Mitochondrial Donation Law Reform (Maeve's Law) Bill 2021

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To the Senate Community Affairs Legislation Committee,

Thank you for the opportunity to offer feedback on the Mitochondrial Donation Law Reform (Maeve's Law) Bill 2021.

Science & Technology Australia (STA) is the nation's peak body for the science and technology sectors. Through our 85 member organisations, we represent more than 88,000 scientists, mathematicians, engineers and technologists. Our members include specialist scientific societies, research institutes, groups of maths and science educators, and research strategy bodies such as councils of deans.

For parents with mitochondrial disease, there is a high risk of passing on these disorders through the maternal line. While egg donation can allow someone with a mitochondrial disorder to get pregnant, the child will not be genetically related to the parent.

Mitochondrial donation technologies allow a parent's nuclear genome to be placed into a donor egg that has healthy mitochondria. It provides an opportunity for parents to have children that are genetically linked to them without the risk of having their mitochondrial disease.

The proposed Mitochondrial Donation Amendments allow the use of a well-established health technology to prevent severe disease in children. This is a technology that has been extensively reviewed, is established in the UK, and will be strongly regulated by the proposed legislation.

In considering these amendments, STA invites the committee to pay particular attention to three key aspects:

- The importance of mitochondrial donation to prevent severe mitochondrial disease;
- The strong regulations under these amendments and in the research sector to ensure this technology is used safely; and
- The success of similar regulation in the United Kingdom.

Given the extensiveness of consultation, the large body of scientific evidence, and the comprehensive regulatory framework **STA recommends the Senate pass this legislation.**

Yours sincerely,

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The importance of mitochondrial donation law reform

According to the National Health and Medical Research Council, one in every 200 children will be born with some level of mutation in their mitochondria. Between one in 5,000 and one in 10,000 Australians will develop a severe mitochondrial disease for which there is no cure and few effective treatments (Minister for Health and Aged Care 2021). Many of these diseases are considered rare, however a recent study of 350,000 people by University of Cambridge has linked genetic mutations in mitochondria to common diseases such as multiple-sclerosis, Type 2 diabetes, or to massively reduced life expectancy (Yonova-Doing et al. 2021).

Because the mitochondria are inherited through the maternal line (i.e. from their mother), women with mitochondrial mutations (1 in 200 Australians) run the risk of their children suffering this illness (approximately 56 a year) and dying before the age of five (Minister for Health and Aged Care 2021). *In vitro* fertilisation and donor eggs can be used to allow women with mitochondrial mutations to get pregnant, but their children will not be genetically related to them. Mitochondrial donation allows for the genetic information from a parent to be inserted into a donor egg that has healthy mitochondria.

The concern that mitochondrial donation would result in "three-parent" children is not founded in scientific fact. Placing the DNA of a mother's nucleus into a donor egg does not significantly change the genetic makeup of the child. The nuclear genome contains just over 20,000 genes that encode for a protein, mitochondria only have 13 genes and code for proteins exclusively in the mitochondria (Salzberg 2018). While mitochondria do contain its own DNA, the function of this DNA is to allow the proper function of the mitochondria - to produce energy for the cell.

Regulation of mitochondrial donation for research and health purposes

Under the current regulations, research into mitochondrial donation and its related techniques is prohibited. This prohibition limits research into both mitochondrial diseases as well as new and improved mitochondrial donation techniques.

The proposed amendments would allow the use of mitochondrial donation for health and research purposes under a licence system administered by the NHMRC and using the process which has successfully regulated human embryo research in Australia for almost 20 years. What the amendments do not allow is alteration of genes either in the donor egg's mitochondria or the parents' nuclear DNA. This means that techniques for gene editing (like CRISPR) cannot be used to genetically modify the DNA of an embryo.

The regulations extend beyond a simple licencing system, however. Safeguards embedded in the proposed amendments include:

- A requirement for pre-treatment counselling;
- Privacy laws that protect families and children;
- Mandatory reporting of any adverse effects;
- Laws that prevent egg donors being considered legal parents;
- The rights of children to apply for donor information; and
- A clearly legislated exclusion of intentional modification of the DNA of the nucleus or the mitochondria which will be monitored as part of the licensing mechanism.

