

Three Parent Babies:
An Ethical Review of Mitochondrial Replacement Therapy

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Introduction

The future of reproduction is becoming increasingly ambivalent with advancements in medical and genetic technology. Techniques for developing healthier and more capable human beings are starting to be implemented in medical practices. Mitochondria replacement treatment (aka three parent babies) is a new and controversial form of genetic alteration that aims to treat rare genetic defects. In this paper, I will address: the nature of mitochondrial disease, medical implications, moral support, and moral objections, of the treatment. I argue the benefits of the treatment outweighs the risks and take precedence over societal norms.

Background

1 in 5,000 children suffer from mitochondrial disease¹, a chronic illness in which cells lack the ability to produce energy. Cellular failures to produce energy often leads to organ failure and death, usually around the time of birth. “it appears to cause the most damage to cells of the brain, heart, liver, skeletal muscles, kidney and the endocrine and respiratory systems”². The mitochondrial DNA is located outside and separate from the nucleus in the cell and accounts for only .02% of total human DNA. The nucleus within the cell contains both maternal and paternal DNA, which accounts for 99.8% of the human genetic makeup.³ The nucleic DNA is responsible for individual physical and mental characteristics; it is the essence of human individuality while the mitochondrial DNA solely provides energy to the cell to keep it functioning properly.⁴

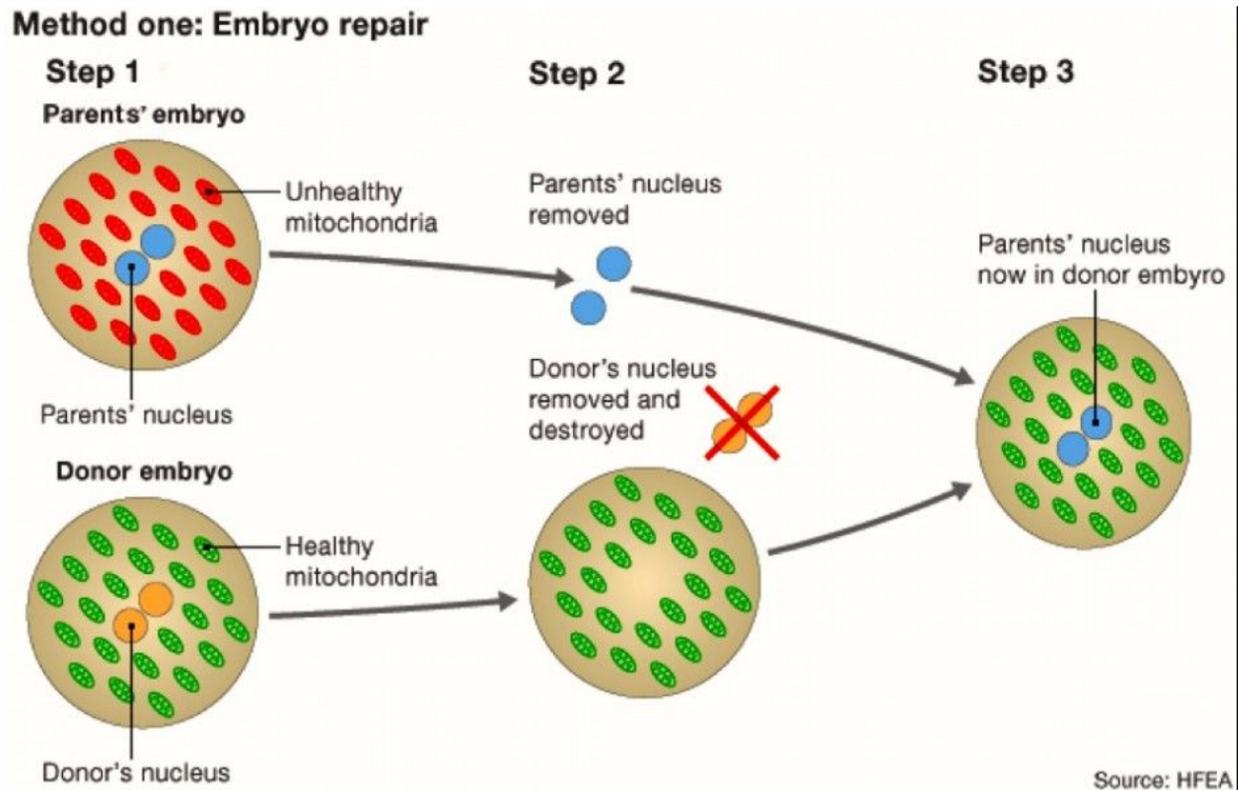
¹Bannwarth, Sylvie et al. “Prevalence of Rare Mitochondrial DNA Mutations in Mitochondrial Disorders.” *Journal of Medical Genetics* 50.10 (2013): 704–714. PMC. Web. 17 Mar. 2016.

²“What Is Mitochondrial Disease?” *What Is Mitochondrial Disease - The United Mitochondrial Disease Foundation*. The United Mitochondrial Disease Foundation, n.d. Web. 03 Feb. 2015.

³ibid

⁴Cavalier-Smith, Thomas. "Origin of Mitochondria by Intracellular Enslavement of a Photosynthetic Purple Bacterium." *Proceedings of the Royal Society B: Biological Sciences*. The National Institutes of Health, n.d. Web. 10 Feb. 2015.

Mitochondrial genetic information is also passed down only through the maternal line from mother to child through *the egg*. The process of implementing a third parent consists of: taking the nucleus from a mother's egg and planting it in another donor egg. This new cell includes mitochondria with the DNA from the third parent and a nucleus from the original parents.



