

ECTOGENESIS: ARTIFICIAL WOMB TECHNOLOGY – A WOMEN’S BEYOND CHOICE

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ABSTRACT

Every year medical advances and breakthrough are dramatically occurring high, Artificial Womb Technology (AWT) is the third era of human reproduction. The concepts of growing babies in the artificial environment are called "ECTOGENESIS" and it is an advanced stage of premature intensive care. Currently, babies who are born too young are placed in the incubator, but those incubators are likely unfriendly environment for premature babies whose lungs are not yet ready to breathe. Artificial womb technology in a certain advanced version of incubators. As the medical technology advances are becoming more and more personalized to every individual, research team from Philadelphia claimed "Principal proof" for artificial womb. We have to know whether Ectogenesis is an advanced stage of neonatal intensive care or something entirely new. This paper defines Artificial womb technology from a biological standpoint and does not focus on ethical issues associated with it.

INTRODUCTION

Would you ever think what if you could grow a baby in a pot? well, that's not a fantasy tale anymore, researchers at Philadelphia created a unique artificial uterus like device called "Biobag" that mimics mother's womb that world has ever seen.^[1] The prototype of a bio bag successfully intended to facilitate the process of ex-utero gestation. Researchers at children's hospital tested and monitored effects of artificial womb technology on the foetus of a lamb which developmentally equivalent to the human infant the lamb displayed Normal growth, Normal breath, grew wool and had a normal neurological function and organ maturation.^[2]

This research will make a strong base for future technology in reproductive science to secure long term prognoses for premature babies. Firstly, we have to understand that, Is ectogenesis completely a new approach? or extension of current Neonatal Intensive Care. Complete ectogenesis is the process of creating an embryo using IVF techniques and then gestated entirely in an artificial womb, but in the case of partial ectogenesis, development of "foetus" in AW for part of gestation period the following transfer from mother's womb.^[3]

I consider the experimental artificial womb technology is Innovative treatment and a novel approach particularly as an alternative to Neonatal Intensive Care.

Before we start this conversation, I want to expose the background history of ectogenesis, the concept of reproduction outside the human body is not new, there is a reference from Mahabharata the world-famous Epic, it says Gandhari queen of Dhritarashtra mothered a hundred children at once notably all are men and same age. History of Indian Mythology depicts that Rishi Vyasa arranged 100 pots and splatted flesh into 100 pieces and transfer into jars, preserved safely with the help of cloth beneath the earth, after 2 years of waiting those pots was ready with 100 babies all children grew up to strong full and Powerful.^[4]

English biologist JBS Haldane in the year 1923 given a lecture about the artificial womb, he was the first one to propose that an egg could be fertilized outside the womb.^[5] In 1990 Japanese scientist announced that they have raised a goat foetus in an artificial rubber womb with amniotic fluid. Yoshinori Kuwabara, need (SPACE) a gynaecologistat Tokyo University's medical department, removed the foetus from its mother by Caesarean section after 120 days of gestation. He placed it in a rubber womb filled with artificial amniotic fluid, and the baby was delivered after 17days.^[6] Recently a

research team from the Netherlands announced that they have a permission grant to develop artificial womb prototype. If this process of progress continues then ectogenesis in the not-too-distant future.^[7]

Abortion and Viability

Abortion is one of the most controversial subjects in modern society, it can be defined as "Exclusion of the foetus before it is viable". This could include spontaneous abortion and induced abortion. Sometimes induced abortion upholds variability as a critical deciding point. Let me exemplify, if a pregnant woman develops toxemia or gestational diabetes or a form of cancer, in that particular case she needs treatment that would harm a foetus. But medical advances made it possible, now AWT could allow women to "Terminate her pregnancy without terminating the embryo".^[8] The court stated that a point of viability at which they are inherently defining life would properly leave this private choice in women's hand.^[9] According to abortion surveillance in 2018, "6,19,591" legal induced abortions were reported to the Centre for Disease Control and prevention, from 49 reporting areas. Among 48 reporting areas with data each year from 2009 to 2018, In 2018 a total of 614,820 abortions were reported. The abortion rate was 11.3 need abortions per thousand women. According to CDC abortion surveillance system in 2018 majority of abortions took place early in gestation 92.2 % of abortions were performed at ≤ 13 weeks of gestation. A smaller number of abortions 6.9 % were performed at 14 to 20 weeks of gestation, due to problems associated with gestational diabetes, congenital anomalies and some type of cancers.^[10]

