



Artificial Wombs: Filling a Microbial Gap in Knowledge

California University of Pennsylvania, Department of Biology

Savannah L. Davis



Introduction:

Today over 4,000,000 babies are delivered each year in the United States alone. About 70% of these births are vaginal births. The last 30% being caesarian births due to choice, or by complication (CDC, 2019). From the beginning of time childbirth has been one of the highest leading causes of death for women all over the world. While the rate of mortality via childbirth has significantly dropped since the early 1900s, it is important to note that these complications still exist and can be lethal within the right conditions. Due to a variety of reasons many women have taken to having a caesarean section to reduce complications. What many don't know is that caesarean births lack the mechanism to deliver essential microbes to a child during birth. In this review of research, I will be assessing the deficits of not being able to perform this action, and how it could be the next step in artificial womb research.

What is the Microbial rush?

Studies have shown that the microbial rush stimulated via vaginal birth sets a child up for increased cognitive function. These microbes can also contribute to immune system support, gastrointestinal support as well as respiratory support. Research is being done to connect this microbial transfer with the development of behavioral and psychological disorders such as ADHD, ADD, depression, anxiety and more.

Some Common Microbes Transferred During Birth

- Bifidobacterium
- Enterobacteria

Conclusion:

Artificial wombs present a new reality to society. One in which women no longer must accept the risk of a life-threatening pregnancy. However, with the introduction of a device like this the introduction of mutation is a real concern to the scientific community. By essentially growing a fetus in an external environment we are making them more susceptible to developmental mutations. It also presents an entire list of ethical concerns as many wonder if humans should have this much power over reproduction. Current scientists have spent a lot of time developing an external womb that mimics their original environment however its apparent that there are functions of the human body that aren't scientifically reproducible. Microbiology produces a unique opportunity to better understand a human's microbiome and the essential bacteria that help us maintain everyday functions. By filling this gap in knowledge, the offspring of the external womb could have a better quality of life, and better functionality in several areas of the body.

Vaginal Birth vs Caesarian Birth

Normal Gestation Expectations:

- Human gestation occurs along 40 weeks of development.
- Any birth from about 24-37 weeks of development is premature and can come with a list of possible complications ranging from death to underdeveloped structures and motor functions.

Differences Between the modes of Birth

- Vaginal birth offers a smaller healing window, as well as immune and microbial support via the microbial rush.
- Caesarian Birth offers a smaller gestation period, which is essential to failing, flawed, or emergent births. This option is essential to many mothers.

Artificial Womb Research

Studies:

