In a world increasingly divided over the ethical implications of genetically modified human embryos that have arisen from technological innovations, from stem cells to so-called designer babies, parents at risk of mitochondrial disease have found renewed deliverance following a UK ruling that supports mitochondrial donation, also know as three-parent offspring. There exists prenatal screenings for mitochondrial diseases though these diseases remain prevalent and prove difficult to treat.  Recently, a new fertilization technique has been developed to help carriers of these diseases have genetic offspring unaffected by their disease. However, a big question remains, are these treatments doing unknown harm to the human genome?
Mitochondrial diseases are inherited through the maternal mitochondrial DNA, meaning that children of women affected by mitochondrial diseases will often inherit these mutations. Mitochondrial diseases are incurable, and, though there are several treatments available for people with these diseases, most treatments are severely limited. This is why the new fertilization technique is so exciting. Therefore, many parents with these diseases have welcomed mitochondrial donation. This technique involves removing a nucleus from an egg of a mother with diseased mitochondria and transferring the nucleus into a healthy donor egg, hence this technique being called 'three parent offspring'. This transfer takes place before the egg is fertilized, thus reducing adverse complications. However, there have still been many outspoken critics that claim the technique is unsafe.
Because the technique involves the transfer of different genetic material to the offspring, the donor mitochondrial DNA can be passed down through a maternal line to be inherited in future generations, which allows the possibility of a bottleneck effect to occur if mitochondrial donation were to become widespread. This is because most of the population would have relatively few maternal mitochondrial lines, as donor lines were used again and again, leading to a decrease in genetic variability. While this belief is not unfounded, the amount of mitochondrial donation that was needed to have this  occur would have to outweigh the unmodified fertilization process -- a fact that seems unlikely noting the technique remains illegal in all countries except the United Kingdom.
Another common criticism is that the level of disease cannot be predicted based upon maternal phenotype. These critics point to the fact that many screening methods for mitochondrial disease are imperfect and unable to screen for all possible genetic defects. This means that donors or parents may not know that they are carriers for a mitochondrial disease until an offspring is produced, which can lead to the development of the disease in the child. The only way to truly eliminate this risk is for the future development of more accurate and sensitive genetic tests designed to screen for mitochondrial disease, even in carriers. Also, important is to work on developing the technology so as to make it more affordable. That way health disparities can be eliminated.
While this technique remains highly controversial, with some claiming it is promoting the idea of genetically modified child, it was developed to help parents at a high risk of having children with incurable illnesses. It is true that a more widespread use could lead to a genetic bottleneck and even produce disease in unaffected family lines, but for now it seems that mitochondrial donation has positive genetic implications.