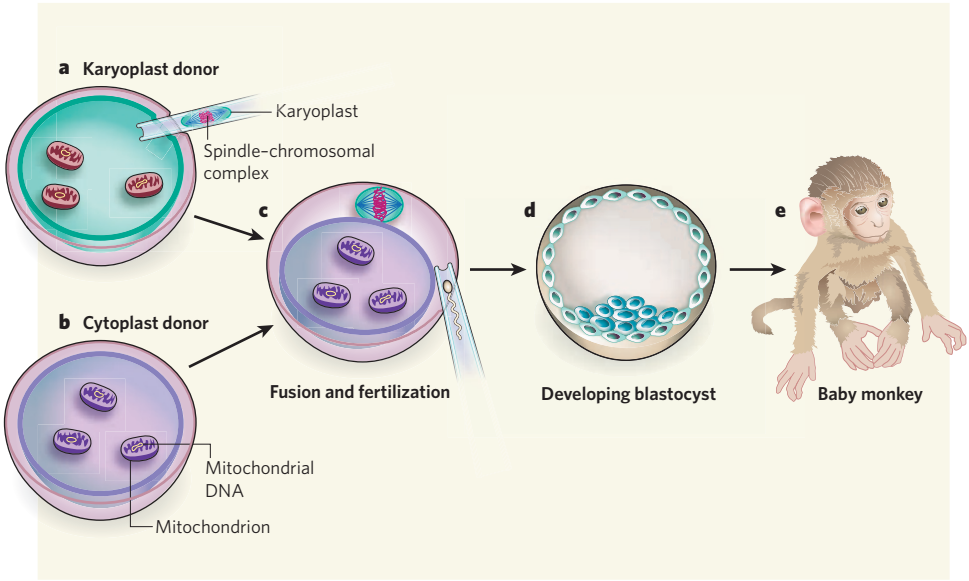

Figure 1 | Swapping mitochondrial DNA in mammalian oocytes. Working with rhesus macaque monkeys, Tachibana *et al.*[2] removed the nuclear material plus a cellular membrane (a karyoplast) from a mature oocyte, leaving behind its mitochondria (**a**). They transferred the karyoplast to an oocyte whose nucleus had been removed (a cytoplast; **b**). The nuclear material in the karyoplast consists of condensed chromosomes attached to thread-like spindle fibres (the spindle–chromosomal complex). The authors fused the karyoplast with the cytoplast and then fertilized the reconstructed oocyte (**c**). The developing blastocyst (**d**) was implanted in a surrogate mother, which gave birth to a healthy baby (**e**). This technique has the potential to prevent transmission of human mutated mitochondrial DNA from mother to baby.

was derived from the cytoplast donor.

It is encouraging that the technique used by Tachibana and colleagues[2] seems to have worked so efficiently in a primate model, but there are many hurdles, some practical, some ethical, that need to be overcome before this method could be transferred to the clinic. The practical issues relate to the safety of the viral agent used to fuse the spindle–chromosomal complex with the enucleated oocyte, as well as the efficiency with which spindle–chromosomal complexes can be safely removed and transferred from human oocytes. Also, it's not known whether the presence of foreign mitochondrial DNA in cells will have any biological consequences for the offspring, and this will have to be carefully investigated.

As discussed in a recent Editorial in *Nature*[6], the ethical debates that surround human reproductive research will probably be revived by this work. The procedure used by Tachibana and colleagues[2] requires the use of donor eggs with normal mitochondrial DNA, and certainly the research necessary to test the efficiency and safety of the procedure will require the destruction of embryos. However, unlike therapeutic cloning procedures, in which somatic-cell nuclei are transferred to enucleated eggs with the goal of isolating embryonic stem cells, here, the donor egg is not destroyed, but rather allows the birth of a healthy child.

But the mixing of nuclear and mitochondrial genomes brings other ethical issues to the fore, not least the production of offspring with genetic contributions from three parents — a combination forbidden by most jurisdictions. Thus, the laws regulating human germline DNA manipulation would have to be rewritten. It is worthwhile pointing out that if donor eggs could be obtained from a maternal relative who has not inherited the mutation, the reconstructed embryo would be genetically identical to one conceived naturally because of the exclusive transmission of mitochondrial DNA through the female germline.

Currently, the only way to prevent transmission of mutated mitochondrial DNA is preimplantation genetic diagnosis, in which cells of the early embryo are tested for the presence of mitochondrial-DNA mutations, and only genetically normal embryos are implanted[7]. There is, however, no guarantee that embryos without the mutation will be identified, and it is also not always clear whether embryos with low proportions of mutated mitochondrial DNA will be free of disease. The technique reported in the present paper, if proven safe and effective, could provide a universal solution to the problem. ■

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50 YEARS AGO

More science means more information, in the form of books, journals and conferences. No scientist needs to be reminded of this. It was estimated recently that to keep up with all the current work a physiologist would have to read nearly four hundred papers a day; Sir George Thomson has even gone so far as to suggest that it is the impossibility of absorbing the necessary information that will ultimately halt scientific progress.
From *Nature* 19 September 1959.

100 YEARS AGO

The position and prospects of polar exploration have been given great attention in the daily Press during the last few days. No precise information as to Dr. Cook's journey to the North Pole has yet been published, but the general narrative of Commander Peary's expedition leaves little room for doubt that Commander Peary reached the neighbourhood of the pole, and probably the pole itself, though an element of uncertainty must exist until his observations for latitude are examined critically ... Announcement has also just been made that a British Antarctic expedition will start next August under Captain R. F. Scott, who commanded the National Antarctic Expedition of 1900-4, with the object of reaching the South Pole. As all the world knows, Mr Shackleton's record of this year has given Great Britain the premier position in Antarctic exploration, and an earnest desire is felt by British explorers to place to the credit of this country the feat of first reaching the South Pole ... The full narrative of Commander Peary's expedition to the North Pole appeared in the *Times* of September 11 and 13 ... The expedition left Etah, Greenland, on August 18, 1908, in the *Roosevelt*, having on board 22 Eskimo men, 17 women, 236 dogs, and about 40 walrus.
From *Nature* 16 September 1909.

50 & 100 YEARS AGO