Neonatal Intensive Care

In developing countries, approximately 20 million premature and low birth weight infants are born every year nearly 4 million die within one month. The major reason behind these deaths is due to unavailability of traditional incubators and the shortage of Neonatal Healthcare providers so the complications associated with preterm birth decrease with increasing gestation.^[11] If an infant born before 26 weeks of gestation remained unlikely to survive. It led to severe long-term impairment around 50% of surviving preterm born at 26 weeks. This range will increase to 75% among those born at 23 weeks.^[12] The biggest cause of suffering to preterm include underdeveloped lungs, heart, brain, respiratory problems, circulatory problems, Low blood pressure, oxygen impoverishment and underdeveloped ability to suck or swallow, these complications are almost inevitable before 26 weeks.^[13]

Limitations

By providing mechanical ventilation administering oxygen using external pumps to aid circulation and nasogastric feeding but the traditional incubators remind interventions in facilitated infants^[17]

Biobag

Overcoming biological obstacles, a team of researchers has crafted what may be the best artificial womb yet, that perfectly mimics what mom would provide.^[14] The bag enables the constant exchange of amniotic fluid, providing all necessary water and nutrients. Cannula act as an 'umbilical cord' carrying required nutrients and oxygen into the subject's bloodstream. Circulation is dependent on the subject's heart working with an oxygenator. This mimics normal placental circulation, ensuring sufficient oxygen and safe blood pressure. The bio bag may not look much like a womb but it contains the same key parts a clear plastic bag that encloses the fetal lamb and protects it from the outside world like the uterus. An electrolyte solution that bathes the lamb similarly to the amniotic fluid in the uterus, and a way for the foetus to circulate its blood and exchange carbon dioxide for oxygen. one tube supplying artificial amniotic fluid and another draining it out.^[15] There are still many potential problems to overcome, however. There is a significant risk of infection, even though the biobag is sterile and sealed. Finding the right mix of nutrients and hormones to support a human baby will also be a challenge.^[16]

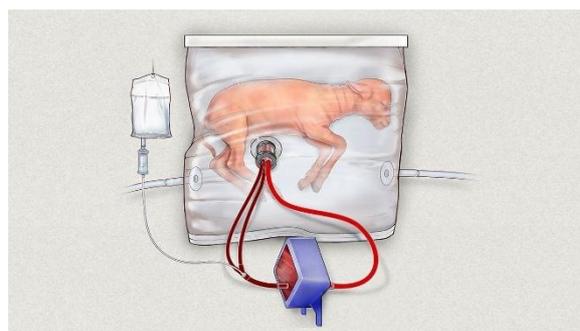


Figure: Lambs delivered prematurely are kept afloat—literally—in a sealed, fluid-filled “biobag” that mimics what mom would provide. Children's hospital of Philadelphia.^[14]

Mechanical ventilation and the administration of oxygen can inhibit further lung development or it can damage the lungs. External support for circulation can cause heart failure and maximum chances of Babies got infected. Due to limitations and high risk of traditional incubators scientist believe clinical possibilities of neonatal Intensive Care has been exhausted.^[18]

Analysis

Artificial womb technology is a revolutionise reproduction procedure that can sustain the artificial gestation of human entities, by challenging the fundamental fact of human reproduction that has overcome since the beginning of time "that a foetus must gestate in the woman's womb. The process of utilising the artificial womb technology for partial ectogenesis is the motivation behind current scientific development because it is a search after as an advanced alternative to neonatal intensive care.^[19] Prematurity remains the leading cause of death in neonates, thus it is hoped that the development of more sophisticated technology (AW)

might be better able to improve preterm mortality rate and reduce the incidence of morbidity in preterm neonates.^[20]

Let's discuss the pros and cons associated with artificial womb technology.

