Making Sense of Bioethics
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The Ethics Of "Correcting" Mitochondrial Disease

"We are not actually 'repairing' a defective egg, but constructing a new, alternative, and clearly different egg out of the contributions from two separate women. The final egg produced really belongs to neither woman..."

Mitochondria are small, elongated structures in a cell that produce energy. These "cellular batteries" contain their own small piece of DNA, separate from the rest of the cell's DNA found in the nucleus.

When defects or mutations occur in this mitochondrial DNA it can result in a number of diseases. In severe cases, children can be born blind, epileptic, unable to crawl and may manifest severe neurological delay and die at an early age. No real therapies exist for most mitochondrial diseases beyond treating the symptoms.

In 2009, however, scientists in Oregon announced a technique to "swap out" defective mitochondria in an egg cell by using healthy mitochondria from another egg. The technique loosely resembles cloning, since it involves transferring the nucleus from the defective egg into a non-defective egg that has had its own nucleus removed. This newly 'reconstructed' egg will then contain mitochondria only from the new egg cell, leaving behind any defective mitochondria from the original cell. The reconstructed egg can then be fertilized with sperm by *in vitro* fertilization (IVF) to create an embryo that is free of mitochondrial mutations or defects.

Mitochondrial swapping, followed by IVF, has been successfully performed in the laboratory using monkey eggs, and several disease-free monkeys have already been born. Scientists believe that women may be able to use the method to avoid passing mitochondrial disorders to their children. Using the technique in humans, however, would raise at least two serious ethical objections.

The first objection is that it would encourage IVF as a means of producing new human life. Although this way of engendering new human life has become commonplace in our society, it remains an inherently unethical approach to human reproduction. IVF not only sanctions the manipulation, freezing and destruction of human embryos, but also violates the inner meaning of human procreation by reducing it to an act of manufacture or production.

To put it another way, our children have the right to be procreated, not produced. They have the right to enter the world in the personal, love-giving marital embrace of their parents, not in the cold and impersonal glass world of a test tube or petri dish. They have the right to be uniquely, exclusively and directly related to

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the mother and father who bring them into the world. IVF fails to respect these key rights of the child.

The second objection to mitochondrial swapping in humans is that it would introduce a rupture into parenthood, by creating children who inherit genetic material from three parents. While the mother and father would contribute the majority of their child's DNA from their own egg and sperm, a small amount would come from a second woman donating healthy mitochondria from one of her eggs. In other words, the procedure dilutes parenthood by introducing another parent, another woman, into the procreation of the child.

In the mitochondrial swapping scheme, it is significant that not just the mitochondria are "swapped" but actually all the other structures of the cell come from the second woman's egg as well (except for the nucleus and its chromosomes). In other words, one woman provides the DNA from her own chromosomes, while another woman provides everything else: all the other subcellular machinery of the egg, including the mitochondria. In summary, then, we are not actually 'repairing' a defective egg, but constructing a new, alternative, and clearly different egg out of the contributions from two separate women. The final egg produced really belongs to neither woman, so that the technological manipulations introduce a fissure between any child conceived from the engineered egg and both "mothers." The child becomes "distanced," and to a significant degree "orphaned" from both women involved in the process.

In order ethically to achieve a "cure" for mitochondrial diseases in children of the next generation, scientists will hopefully be able one day to correct the mutated gene sequences themselves in the mitochondrial DNA, perhaps while the egg is still inside the ovary, so that once ovulated, the couple could achieve a conception and pregnancy through normal marital relations.

Our sex cells, both sperm and egg, express and embody our individuality, our identity, and our parental roles in a unique way. These cells clearly should never be given over or sold to other people to use, in whole or in part, for the purpose of creating children. In particular, the exclusivity that is written into a woman's body and her reproductive faculties is violated by any decision on her part to donate her eggs, or even significant parts of her eggs, to another woman. Mitochondrial swapping technology, then, contrary to popular belief, is not an authentic example of "curing" or "correcting" a disease. It is an instance of setting up an alternative system for constructing a baby, which invariably runs counter to the authentic order of human procreation in marriage.

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