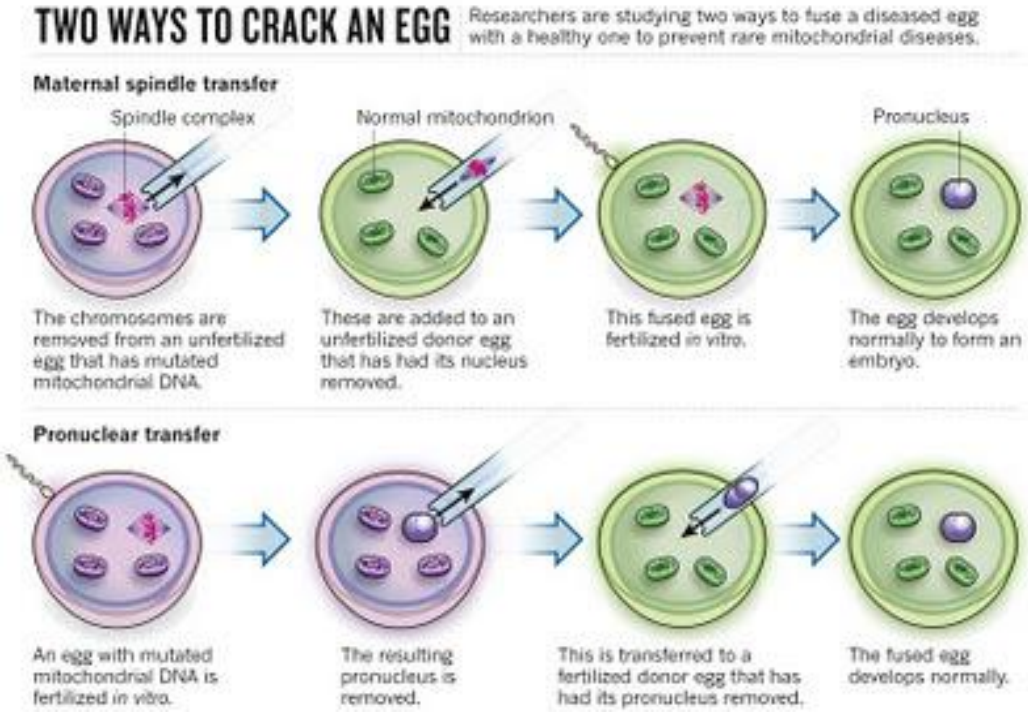
英批准胚胎基因改造

英國人工生殖與胚胎管理局（HFEA）1 日首度核准科學家對人類胚胎基因改造研究，找出不孕與流產原因；但這項技術早已是國際間激辯主題，有人認為可能引發倫理疑慮，甚至有人憂心，改動人類胚胎的 DNA 可能被用來訂做「基因寶寶」。

申請獲得批准的「佛朗西斯克里克研究中心」（Francis Crick Institute）奈亞肯（Kathy Niakan）博士表示，科學家需要瞭解一個人類胚胎成功發展成健康嬰兒的基因要求，「流產和不孕非常普遍，而我們對此知之甚少。」

奈亞肯博士過去 10 年一直在研究人類胚胎的成長過程，她將運用稱為 CRISPR-Cas90 的技術改造胚胎，在下一階段集中關注胚胎受精後 7 天內，從單一細胞到大約 250 個細胞的進展。



BBC 報導，每 100 個受孕卵子中只有不到 50 個能夠發育到囊胚階段，而把 25 個這樣的卵子植入子宮後只有 13 個能夠存活 3 個月以上。

研究所所長努爾斯（Paul Nurse）對奈亞肯博士研究申請獲得批准感到高興，認為有助於提高體外人工授精的成功率。愛丁堡大學（University of Edinburgh）教授惠特勞（Bruce Whitelaw）表示，此計畫應能「協助不孕夫妻，並減輕流產的巨大痛苦」。

法新社指出，這些胚胎不會變成小孩，因為胚胎必須在 14 天內銷毀，且只能供基礎研究使用。批評者則警告，以這種方式扭轉遺傳密碼，最終可能導致基改寶寶誕生。

UK sets sights on gene therapy in embryos

Britain has set out a road map towards the first clinical tests of reproductive techniques that combine parents' genes with DNA from a third party. The approach raises ethical questions, but could spare children from inheriting some rare diseases, including forms of muscular dystrophy and neurodegenerative disorders that affect around 1 in 5,000 people.

These conditions are caused by defects in the mitochondria, the 'power packs' of the cell, which are inherited from a child's mother through the egg. Experiments on primates, and with defective human eggs, have already shown that genetic material can be removed from an egg that has faulty mitochondria and transferred to a healthy donor ovum, leaving the flawed mitochondrial DNA behind. In principle, the resulting egg could then develop into a healthy child carrying both the parents' nuclear genes and mitochondrial DNA from the donor. But the work amounts to genetic modification of embryos — which is currently illegal in the United Kingdom — and also involves destroying fertilized eggs.

Two procedures are being developed: pronuclear transfer and maternal spindle transfer. Nature – Scientists and politicians are working together to bring new reproductive techniques to Britain.

Spindle Transfer

US researchers have already used maternal spindle transfer to produce two healthy rhesus monkeys.

Nature – Mitochondrial gene replacement in primate offspring and embryonic stem cells

Mitochondria are found in all eukaryotic cells and contain their own genome (mitochondrial DNA or mtDNA). Unlike the nuclear genome, which is derived from both the egg and sperm at fertilization, the mtDNA in the embryo is derived almost exclusively from the egg; that is, it is of maternal origin. Mutations in mtDNA contribute to a diverse range of currently incurable human diseases and disorders. To establish preclinical models for new therapeutic approaches, we demonstrate here that the mitochondrial genome can be efficiently replaced in mature non-human primate oocytes (Macaca mulatta) by spindle–chromosomal complex transfer from one egg to an enucleated, mitochondrial-replete egg. The reconstructed oocytes with the mitochondrial replacement were capable of supporting normal fertilization, embryo development and produced healthy offspring. Genetic analysis confirmed that nuclear DNA in the three infants born so far originated from the spindle donors whereas mtDNA came from the cytoplast donors. No contribution of spindle donor mtDNA was detected in offspring. Spindle replacement is shown here as an efficient protocol replacing the full complement of mitochondria in newly generated embryonic stem cell lines. This approach may offer a reproductive option to prevent mtDNA disease transmission in affected families.

Pronuclear Transfer

Neurologist Douglass Turnbull of Newcastle University, UK, and his team have performed pronuclear transfer on defective human eggs, and found that normal development occurred in a small minority.

Nature – Pronuclear transfer in human embryos to prevent transmission of mitochondrial DNA disease

Mutations in mitochondrial DNA (mtDNA) are a common cause of genetic disease. Pathogenic mutations in mtDNA are detected in approximately 1 in 250 live births and at least 1 in 10,000 adults in the UK are affected by mtDNA disease. Treatment options for patients with mtDNA disease are extremely limited and are predominantly supportive in nature. Mitochondrial DNA is transmitted maternally and it has been proposed that nuclear transfer techniques may be an approach for the prevention of transmission of human mtDNA disease. Here we show that transfer of pronuclei between abnormally fertilized human zygotes results in minimal carry-over of donor zygote mtDNA and is compatible with onward development to the blastocyst stage in vitro. By optimizing the procedure we found

the average level of carry-over after transfer of two pronuclei is less than 2.0%, with many of the embryos containing no detectable donor mtDNA. We believe that pronuclear transfer between zygotes, as well as the recently described metaphase II spindle transfer, has the potential to prevent the transmission of mtDNA disease in humans.