to give the cells a clean bill of health.

Fetal cells also appear to migrate to injury sites and have been found in patients with thyroid and liver damage, where they had morphed into organ cells, which suggests that they are on a repair mission. This may be because some of the microchimeric cells are stem cells, which can reproduce indefinitely and change into different forms of tissue. Stem cells are being tested elsewhere in the medical research world to see if they can repair heart muscle damage caused by heart attacks, for instance. A mother's body might actually be recruiting the fetal stem cells to aid in healing.

The jury is still out on the effects of microchimerism—or if there's an effect at all. "There isn't enough evidence to accuse or acquit microchimeric fetal cells," Bianchi says.

It is also unclear how long microchimerism's harms or benefits might last. The protective effect of the cells on rheumatoid arthritis decreased over time, with no benefit seen 15 years after a woman last gave birth, according to a study in *Arthritis & Rheumatism* published online March 2010. The number of children a woman had didn't seem to matter—only how recently the last one had been born. And pregnancies had to have lasted for at least 20 weeks to see an effect.

Nelson speculates that the beneficial effect might wane as the fetal cells' regenerative powers dwindle over time, as they do in the offspring themselves. "If your son is looking at you and he's 15, we're misleading ourselves to call it 'fetal'. These cells have aged."

Even if microchimeric fetal cells don't turn out to be a power player in a mother's health, they might help persuade scientists that pregnancy is a health factor that needs to be considered anew. "Before we knew about these persisting fetal cells, and the persisting maternal cells, researchers didn't often analyze their data according to difference in sex," says J. Lee Nelson, a professor of human immunogenetics at the Fred Hutchinson Cancer Research Center, and a co-author on the rheumatoid arthritis study. "And they certainly didn't analyze it according to a woman's pregnancy history. One of the benefits of this field is showing how important this can be."

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