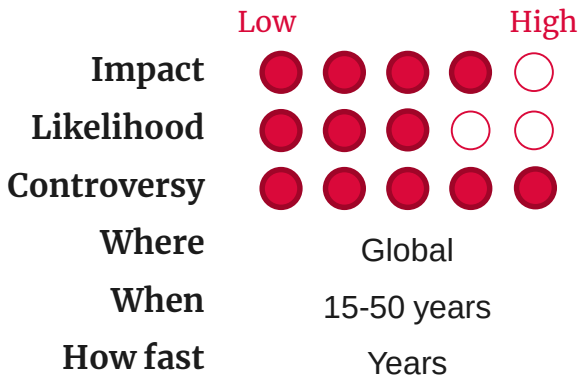
Synthetic embryos could break the idea of a nuclear family and revolutionise medicine by growing replacement organs

Dr. András Sándor

Scientist – Herbicide Discovery

MoA Technology



Synthetic embryos are not grown from a fertilised egg, but instead are produced by chemically reprogramming adult cells (known as induced pluripotent stem cells) which then behave as an embryo and begin to divide and grow accordingly. The trend of recent breakthroughs in this field suggest that this technology could start to affect everyday life from the mid-21st century.

Synthetic embryos will bring about a new wave of revolutionary medical treatments, as growing organs from the cells of a patient will replace current organ transplantation techniques and will drastically simplify treatment of a host of diseases that are currently difficult to combat. Increased life expectancy will have a host of socio-economic effects across all of society, and unequal access to this technology might lead to serious tension between different social classes.

The ability to grow human embryos in mechanical wombs could drastically alter how we view the concept of family. As single-parent children become a reality, even fewer adults might live in committed relationships, altering the very basis of human society.

This new technology will inevitably lead to ethical and legal controversies, and will likely enter popular discussion in the next decade. This will shape how synthetic embryos are viewed and will have a serious impact on how quickly it is accepted.

Summary

The brief history of synthetic embryos

Research into synthetic embryos took off in the last decade when early mice embryos were implanted into females to allow them to grow for several days[1,2]. This summer, scientists at the Weizmann Institute have published a paper where they managed to grow these synthetic embryos inside a mechanical womb for 8 days, almost half the normal gestation time of a mice embryo. These embryos show the early structures expected from a normal embryo, such as a beating heart[3]. With this field developing so rapidly, it is now time to consider the possible impact of this technology.

Implications

Healthcare: effects of this technology could range on a wide scale. Infertility affects one in six couples[4], and the insights gained into early pregnancy will likely improve the success rate of treatment. More uncertain, but impactful uses would include the use of organs grown from the cells of a patient to revolutionise personalised medicine. Instead of transplanted organs that are difficult to acquire and are at risk of rejection, patients can have a replacement grown. Countries with an ageing population (such as the UK) could combat several common diseases efficiently with this strategy (e.g., a variety of cancers, diabetes, neurological diseases, heart disease) potentially increasing the expected lifespan by up to 10-15 years.

Socio-economic: Lengthening the expected lifespan of the population will have immense societal effects, reducing the pressure on the healthcare and pension schemes as adults can have healthier lives and stay in the workforce for longer. However, such longevity treatments might not be universally available due to the high cost, leading to increasing tension between social classes. The capacity to carry a synthetic embryo to term would also inevitably have great societal effects. With more people living alone than ever before[5], the concept of single-parent families could acquire a new meaning, as biological children without a partner become a possibility. Such single-parent children could further reduce the number of couples and introduce a new family model. More sombre uses of the technology are also possible, with illegal cloning of people possible if a small number of cells can be acquired, and authoritarian regimes facing a shrinking population might consider using synthetic embryos to counter this trend forcefully.

Legal & Ethical: This technology will essentially enable human cloning and the use of partially grown embryos for medicinal purposes which will undoubtedly lead to major ethical and legal controversies and lengthy discussions before (and possibly even after) it is accepted for medical use.

Early indicators

Scientists are most likely to first see that the technology is maturing enough to be applicable and will initiate ethical discussions. Careful observation of dedicated scientific funding (e.g., from DARPA) into this area will also highlight if the science is approaching direct utilisation.

Parallels, Inhibitors and Drivers

Three-parent children[6] and the first CRISPR-genome edited children[7] showcase that laws or ethical concerns can slow down but not completely stop the deployment of these technologies. As such, legislation, economic forces and public opinion can be both powerful inhibitors and drivers.

References

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