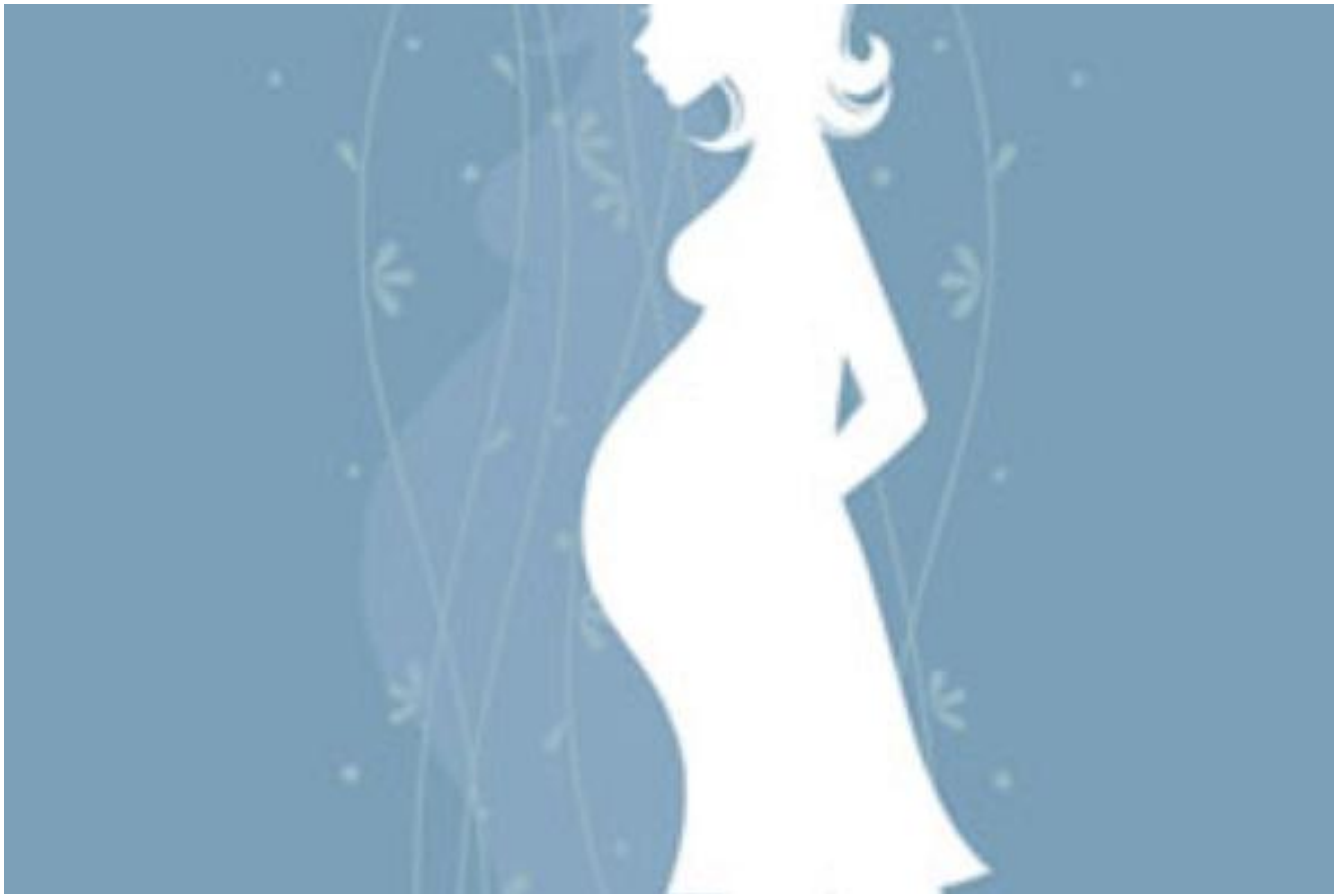

HEALTH

Scientists Discover Children's Cells Living in Mothers' Brains

The connection between mother and child is ever deeper than thought

By Robert Martone on December 4, 2012



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The link between a mother and child is profound, and new research suggests a physical connection even deeper than anyone thought. The profound psychological and physical bonds shared by the mother and her child begin during gestation when the mother is everything for the developing fetus, supplying warmth and sustenance, while her heartbeat provides a soothing constant rhythm.

