Three-Parent Babies: A Debate of Eugenics

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The possibility of creating a baby with a genome comprised of genetic material contributed by three individuals has prompted responses in the past year from both the United States Food and Drug Administration (FDA) and the British Parliament. This new possibility of introducing a third parent's genetic material stems from the mitochondria in our cells containing a small genome completely separate from the DNA in the nucleus. While nuclear DNA of a child comes from both of his or her parents, the 37 genes in mitochondrial DNA are inherited only from the mother, who contributes the mitochondria-containing cytoplasm of the fertilized egg. New therapies seek to prevent mitochondrial diseases like muscular dystrophy by replacing the mother's mitochondrial DNA with another woman's healthy mitochondrial DNA in vitro before fertilization (Tingley 2014, Sample 2014).

The first successful pregnancy of a "three-parent baby" occurred in August 1996 at the St. Barnabas Medical Center in New Jersey (Tingley 2014). In this case, the older technique of cytoplasmic injection was used, in which cytoplasm of the second woman's egg is inserted into the mother's egg. Seven documented clinics reportedly used the same technique of cytoplasmic injection until 2001, when the FDA declared that insertion of an egg's cytoplasm into another egg requires an Investigational New Drug (IND) application for use in humans (Tingley 2014). Recently, Shoukhrat Mitalipov, the U.S.'s preeminent researcher in the field, has stirred up ethical debates with an improved mitochondrial-replacement therapy technique he used to birth five monkeys (Weintraub 2014). Rather than simply injecting cytoplasm, this method specifically pairs the mitochondrial DNA of a healthy egg with the nuclear DNA of the affected mother's egg (Tingley 2014).

This past February, the FDA held a conference to investigate the implications of conducting clinical trials on humans. Leading the discussion in favor of the technique, Mitalipov claims, "[w]e want to replace these mutated genes, which by nature have become pathogenic to humans" (Weintraub 2014). Other supporters of the technique, such as England's Chief Medical Officer, Dr. Sally Davies, state that only 37 mitochondrial genes would be eligible for replacement, leaving intelligence, physical appearance and behaviors unchanged (Stein 2014).

Yet, others such as David King, a British molecular biologist active in the Human Genetics Alert group, fear the effects on society, stating that it "can potentially lead to this future of designer babies and consumer eugenics" (Stein 2014). King's organization, the Human Genetics Alert, argues that social benefits of mitochondrial-replacement therapy are driving proponents of the technique, rather than medical benefits (Human Genetics Alert 2012). For example, although less ethically charged methods such as egg donation exist, proponents of mitochondrial replacement argue that these methods do not provide the child with any of the mother's genes. In addition, some proponents point out that mitochondrial-replacement therapy could open the door for lesbian couple conception, allowing them to conceive a child with genetic material from both female parents (Morgan 2012). The Human Genetics Alert believes that such social benefits should not be considered over the medical well-being of the child. Other opponents, like evolutionary biologist Klaus Reinhardt, also fear the possibility of "language" gaps in the genetic code for future generations caused by the mitochondrial and nuclear DNA not complementing each other (Weintraub 2014). Not enough is understood about the interactions between mitochondrial and nuclear DNA, and all future offspring of a baby created through mitochondrial replacement therapy would be vulnerable to any issues stemming from having a different source of mitochondrial and nuclear DNA.

While the FDA has not stated a timeline to issue an edict for clinical trials, British Parliament is close to voting within the coming months on whether to allow mitochondrial-replacement therapy (Tingley 2014). Should Parliament pass legislation allowing the therapy, this would mark a watershed event in eugenics not seen since the United Nations' agreement not to alter the human genome 15 years ago (Weintraub 2014).

References

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