Medical Implications

The most important implication to any new medical treatment is its effectiveness in improving a patient's well-being. This therapy would effectively eliminate all mitochondrial disease in one treatment. Concerns with mitochondrial replacement regarding unknown genetic implications later in life are somewhat unknown and potentially dangerous. Because imIVF is considered germ line therapy, the genetic rewards, as well as the hazards, are passed down to

future generations. Having a third parent to avoid organ failure or disease may seem beneficial, especially when it is imminent, but the treatment could be traded for another unforeseen condition later in life. This has been observed in previous gene therapy treatments but only in cases of manipulation of nucleic DNA, which mtIVF (mitochondrial in vitro fertilization) does not affect.

Regarding the current safety of the therapy, the Human Fertilization and Embryology Authority commented, “The panel of experts convened by the HFEA to examine the safety and efficacy of mitochondrial replacement carefully considered the interaction between nuclear and mitochondrial DNA and concluded that the evidence did not show cause for concern.”⁵

Continuing to support research provides for a more informed policy debate and establishes parameters for future discourse upon a larger public implementation. The United Kingdom has recently accepted the methods of mtIVF as being a valid treatment plan. They have taken steps to further this technology and passed legislation to allow human volunteers to receive treatment, making them the first in the world to do so. The first treated baby is to be born sometime in 2016 and may serve as an example for future treatments.

Moral Objections

With low risk and a growing understanding to provide safer and more reliable practices, the debate against the research and use of mtIVF proves insubstantial. Many oppose mtIVF on the premise that having the DNA of three parents is unethical because it is not found in nature. The primary reason for rejecting the treatment, outside of medical grounds, is largely opinions

⁵HFEA - Fertility, Infertility, IVF, Embryo Research - Human Fertilisation & Embryology Authority." *HFEA - Fertility, Infertility, IVF, Embryo Research - Human Fertilisation & Embryology Authority*. N.p., n.d. Web. 10 Feb. 2015.

based on societal norms of reproduction. In certain objective moral theories genetic alteration could be viewed as unethical at its core regardless of societal norms.

Kantian ethics for example, may suggest that genetic engineering is wrong in itself and no matter the implications, it is always wrong. Kant however, was in favor of finding objective moral truths through reason. If there are no significant medical threats or risks to an individual's health, and treatment is likely to promote his/her well being, then it could be interpreted to be objectively wrong to withhold that treatment. This would be true regardless of our emotional or cultural disposition.

Another primary concern critics raise, is altering a human to such an extent as they lose individuality and become a creation of science instead of nature. They also suggest this treatment is a stepping-stone for further more intense genetic engineering. With a basic scientific understanding of nucleic and mitochondrial DNA and their responsibilities (mentioned earlier in this paper), it becomes very clear the individual's characteristics are preserved, only that they will function with a healthy energy supply to their cells. Prime Minister, David Cameron describes the process, "We're not playing God here, we're just making sure that two parents who want a healthy baby can have one."⁶

Some religious beliefs may insist that the "natural state" should in principle be preserved. In the circumstance of mitochondrial replacement, where the characteristics and individuality are preserved and only serves to better support the function of those cells, the argument for keeping human essence is weak. In this case, the notion accepts suffering as a principle of human

⁶Gallagher, James. "MPs Say Yes to Three-person Babies - BBC News." BBC News. Accessed March 17, 2016. <http://www.bbc.com/news/health-31069173>.

existence, as something essential that should not be taken away. The idea that empowering health and preserving identity is a bad thing, would be to reject medical treatment in all forms.

The choice for gene therapy should be an individual autonomous one, however, in the case of mtIVF, the implications of that choice do not affect the individual making the decision. Personal decisions based on personal beliefs should always be respected; but cases where they have the ability to substantially alter the lives of others, they should be thoroughly examined. Allowing someone to deliberately forego a treatment for his or her child that would alleviate a life of suffering could be viewed as a form of child abuse. For cases of child abuse are matters of the state, it could be argued that obligatory policy should be implemented in circumstances of specific and substantial consequences.

Natural Sex

The idea of genetic manipulation is a somewhat taboo one. Objections to the treatment are based on personal and cultural ideas of how sex should be. Reproduction is most commonly thought of as sex between a male and female to produce offspring. Eventually, science and technology will give us the tools to produce future generations that will marvel at our medical hardships, battles with cancers, diseases, aging, and the like. If society continues to hold beliefs that the natural way is the best and only way to live, biological and medical conditions that produce some of the greatest depths of human suffering will go unaddressed by way of social uncomfortability.

Conclusion

Science is increasingly influencing the way we perceive ourselves and how we function. Chemical and mechanical alterations have changed the way we live, arguably for the better. The

power to change the way our bodies and minds perform is not a new application, but rather has always been on a continuum of change from our naturalistic tendencies toward a more pleasurable conscious experience. To avoid the slippery slope of genetic engineering as new discoveries and technologies emerge, issues should be researched and carefully analyzed to make an informed rational decisions rather than an a priori one. The exponential leap in technology is giving humanity the capacity to solve problems and empowers us to reflect our values if it is implemented in the correct way.

Medical ethics should be based on medical facts and states of well-being rather than social constructions. With safe applications of mtIVF and the preservation of individual characteristics, society should conform to the needs of its inhabitants. At the very least arguments should be made to expand this research and funds allocated to testing and establishing safer methods. It would be unethical to withhold an effective treatment to preserve social ideas with little to no medical objections to mtIVF.

Notes

Bannwarth, Sylvie et al. "Prevalence of Rare Mitochondrial DNA Mutations in Mitochondrial Disorders." *Journal of Medical Genetics* 50.10 (2013): 704–714. PMC. Web. 17 Mar. 2016.

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