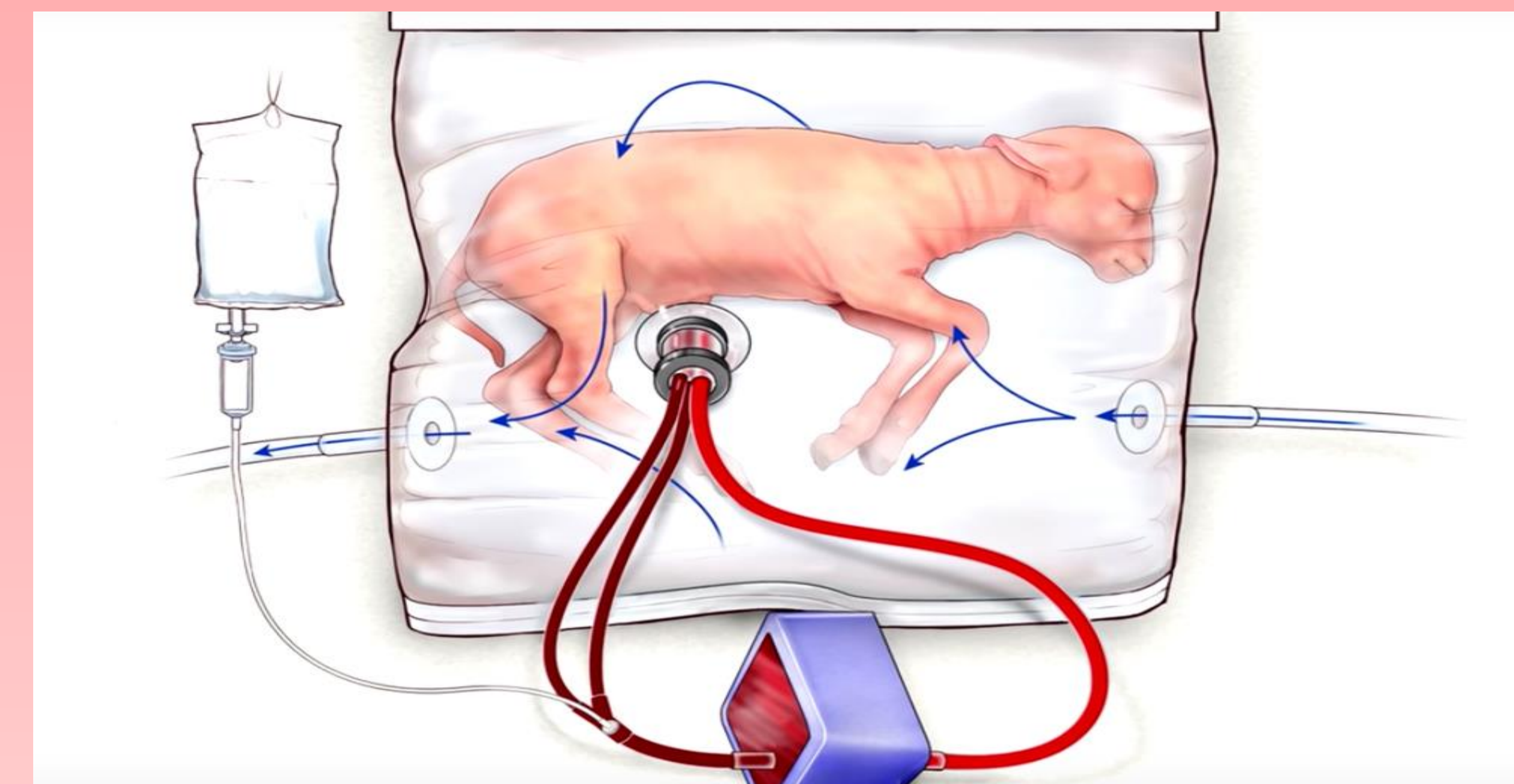
- Dr. Greenberg's Trial run
- The EVE platform- Dr. Haruo Usuda
- The BioBag- The Children's Hospital of Philadelphia

Results of Artificial Womb Research:

- Usuda's EVE platform study had an outcome of 85.7% of normally functioning lambs. The rest developed a range of neurological defects and liver damage.
- In the Biobag trial the device proved to gestate up to 28 days. Not much is known about the long-term results, but all offspring gestated in this external womb survived and lead to normally functioning lambs.

Notes of Concern:

As research dictates much of what is known about the microbial rush and its immune, and developmental building functions could be used to further artificial womb research. By recreating this mechanism, we could potentially see better results with the kidneys, livers, and psychological/behavioral neurological problems.



References:

- Achievements in Public Health, 1900-1999: Healthier Mothers and Babies. (n.d.). Retrieved November 14, 2020, from <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm4838a2.htm>
- Bulletti, C., Palagianò, A., Pace, C., Cerni, A., Borini, A., & de Ziegler, D. (2011). The artificial womb. *Annals of the New York Academy of Sciences*, 1221, 124–128. <https://doi.org/10.1111/j.1749-6632.2011.05999.x>
- Neu, J., & Rushing, J. (2011). Cesarean versus vaginal delivery: long-term infant outcomes and the hygiene hypothesis. *Clinics in perinatology*, 38(2), 321–331. <https://doi.org/10.1016/j.clp.2011.03.008>
- Partridge, E.A., Davey, M.G. & Flake, A.W. Development of the Artificial Womb. *Curr Stem Cell Rep* 4, 69–73 (2018). <https://doi.org/10.1007/s40778-018-0120-1>
- Romanis, E. (2019, November 29). Artificial womb technology and clinical translation: Innovative treatment or medical research? Retrieved November 13, 2020, from <https://onlinelibrary.wiley.com/doi/full/10.1111/bioe.12701>
- Romanis EC Artificial womb technology and the frontiers of human reproduction: conceptual differences and potential implications. *Journal of Medical Ethics* 2018;44:751-755.

