This response was submitted to the call for evidence by the Nuffield Council on Bioethics on *Emerging techniques to prevent inherited mitochondrial disorders: ethical issues* between January 2012 and February 2012. The views expressed are solely those of the respondent(s) and not those of the Council.

**Anonymous 2**

Summary:

- I support the use of PNT to prevent the transmission of mitochondrial DNA disease.
- The genes within the mitochondria will not affect who the child becomes or what they look like, simply the function of the mitochondria within their cells.
- The child will still be a genetic combination of the DNA from both parents.
- Preventing the transmission of these diseases is important.
- I disagree with the term '3 parent children'.

Mitochondrial DNA disorders are a debilitating set of diseases which may cause the premature loss of life in both children and adults. Since the current treatments available for these disorders mainly focus on the management of symptoms rather than on a cure, it is important to think of innovative ways in which these disorders can be prevented. Therefore the technique proposed by Newcastle University has my full support.

As with any technique which considers DNA a number of ethical questions arise. Many people automatically think of cloning or creating designer babies. The techniques put forward to prevent the transmission of these mitochondrial disorders do not involve cloning or the creation of children with only desirable traits. They simply allow parents to have healthy children. The transfer of mitochondria between embryos will not affect the identity, looks or personality of the child. This information is all stored within the thousands of genes within the nucleus of the cell; this information will still be a combination of chromosomes from both the mother and father of the child. All the donor provides is healthy mitochondria and the ability of these mitochondria to continue functioning into adulthood and later life. The 13 genes within the mitochondria only provide the means for the mitochondria to work efficiently, they DO NOT affect any other characteristics of the resulting child. In my opinion the effect of the donation of 13 genes within healthy mitochondria compared to the thousands of genes the child will receive from their parents is very small, yet it carries with it the chance for mothers with mitochondrial disease to have a healthy child who will not be prematurely taken from them or severely disabled.

Because mitochondria are passed from mother to child, any female children born as a result of this treatment would then pass the donated mitochondria onto the next generation. The mitochondria should still be healthy and not contain any of the mutations that lead to disease in their grandmother. Therefore in theory the transmission of mitochondrial disease would not just be prevented from mother to daughter but to granddaughter and great granddaughter. The use of these treatments to prevent the transmission of mitochondrial disorders has therefore far reaching possibilities.

There has been a lot of press usage of the term '3 parent embryos', since the embryos will contain genetic material from 3 individuals. While I understand where this term comes from I disagree with its usage and in my opinion feel it is misleading. The children that result from this treatment, if it is given approval, would still look like their parents, they will have the same hair colour, eye colour and be no different to any siblings. There will be no outward signs that they carry within their cells the mitochondrial DNA from another individual. While I appreciate that the donor embryos will have been created from donate oocytes, I think the thought that the donor should have some relationship with the resulting child is ridiculous. I realise that people tend to me more sensitive about the donation of reproductive cells than other cells and I can appreciate why, considering their use may result in a child, however I believe that if this is considered in a logical manner this issue can also be resolved.

The donated oocytes used to create the embryos for PNT will have their nuclei removed, thus removing the vast majority of the DNA from the donor, this will leave only the mitochondria and their DNA, which as a mentioned earlier will only affect the health of the child rather than their characteristics. The donor woman will have donated one cell to this child, and a tiny fraction of their DNA. The other building blocks to create this child will have come from their parents, not the donor. In my view this is no difference to the donation of any cell or tissue. When someone donates bone

marrow, or an organ much more genetic material is transferred to the individual than would occur following PNT, do these donors have the right to a relationship with the recipient too? I think that one way to bypass these arguments is to encourage the donation of oocytes from women who have already had their own children. When you consider how many oocytes a woman will produce in a lifetime and how many are discarded with their monthly cycles, the donation of a handful of these to give women affected by mitochondrial disorders the chance to have healthy children would seem to me to be an easy choice.

While I give my support to the use of these techniques to the treatment of mitochondrial DNA disorders I believe that tight regulations should remain in place ensuring that only a handful of researchers, clinicians and NHS staff have the ability to use or give advice with regards to this treatment. These techniques should not be used to modify the nuclear DNA of an embryo. This technique would affect the characteristics of a child and would incur more ethical issues that the transfer of JUST the mitochondria. The transfer of the pronuclei offers hope to prevent the transmission of mitochondrial DNA disorders but other techniques need to be established for the prevention of transmission of disorders caused by mutations in the nuclear DNA, e.g. Cystic Fibrosis, Down's syndrome, Huntington's disease etc. In my opinion it is important to give everyone involved donors, parents etc full genetic counselling to allow them to understand not just the implications of their undertakings but also the techniques themselves.

I think that these techniques offer huge promise to the women affected by mitochondrial disease, but further research needs to be performed before a child can be created following these techniques. For example, how will the electron transport chain proteins encoded by the donor mitochondrial DNA integrate with the electron transport chain proteins encoded by the nucleus? I believe that they will integrate with no problem, but I feel this needs to be verified. How many of the embryos which have undergone PNT will develop further into foetuses etc (what will the success rate of this technique be? Will it be comparable to other IVF techniques?). What will the screening criteria for donor oocytes be? Will there be an age limit for donors since even with normal ageing mitochondrial DNA develops mutations, not sufficient enough to cause disease, but will this be the same when considering a single oocyte.

I believe that every woman has the right to want to have healthy children. For many women affected by mitochondrial disease this may not be possible, their children may be born severely disabled or even die within a few moments of birth. If there is the possibility to help these people using PNT then I think every support should be given.