Potential Uses of Ectogenesis

Uteroplacental vascular insufficiency/placental insufficiency is a complication of pregnancy is unable to deliver an adequate supply of oxygen and nutrients to the foetus and thus cannot fully support the developing baby. In such situations, AWT will be a benefit for the women suffering with placental insufficiency, now she had a choice of "terminate pregnancy but not foetus".^[21]

In the case of multiple pregnancies, when a pregnant with twins/triplets or more babies is called a "higher-order pregnancy" occur when more than one embryo implants in the uterus. Multiple pregnancies are more common than they used to be mainly because of the increasing use of in vitro fertilization (IVF). In such conditions, ex-utero gestation is a choice of women by transferring extra embryos to the bio bag, thus AWT plays a prominent role in conditions like high order pregnancy.^[22]

According to health law central, surrogacy involves a woman agreeing to carry a baby for someone else, after the baby is born the birth mother gives custody and guardianship to the intended parents. As of now, we are encouraging surrogacy supported by a legal agreement. Hence, AWT is preferably far better choice of growing babies in an artificial environment rather than some other unknown women's womb.^[23] In some cases, ovulation irregularities, endometriosis, blocked fallopian tubes, structural problems in the reproductive system, age or underlying medical problems, leads to infertility. In such cases, AWT would be a benefit for those who can't procreate their own.^[24]

Most probably employees and mothers on a range of issues related to managing pregnancy maternity leave and returning to work are most challenging. Hurdles related to pregnancy and returning to work after 9 months will affect the job opportunities people who broadly thinking of it then artificial womb Technology will bring a possible solution.^[25] Usually, most the pregnancies occur without complications; however, some women will experience complications with pregnancy that can involve their health and their baby's health some of the complications include gestational diabetes, preeclampsia, preterm labour pains and loss of pregnancy or miss carriage, thus AWT will truly subside all of these complications.^[26]

Pregnancy and childbirth were associated with the dangerous event for both baby and mother, according to the World Health Organisation, more than 300,000 women died from pregnancy-related problems like

Labour pains. that's 830 women every day. Hence AWT will be a possible way to subside complications associated with pregnancy. By using ectogenesis we can subside maternal malnutrition which increases the risk of poor pregnancy outcomes including obstructed labour premature or low birth weight babies and post-partum haemorrhage severe anaemia, during pregnancy linked to increased mortality at labour. Similarly, it could allow single men and Gay male couples to become parents without Surrogacy.^[27]

By considering the rational problems associated with pregnancy, artificial womb Technology (partial ectogenesis/ complete ectogenesis) plays an effective role and it will be the future of human reproduction.

Downsides of ectogenesis

The pivotal role of being a mother is still The Divine Mission assigned to women alone. It illustrates the relationship and bonding between the mother and her child in the long run to society.

- Artificial womb technology diminishes women's role in society.
- Women lost their fundamental respect.
- AWT might further increase the gap between rich and poor.
- Artificial wombs to be fundamentally against the natural reproductive order.
- It will lead to many machine-made babies probably trading babies like a cup of coffee.
- Complete ectogenesis destroys the bond between natural pregnancy to mother and children if any interruption in the power supply to the bio bag so-called artificial womb leads to the sudden death of baby inside the artificial environment.^[28]

CONCLUSION

Artificial womb Technology will be the game-changing medical advancement and probably most exciting, from science fiction to science fact. But we can consider this exutero gestation will be used as an alternative to conventional Neonatal Intensive Care. Even though we have a lot of ethical Barrier's, legal obstructions, AWT has its functionality. Growth pods will be able to produce super babies by constant monitoring and supplying vitamins nutrients to preterm regularly. Women have the right to choose over her body and the outcome of their potential foetus. Hence AWT is a Better alternative to abortion. The Downsides of AWT should be taken into consideration for further process of R&D. Meanwhile the purpose of highlighting these implications of the 'artificial womb' is not to deny the wealth of opportunities it could offer to those people unable or unwilling to gestate.

However, AWT economically competitive with other forms of gestation, it will take a lead shortly. Previous research results from Philadelphia were promising and large trials are underway. "If reliable artificial womb

technology does become available, it is important that we ensure equal access to it for all, it will result in much better outcomes than neonatal intensive care. It will be expensive, and there will inevitably be a limited number of devices available - we would therefore need to ensure that decisions about who had access to them do not exacerbate social inequality."In our view, AWT is the next important step in the treatment of premature infants and we strongly believe the feasibility of partial or complete ectogenesis of research provide evidence to suggest that improving technology advance this goal.

