Why the UK has voted to allow "three-parent babies"

By Arthur Bright
February 5, 2015

(*The Christian Science Monitor*) Britain's House of Commons voted overwhelmingly on Tuesday to legalize the creation of so-called "three-parent babies." Though advocates of the move say it will help prevent a debilitating and often lethal condition, many warn that the procedure, though well-intentioned, opens the door to ethical and safety questions that have yet to be sufficiently grappled with.

**What condition are doctors trying to remedy?**

The newly approved line of research is meant to address genetic defects found in the mitochondria of eggs and embryonic cells.

Mitochondria are structures, found within all human cells, that convert food into energy. They have their own genetic material, distinct from the DNA found in cellular nuclei, that is inherited solely from the biological mother.

Defects in mitochondrial DNA,  or mtDNA, can cause a range of diseases that are particularly devastating as they strike early in childhood, are largely untreatable, and are inherited: The BBC in 2012 highlighted one instance where a mother lost seven children to mtDNA-related conditions, most in infancy.

**And the solution is to create 'three-parent' babies?**

Not exactly. "Three-parent babies" is a misleading term used to describe what is more precisely called "mitochondrial replacement." In the procedure, doctors take an egg or fertilized embryo from a mother who carries the mtDNA defect and extract the nucleus, discarding the rest of the cell—including the defective mitochondria. The nucleus is then placed in a cell (either an egg or a fertilized embryo) provided by a donor with healthy mitochondria to create a new, healthy cell.

The new cell does indeed contain the genetic material of three different people: the nucleus holds the DNA of both parents, while the mitochrondia contain mtDNA belonging to the donor. However, there is no splicing or other combination of DNA

that the "three-parent babies" terminology might imply. And the third-party donor's genetic contribution is comparatively minor: the mtDNA contains only 37 genes, compared to the 20,000 or so parentally inherited genes in the nucleus.

And in theory, the new cell will have all the benefits of the original parents' DNA but will be free of disease-causing mtDNA defects.

**If this will result in healthy babies, why the controversy?**

Although the theory is appealing, it has yet to be shown effective in practice, particularly for humans. The Center for Genetics and Society, a Berkeley, California-based nonprofit focused on medical ethics and governance, writes that the safety of mitrochondrial replacement techniques has yet to be shown—and has much higher stakes, because the treatment is irreversible. The techniques "could cause immediate problems for any child born from these techniques, but could also cause problems later in life. Any problems that arise would additionally be passed on to future generations."

The center also notes on its blog that there are many misconceptions about the techniques. For one, they have not been successfully and extensively tested on non-human primates. Nor is it clear that substituting mtDNA will not interact negatively with the nucleic, parental DNA, perhaps contributing to other diseases.

Moreover, mitochondrial replacement poses numerous ethical questions, both scientific and religious. The technique, in at least some of its forms, involves the destruction of fertilized embryos, which both the Catholic and Anglican churches strongly oppose, the BBC reports. In addition, opponents of the procedure warn that it opens the door to further tinkering with genetic code for medical reasons. David King, from the campaign group Human Genetics Alert, warns that "once you cross the ethical line, it is very hard not to take the next step of designer babies."

Besides, the center notes, there are alternative procedures that would allow prospective parents to minimize the risk of mtDNA defects without mitochondrial replacement techniques.

**If there are so many concerns, why is Britain pushing ahead?**

Advocates for the procedure's legalization say that enough research has been done to allow its careful, managed rollout. In a public letter published in *The Times of*

*London* last week, several doctors and researchers wrote that "A vote in favour will not allow clinics to offer mitochondrial donation immediately: they will still need a licence from the Human Fertilisation and Embryology Authority, which will be granted only with scientific evidence that any risks in each particular case are low."

They also alluded to the powerful motivation provided by those who have lost children to mtDNA defects. "We believe that those who know what it is like to care for, and sometimes to lose, an extremely sick child are the people best placed to decide whether this technology is right for them, with medical advice and within the strict regulatory framework proposed." It is difficult, confronted with stories like those that have appeared in the British press, for parliamentarians to vote against legalization.

There may also be an element of national interest. One of the leading centers of mitochondrial replacement is Newcastle University in Britain. The university, with guidance from the government's Human Fertilisation and Embryology Authority, has been researching such techniques for years.

**Could Parliament's vote open the way for other countries to begin similar research?**

Perhaps. The House of Lords still has to vote on legalizing the treatment, though it is likely it will. And once it is legal in Britain, the next likely country to move ahead with mitochondrial replacement research is the United States. The FDA is just beginning a 14-month study of the “genetic modification of eggs and zygotes to prevent transmission of mitochondrial disease.”