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Re: Mitochondrial donation

Dear Senators,

I would like to provide my support for mitochondrial donation to be made available to families affected by mitochondrial diseases in Australia. I have been an active researcher working on mitochondrial diseases since the start of my career in 1997. I have dedicated the past 21 years to understanding the genetic causes and pathology of mitochondrial diseases. My main research interest are mitochondria that are the tiny parts of each of our cells that make most of the energy required by our bodies. These organelles contain their own genetic material known as mitochondrial DNA that is different to the DNA in our chromosomes but just as important because these genes are essential for energy production. Mutations in the mitochondrial DNA lead to mitochondrial diseases that are progressive and debilitating multi-system disorders, which occur at a frequency of up to 1 in 4,300 live births. In fact, 1 in 200 individuals are thought to be at risk of developing disease as a result of mutations in the mitochondrial DNA. Half of mitochondrial diseases are caused by mutations in mitochondrial DNA.

At present, there are no cures nor effective treatments for these devastating diseases and these frequently cause premature deaths. Because of the severe and drawn-out course of these diseases, the emotional, societal, and financial costs are devastating. As a researcher who has had experience in providing molecular diagnosis for patients and families affected by mitochondrial disease I have seen the devastation it causes not just in terms of the difficult pathologies but the stress and emotional turmoil in caring for the affected loved ones as well as the concerns related to future family planning. I have met many of the Australian families affected by mitochondrial diseases and seen their brave struggle in caring for their loved ones and the high costs required for the care of patients affected by these devastating diseases. Therefore, any opportunity to prevent and treat these diseases and the transmission of mutant mitochondrial DNA is essential.

Mitochondrial DNA is transmitted through the mother to her children. Mitochondrial DNA exists in multiple copies within each cell of our body and typically healthy and mutant mitochondrial DNA can co-exist together. If the mutant mitochondrial DNA load exceeds that of the healthy mitochondrial DNA this leads to different pathologies with varied severities and outcomes. Unlike our chromosomes where we inherit one copy from each parent, the mitochondrial DNA transmission from a mother to her children can be a random selection. This means that it is

impossible to predict if the children will have a mitochondrial disease or not. However, if the mother has mitochondrial DNA mutations there is high chance that she will transmit the mutation to her children. Mitochondrial donation is an effective strategy to circumvent the transfer of mutant mitochondrial DNA carried by mothers to their children. It uses a donor that has healthy mitochondrial DNA that can replace the mutant mitochondrial DNA from the mother. This is a practical approach to overcome the transmission of mutant mitochondrial DNA and to prevent the development of mitochondrial diseases.

Mitochondrial donation would enable couples to have healthy children that would otherwise be at risk of having children affected by mitochondrial diseases. Currently in Australia the predicted number of births per year among women at risk for transmitting mitochondrial DNA disease is ~60. Although prenatal diagnosis and preimplantation genetic diagnosis can be useful for some couples, this would be ineffective for most at risk couples. Therefore, mitochondrial donation would be the most optimal choice to avoid the transmission of mutant mitochondrial DNA. Research studies that support the safety and efficacy of this procedure have been conducted in Newcastle, UK and Oregon, USA in primate models and human embryos. Additional studies carried in mice have shown that donated mitochondrial DNA has no significant effects on physiology and metabolism and ethical reviews in the UK, and USA, have recognised mitochondrial donation as distinct from germline genetic modifications and should not be prevented based on these arguments. Since the mitochondrial DNA encodes a small number of genes that carry out well defined roles in energy production it is established that they do not contribute to any other traits that would impact on the child or would be different from the biological mother and father.

Mitochondrial donation will be an invaluable opportunity for families considered at risk of mitochondrial DNA diseases and would allow them to have healthy children. Although mitochondrial donation is at an early stage of development additional research and clinical follow up of children born following mitochondrial donation would enable scientists and clinicians to evaluate any potential long-term effects. In Australia we would need to establish a regulated process that draws on the foundations established by the UK model. Based on this model at risk couples would be evaluated if they would benefit from mitochondrial donations and would require an approval to ensure that they benefit from the procedure and fully understand the safety, efficacy and potential uncertainty associated with the early stage development of this procedure. The advantage of having this available in Australia would be that couples would not seek treatment in unlicensed countries that may put them at a greater risk. Mitochondrial donation in Australia would make an enormous difference for families affected by the devastation of mitochondrial diseases and would contribute to the goal of improved health and healthy ageing in Australia.

Thank you for your consideration.

Yours sincerely,

Aleksandra Filipovska