REFERENCES

1. Partridge, E., Davey, M., Hornick, M. et al. An extra-uterine system to physiologically support the extreme premature lamb. *Nat Commun*, 2017; 8: 15112. [CROSS REF]
2. Julia Dalzell, *The Impact of Artificial Womb Technology on Abortion Jurisprudence*, 25 *Wm. & Mary J. Women & L*, 2019; 327.[CROSS REF]
3. Romanis EC. Artificial womb technology and the frontiers of human reproduction: conceptual differences and potential implications. *Journal of Medical Ethics*, 2018; 44: 751-755. [CROSS REF]
4. Sathya Narayanan.Kauravas Birth-Artificial Fertilization? *NOV 13*, 2015. [CROSS REF]
5. Oscar Schwartz. *On the History of the Artificial Womb*. September 11, 2019. [CROSS REF]
6. Peter Hadfield. Japanese pioneers raise kid in rubber womb. 25 April 1992.[CROSS REF]
7. Nicola Davis. Artificial womb: Dutch researchers given €2.9m to develop prototype, 8 oct., 2019. [CROSS REF]
8. Hern, warren, *Abortion: medical and social aspects*. [CROSS REF], 1995.
9. Amy Borovoy, *Beyond Choice: A New Framework for Abortion?* [CROSS REF], 2011.
10. Kortsmmit K, Jatlaoui TC, Mandel MG, et al. *Abortion Sueveillance United States*, 2018. *MMWR Surveill Summ*, 2020; 69(No. SS-7): 1-2. [CROSS REF]
11. Shaib, mounir & rashid, mohammad & hamawy, lara & arnout, mohammad & el majzoub, imad & zaylaa, amira. *Advanced portable preterm baby incubator*. 10.1109/icabme, 2017; 8167522. [CROSS REF].
12. Elizabeth Chloe Romanis, *Artificial Womb Technology and the Choice to Gestate Ex Utero: Is Partial Ectogenesis the Business of the Criminal Law?*, *Medical Law Review*, 2020; 28(2): 342–374. [CROSS REF]
13. Lissauer and Clayden, (n225): 159.
14. Jennifer Couzin-Frankel, fluid filled “bio bag” allows premature lambs to develop outside the womb.[CROSS REF], 2017.
15. Rachel Becker *An artificial womb successfully grew baby sheep – and humans could be next*.[CROSS REF], 2017.
16. Michelle Roberts. *Premature lambs kept alive in ‘plastic bag’ womb*. [CROSS REF], 2017.
17. Elizabeth Romanis. *Regulating the 'Brave New World:' Ethico-Legal Implications of the Quest for Partial Ectogenesis*. [CROSS REF], 2020.
18. Jennifer hendricks, ‘not of woman born? technology, relationship and right to a human mother,’[CROSS REF], 2011.
19. Randall & Randall, *supranote*, 23, at 292.
20. Rieder TN. *Saving or creating: which are we doing when we resuscitate extremely preterm infants?* [CROSS REF], 2017.
21. Mount sinai hospital. toronto. *Placental insufficiency*. [CROSS REF]
22. *Pregnancy birth and baby*. Types of multiple pregnancy. [CROSS REF]
23. *Pregnancy birth and baby*. Surrogacy. [CROSS REF]
24. Rachel Gurevich, RN. June 09, 2020. *Why am I not getting pregnant?*[CROSS REF]
25. Lorna adams, Mark winterbotham. *Pregnancy and maternity-related discrimination and disadvantage: first findings*, 23 July 2015. [CROSS REF]
26. Jacquelyn Cafasso. *Complications During Pregnancy and Delivery*. May 25, 2016. [CROSS REF]
27. Hannah Ritchie. *How many women die in childbirth?*September 16, 2019. [CROSS REF]
28. *MED LAW REV*, 2020; 28(2): 342–374. 2019 DEC 18. [CROSS REF]