

Critical Reading Assignment 3: Bioethics Paper

Margarida Lora

Old Dominion University

BIO294: Genetics

Professor Janet Rinehart-Kim

April 20, 2026

Mitochondrial DNA replacement therapy is an emerging reproductive technology that raises important ethical concerns. Overall, it should be supported because it has the ability to prevent serious genetic disease and improve quality of life for affected families. While the idea of altering genetic material can seem controversial, the purpose and potential benefits of this technology make it a valuable advancement in modern medicine. In particular, using this technology offers a solution for families who otherwise would risk passing on severe, inherited conditions.

Mitochondrial DNA (mtDNA) is inherited maternally and plays a key role in energy production in cells. Mutations in mtDNA can lead to severe disorders that affect organs with high energy demands such as the brain, heart, and muscles. These conditions are often debilitating and even life-threatening in some cases. Mitochondrial DNA replacement therapy works by replacing the defective mitochondria in an egg or early embryo with the healthy mitochondria from a donor. Techniques such as spindle transfer and pronuclear transfer allow the nuclear DNA from the biological parents to remain intact while introducing the healthy mtDNA, ultimately preventing the transmission of disease (Mitalipov & Wolf, 2014). This aligns with lecture material from Module 8, where Mitochondrial inheritance is strictly maternal and mutations can significantly impact cellular function.

Despite its benefits, mitochondrial DNA therapy presents several ethical challenges. One of the primary concerns is that it involves germline modification, meaning the genetic changes are heritable and could affect future generations. This does raise uncertainty about the long-term safety of mtDNA and if unintended consequences could emerge over time. Additionally, the involvement of a mitochondrial donor has led to the idea of “three-parent babies”, which creates confusion about identity and parenthood. There are also concerns regarding allowing genetic modification, even for medical purposes, which could open the door to non-medical or aesthetic enhancements in the future. Another ethical concern is whether access to this technology would be equitable, as it may be unavailable to those who cannot afford it.

However, the benefits of mitochondrial DNA replacement therapy strongly outweighs these concerns. First, it provides families with a way to have healthy biological children without passing down genetic, inheritable diseases which may be debilitating. Evidence suggests that the techniques are effective, with minimal transfer of mutated mtDNA and no major abnormalities observed in early studies (Mitalipov & Wolf, 2014). Additionally, the genetic contribution from the mitochondrial donor is very small, only about 0.1% of total DNA. This means the child’s genes are still majorly derived from the biological parents. From a medical perspective, preventing serious disease is a strong ethical justification for the use of this technology. Furthermore, the ability to reduce suffering and improve long term health outcomes strengthens the argument in favor of using this technology.

Ethical concerns can be addressed through careful regulation and oversight. Restricting the use of this type of therapy to medical purposes, ensuring informed consent, and continuing to research the long term effects of mtDNA can help minimize risks. These precautions allow society to benefit from this technology while also maintaining ethical standards.

In conclusion, mitochondrial DNA replacement therapy demonstrates a significant advancement in reproductive medicine. Although it raises some valid ethical concerns, its ability to prevent severe genetic disease and improve overall health outcomes and generational wellbeing. This makes it a justifiable and beneficial medical intervention. With proper regulation and continued research, it can be used ethically.

References

- Mitalipov, S., & Wolf, D. P. (2014).** Clinical and ethical implications of mitochondrial gene transfer. *Trends in Endocrinology & Metabolism*, 25(1), 5–7.
<https://doi.org/10.1016/j.tem.2013.09.001>