

Artificial Womb: A Critical Study of Its Existence and Emergence in the Scientific World

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Abstract: An artificial womb or ectogenesis, which was once fictional, has become a scientific reality now, as researchers have already developed artificial womb technology and successfully done trials on a lamb, and are now working on developing a prototype for a human baby. Like any other reproductive technology, artificial wombs present both significant benefits and serious ethical, legal, and social concerns. On one hand, this technology has the potential to save the lives of premature infants by providing a controlled and supportive environment for fetal growth. On the other hand, it raises the risk of misuse, including the commodification of reproduction and the possibility of artificial baby production. Not only does this extensive biological and genetic data generated during the process —such as genetic and developmental data—pose serious data privacy and security challenges. These are some common legal concerns apart from medico issues, which are particularly heightened in the age of artificial intelligence, as AI systems are increasingly used to monitor and regulate fetal development within artificial wombs. This research critically examines the drawbacks of artificial womb technology, with a specific focus on ethical dilemmas, data privacy risks, and the potential for technological misuse, while emphasizing the need for robust regulatory frameworks for its proper monitoring.

Keywords: Artificial Womb; Ectogenesis; Artificial Intelligence; Data Privacy; Reproductive Technology

Introduction

For many might me artificial womb is new technology but if we go back to the mythology story of Mahabharata there, we can find narratives that parallel the concept of artificial wombs. It was that Gandhari gave birth to a mass of flesh, which Sage Vyasa divided into fragments and incubated in pots filled with ghee, ultimately resulting in the birth of the hundred Kauravas. This ancient practice is often compared to modern practices such as cloning or in vitro fertilization for its depiction of ectogenesis (extra-uterine gestation). Apart from this there is another famous example relate to this is the birth of Lord Kartikeya, in which Lord Shiva's semen was carried by Agni to the wives of the Saptarishis and later transferred to the womb of Goddess Ganga, illustrating a form of divine biological intervention[1].

Thus, from this it will not be wrong to say that artificial womb is not a new concept from modern technology but it was already existed as we can find it from our religious text. Even similar story kind be find from Greek mythology where Zeus swallowed his pregnant wife Metis, and Athena later emerged fully formed from his head, demonstrating gestation within a divine body rather than a traditional womb[2].

Related work

Now one can thing whether artificial womb is real or reel? In 1931, the English writer Aldous Huxley famously depicted the concept of artificial wombs in his novel *Brave New World*. He vividly described a future where fetuses grew "in the crimson darkness, stewing warm on their cushion of peritoneum and gorged with blood surrogate and hormones." At the time, this fictional portrayal was met with widespread criticism, and even today, certain groups in the United States continue to demand the book's removal from circulation [3]. This raises an important question: does such technology actually exist today that allows a baby to be developed outside the mother's womb? The answer is yes. In Tokyo, Dr. Kuwabara, at Juntendo University, attempted to develop a sustainable artificial womb using goat fetuses for experimental purposes. In 1997, he successfully maintained a seventeen-week-old goat fetus in extra-uterine incubation for a period of three weeks [3].

Even scientist of The Children's Hospital of Philadelphia has created an "artificial womb" through which has been successfully tested on fetal lambs, where the lamb has shown normal growth [4]. Through this artificial womb survival of premature baby will be increased with less health complications [5]. Recently Japan has developed the world's first complete artificial womb capable of supporting mammalian embryos from early stages to birth. This is not an incubator, but a synthetic uterus that mimics every function of gestation outside the human body [6]. In this process apart from Bio-technology AI has been used to monitored the real time growth of the foetus of the Goat. This is first successful case of complete growth of foetus outside the mother womb.

Thus, it can be said that artificial womb is no more a mythological story but it has become real now.

Key Contribution

There is no doubt that the artificial womb was once considered merely a concept of science fiction; however, it has now moved closer to reality. Although this technology has not yet been used for the complete development of a human baby, several countries are actively working toward building a functional prototype of an artificial womb for human use. It can therefore be said that, sooner or later, scientists are likely to develop a viable artificial womb prototype for human gestation.

This research aims to help readers understand that artificial womb technology is no longer confined to fiction. It also highlights the crucial role of artificial intelligence in monitoring and regulating fetal growth during extra-uterine development.

Method, Experiments and Results

This study is primarily medico-legal research aimed at examining the existence and current status of artificial womb technology. To achieve this objective, the researcher has adopted a non-empirical research method. Data have been collected from secondary sources, including books, academic journals, research reports, and newspapers. Based on the analysis of these sources, the study finds that artificial womb technology has moved beyond theoretical speculation and is gradually becoming a reality. Ectogenesis is now considered scientifically possible with the support of modern biotechnology, genetic engineering, and artificial intelligence, which together enable the monitoring and regulation of fetal development outside the human womb.

Discussions

The research study proves that artificial womb technology has become a reality now, after the Japanese scientist successfully experimented on a lamb. While current applications are limited to animal models and neonatal support systems, advancements in biotechnology and artificial intelligence indicate that full ectogenesis for humans may soon be achievable. Now, with the advancement and progress of this technology, there arise serious, ethical and legal questions related to it and it's important to check whether the existing laws are well equipped to address all these issues, such as reproductive autonomy, parental rights, fetal status, and the potential commercialization of human reproduction. Use of artificial intelligence will pose serious concerns regarding data privacy, data ownership, and algorithmic accountability. The collection and processing of sensitive genetic and biological data during ectogenesis heighten the risk of misuse, surveillance, and commodification. In the absence of a comprehensive regulatory framework, artificial womb technology may exacerbate social inequalities and ethical dilemmas rather than resolve medical challenges.

Conclusions

There is no doubt that this technology will be beneficial for the protection of the lives of premature babies, but at the same time, it has risks of exploitation, data misuse, and erosion of reproductive rights. There is an urgent need for legal frameworks that can regulate artificial womb technology, particularly in the context of child welfare rights and artificial intelligence, to ensure ethical safeguards, data protection, and human dignity. Proactive legal intervention is essential to balance innovation with responsibility as society moves closer to the possibility of human ectogenesis.

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