The physical connection between mother and fetus is provided by the placenta, an organ, built of cells from both the mother and fetus, which serves as a conduit for the exchange of nutrients, gasses, and wastes. Cells may migrate through the placenta between the mother and the fetus, taking up residence in many organs of the body including the lung, thyroid, muscle, liver, heart, kidney and skin. These may have a broad range of impacts, from tissue repair and cancer prevention to sparking immune disorders.

It is remarkable that it is so common for cells from one individual to integrate into the tissues of another distinct person. We are accustomed to thinking of ourselves as singular autonomous individuals, and these foreign cells seem to belie that notion, and suggest that most people carry remnants of other individuals. As remarkable as this may be, stunning results from a [new study](#) show that cells from other individuals are also found in the brain. In this study, male cells were found in the brains of women and had been living there, in some cases, for several decades. What impact they may have had is now only a guess, but this study revealed that these cells were less common in the brains of women who had Alzheimer's

disease, suggesting they may be related to the health of the brain.

We all consider our bodies to be our own unique being, so the notion that we may harbor cells from other people in our bodies seems strange. Even stranger is the thought that, although we certainly consider our actions and decisions as originating in the activity of our own individual brains, cells from other individuals are living and functioning in that complex structure. However, the mixing of cells from genetically distinct individuals is not at all uncommon. This condition is called chimerism after the fire-breathing Chimera from Greek mythology, a creature that was part serpent part lion and part goat. Naturally occurring chimeras are far less ominous though, and include such creatures as the slime mold and corals.

Microchimerism is the persistent presence of a few genetically distinct cells in an organism. This was first noticed in humans many years ago when cells containing the male “Y” chromosome were found circulating in the blood of women after pregnancy. Since these cells are genetically male, they could not have been the women’s own, but most likely came from their babies during gestation.

In this new study, scientists observed that microchimeric cells are not only found circulating in the blood, they are also embedded in the brain. They examined the brains of deceased women for the presence of cells containing the male “Y” chromosome. They found such cells in more than 60 percent of the brains and in multiple brain regions. Since Alzheimer’s disease is more common in women who have had multiple pregnancies, they suspected that the number of fetal cells would be greater in women with AD compared to those who had no evidence for neurological disease. The results were

precisely the opposite: there were fewer fetal-derived cells in women with Alzheimer's. The reasons are unclear.

Microchimerism most commonly results from the exchange of cells across the placenta during pregnancy, however there is also evidence that cells may be transferred from mother to infant through nursing. In addition to exchange between mother and fetus, there may be exchange of cells between twins *in utero*, and there is also the possibility that cells from an older sibling residing in the mother may find their way back across the placenta to a younger sibling during the latter's gestation. Women may have microchimeric cells both from their mother as well as from their own pregnancies, and there is even evidence for competition between cells from grandmother and infant within the mother.


What it is that fetal microchimeric cells do in the mother's body is unclear, although there are some intriguing possibilities. For example, fetal microchimeric cells are similar to stem cells in that they are able to become a variety of different tissues and may aid in tissue repair. One research group investigating this possibility followed the activity of fetal microchimeric cells in a mother rat after the maternal heart was injured: they discovered that the fetal cells migrated to the maternal heart and differentiated into heart cells helping to repair the damage. In animal studies, microchimeric cells were found in maternal brains where they became nerve cells, suggesting they might be functionally integrated in the brain. It is possible that the same may be true of such cells in the human brain.

These microchimeric cells may also influence the immune system. A fetal microchimeric cell from a pregnancy is recognized by the

mother's immune system partly as belonging to the mother, since the fetus is genetically half identical to the mother, but partly foreign, due to the father's genetic contribution. This may "prime" the immune system to be alert for cells that are similar to the self, but with some genetic differences. Cancer cells which arise due to genetic mutations are just such cells, and there are studies which suggest that microchimeric cells may stimulate the immune system to stem the growth of tumors. Many more microchimeric cells are found in the blood of healthy women compared to those with breast cancer, for example, suggesting that microchimeric cells can somehow prevent tumor formation. In other circumstances, the immune system turns against the self, causing significant damage. Microchimerism is more common in patients suffering from Multiple Sclerosis than in their healthy siblings, suggesting chimeric cells may have a detrimental role in this disease, perhaps by setting off an autoimmune attack.

This is a burgeoning new field of inquiry with tremendous potential for novel findings as well as for practical applications. But it is also a reminder of our interconnectedness.

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ABOUT THE AUTHOR(S)

Robert Martone is the Neuroscience therapeutic area lead for The Covance Biomarker Center of Excellence located in Greenfield, Indiana. He is a research scientist with extensive experience in drug discovery for neurodegenerative diseases.

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