Artificial life created in the lab

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Scientists hail prospect of growing human embryos after breakthrough in developing stem cell mice

By **Sarah Knapton** SCIENCE EDITOR

ARTIFICIAL human life could soon be grown in a laboratory, scientists believe, after they successfully created an embryo using only stem cells for the first time.

Cambridge University used two types of mouse stem cells to create a living mouse embryo which formed after just four days. It is the first time scientists have ever been able to create a living embryo without using sperm or an egg.

The breakthrough, described as a "masterpiece" in bio-engineering, could eventually allow scientists to grow artificial human embryos in the lab.

Growing embryos would help researchers to study the very early stages of human life and understand why so many pregnancies fail. But it is likely to prove controversial and raise ethical questions about what constitutes human life.

Dr Dusko Ilic, from King's College London, said the research was a "masterpiece" for creating the earliest steps of life in a lab. "This is science at its best," he said.

Currently scientists can carry out experiments on leftover embryos from IVF treatments, but they are in short supply and must be destroyed after 14 days.

Researchers say that being able to create unlimited numbers of artificial embryos in the lab could speed up research while potentially removing some of the ethical boundaries.

"We think that it will be possible to mimic a lot of the developmental events occurring before 14 days using human stem cells with a similar approach to our technique using mouse stem cells," said Prof Magdalena Zernicka-Goetz, of Cambridge's department of physiology, development and neuroscience, who led the research.

She said: "We are very optimistic that this will allow us to study key events of this critical stage of human development without actually having to work on embryos.

"Knowing how development normally occurs will allow us to understand why it so often goes wrong."

The artificial embryos were created using genetically engineered stem cells coupled with extra-embryonic trophoblast stem cells (TSCs) which form in the placenta in a normal pregnancy.

Previous attempts to grow them using only one kind of stem cell proved unsuccessful because the cells would not assemble into their correct positions.

But scientists discovered that when they added the second "placental" stem cells, the two types began to talk to each other, effectively telling each other where to go.

Together they melded together to form an embryonic structure, with two distinct clusters of cells at each end, and a cavity in the middle in which the artificial embryo would continue to develop.

The embryo created could not have developed into a mouse foetus without more stem cells being added to create a yolk which would have nourished and helped it to grow. However, scientists believe this would have been possible, but chose not to do so on ethical grounds.

Britain leads the world in fertility research, and last year a group at the Francis Crick Institute was given permission to genetically modify human embryos, the first time in the world such a procedure had been approved by regulators.

In 1996, Edinburgh University created the world's first cloned animal, Dolly the sheep. However, the cloning process still requires an egg cell.

The work raises important ethical

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'Designer babies' warning over embryo breakthrough

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questions about the sanctity of human life and whether it should be manipulated or created in the lab at all.

Critics warn that allowing embryos to be grown for science opens the door to designer babies and genetically modified humans.

Dr David King, director of Human Genetics Alert, an independent secular watchdog group, said: "What concerns me about the possibility of artificial embryos is that this may become a route to creating GM or even cloned babies.

"Until there is an enforceable global ban on those possibilities... this kind of research risks doing the scientific groundwork for entrepreneurs, who will use the technologies in countries with no regulation."

The scientists would need to seek permission from the Human Fertility and Embryology Authority before attempting to create human embryos using the technique.

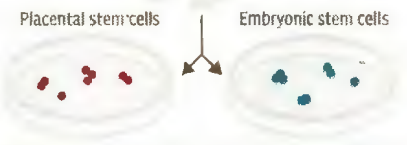
Prof James Adjaye, of Heinrich Heine University, said: "A regulatory body will ultimately decide on whether human stem cell embryos can be generated and for how long they can be left in the petri dish to develop further. Of course, there should be an international dialogue on the regulation of such experiments."

But the study was broadly welcomed by the scientific community. Dr Dusko Ilic, Reader in Stem Cell Science at King's College London, said: "This report is significant. The group from Cambridge is actually making the embryos *de novo*, using two different cell types, mixing them in a specific ratio and letting them to assemble together the embryo."

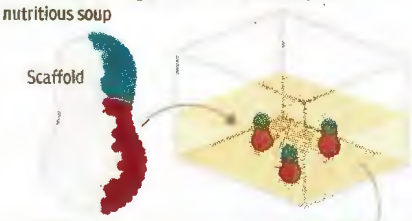
The study was published in *Science* and was funded by the Wellcome Trust and the European Research Council.

Artificial life in the lab

Two kinds of stem cells are taken from a mouse



The stem cells are mixed and placed on a 3D scaffold shaped like an embryo. The stem cell scaffolds are grown in a tank containing a culture medium - a special nutritious soup



A mouse embryo forms, which closely resembles the development and natural architecture of a real embryo

By 96 hours, cells have assembled into an embryo. Scientists hope to grow human embryos in the same way

Probing our earliest days could help couples using IVF

Commentary.

By **Prof Magdalena Zernicka-Goetz**

My lab at Cambridge is trying to answer a very fundamental question: what happens in those first few days when a fertilised egg begins to divide and replicate, forming first into a tiny bundle of cells, then into an embryo, before attaching itself to its mother's womb?

Thanks to recent breakthroughs, we've seen how the cells organise themselves, producing the different components of an embryo.

For this research, we use fertilised human eggs, kindly donated by IVF couples where possible. But these are small in number, so most of our work involves using mouse embryos.

Now, we've shown that it's possible to create a mouse embryo without a sperm and egg. Instead, we used different types of stem cells – programmable "master cells" – and a 3D scaffold on which the embryo can grow. It's not quite a full embryo, so wouldn't grow into a mouse, but it's very close and should allow us to study these early stages in much more detail.

We think we'll be able to use this method to develop the earliest stages of a human embryo, without having to rely on egg donation.

But this is about more than just answering scientific questions. Two thirds of early pregnancies fail – a figure likely to be even higher in people trying for IVF. We don't know why. But hopefully soon we can find out and potentially improve people's chances of having a healthy baby.

Magdalena Zernicka-Goetz is Professor of Mammalian Development and Stem Cell Biology at the University of Cambridge