These proposed reforms are the result of extensive consultation with the community, with people who have mitochondrial diseases, medical experts and researchers, and community groups.

STA also highlights that, should this legislation be enacted, it will not initially lead to the use of mitochondrial techniques. The proposed staged rollout would begin with using mitochondrial donation for certain research and training purposes. This will allow expertise in these techniques to be developed and the licensing of a pilot program building this skill in Australia before it is permitted in clinical practice.

Like all areas of research, mitochondrial donation research also faces stringent regulations. This includes needing approval under the ethics approval under the National Statement on Ethical Conduct in Human Research (2007), approval from a research institution, and publishing under a peer review system that adds a further peer-regulatory layer to medical research. Clinical practitioners of mitochondrial donation and their clinics would also fall under the same requirements as any practitioner working in assisted reproductive technology.

Based on the standard research ethical and quality control mechanisms, and the standards required of medical practitioners, the passage of the proposed amendments will create a comprehensive and robust system in which mitochondrial donation and research can occur in a safe manner.

Consultation and the UK example

There have now been multiple reviews into the science and safety of mitochondrial donation here in Australia. After a Senate inquiry in 2018, the Australian Government requested the NHMRC carry out further consultations into the safety of mitochondrial donation (Community Affairs References Committee 2017).

Substantial consultations have since occurred through the work of the NHMRC (National Health and Medical Research Council 2020). This has included a statement by experts into the techniques used in mitochondrial donation as well as a community consultation (2019 citizens' panel on mitochondrial donation 2019; Mitochondrial Donation Expert Working Committee 2020). The findings of these consultations have been integrated into the legislation to ensure not only the safety of these procedures but a need to review the legislation in seven years, privacy rights of parents and children, and the legal obligations of the egg donor (Australia 2021).

Australia is also not the forerunner with this legislative change. The United Kingdom has allowed mitochondrial donation and related research since 2014. The proposed amendments align closely to the established regulations that are already operating safely and successful in the UK. In the UK, the Human Fertilisation & Embryology Authority (HFEA) undertook reviews in 2011, 2013, 2014, and again in 2016 - a year after the two techniques were considered safe (The Human Fertilisation and Embryology Authority 2013; 2011; 2014; 2016).

The International Society for Stem Cell Research, the preeminent global science organisation in this field, recently recommended that research and clinical use involving mitochondrial donation is permissible. This use is strictly regulated with appropriate oversight and limited to patients at high risk of transmitting serious mitochondrial DNA-based diseases to their offspring. The licensing measures outlined in the Bill are consistent with this international standard (International Society for Stem Cell Research 2005).

At this stage, there is one clinic in the UK offering mitochondrial donations to occur as part of their IVF treatments. This highlights how stringent the regulation of this technology is able to be - and how tough the safety mechanisms are.

Conclusion and Recommendation

Passing this bill will help prevent children being born with severe mitochondrial disease. It will allow parents to have a child, genetically related to them, without the risk of potentially fatal mitochondrial disease.

The issue of mitochondrial donation has been examined and reviewed extensively in Australia over many years, including extensive community consultation, as well as being successfully allowed and regulated in the UK for almost a decade. These consultations have resulted in this legislation including strong and robust regulatory mechanisms. These regulations will protect parents’, children’s and donors’ legal rights and require mandatory reporting of adverse effects.

The legislation also requires an independent review of the Act is to be undertaken every seven years. Initially, licensed research will be limited to pre-clinical and clinical trial research and training. Any decision to extend the clinical application of this technology will only be considered after a thorough review of clinical trial outcomes.

Given the extensive consultations undertaken including scientific advice from the NHMRC and various inquiries including scientific advice from leading experts, STA recommends the Senate pass the Mitochondrial Donation Law Reform (Maeve’s Law) Bill 2021.

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