

This is the editorial for the special issue on the ethics of ectogenesis, in the journal *Bioethics*.

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The ethics of ectogenesis

Two research teams recently announced their success in gestating lambs in biobags.¹ The scientists working on the development of these devices regard them as part of the drive towards improving survival rates for preterm neonates. However, this research has further reaching implications for human reproduction and gestation beyond this narrow medical focus. That is, it represents a step towards ectogenesis: gestation outside the human body.

Ectogenesis may be partial or full. Full ectogenesis refers to a complete alternative to human gestation. Embryos would be created via IVF and transferred into an artificial womb for the whole duration of the gestation period. Full, or complete, ectogenesis has been described by

¹ Partridge, E. A., Davey, M. G., Hornick, M. A., McGovern, P. E., Mejaddam, A. Y., Vrecenak J. D... & Flake, A. W. (2017). An extra-uterine system to physiologically support the extreme premature lamb. *Nature Communications* 8, 1-15; Usuda, H., Watanabe, S., Saito, M., Sato, S., Musk, G., Fee, E... & Kemp, M. W. (2019). Successful use of an artificial placenta to support extremely preterm ovine fetuses at the border of viability. *American Journal of Obstetrics and Gynecology*. 221(1):69.e1–69.e1.

some bioethicists as a moral imperative, something that would liberate women from the unjust burdens of pregnancy and reproduction.²

There are two interpretations of the term ‘partial ectogenesis’. According to one usage, ‘partial ectogenesis’ refers to the removal of a developing embryo or fetus from the female body to an artificial womb for the remainder of its gestation. This form of partial ectogenesis has often been seen as a ‘solution’ to the abortion debate since it appears to offer the possibility of reconciling the fetus’s alleged right to life with a woman’s right to self-determination and autonomy.³ Some commentators disagree that ectogenesis really would offer a solution to the abortion debate⁴ while others argue that people holding the pro-life view – at least – are morally obligated to pursue artificial womb technology to save the allegedly morally valuable human embryos.⁵

The other usage of ‘partial ectogenesis’ refers to techniques already in use in modern medicine. Premature babies at increasingly early stages of gestation can be sustained with medical intervention. Such interventions are designated by some commentators as broadly ectogenetic, with the incubator being regarded as a kind of womb substitute.⁶ At the other end of the gestational spectrum, embryos are routinely created and cultured in vitro. The maximum period during which such embryos can survive has not been definitively established. In all jurisdictions that permit embryo research, there is a 14 day limit. Recent

² Smajdor, A. (2007). The moral imperative for ectogenesis. *Cambridge Quarterly of Healthcare Ethics*, 16(3), 336–345; Smajdor, A. (2012). In defense of ectogenesis. *Cambridge Quarterly of Healthcare Ethics*, 21(1), 90–103.

³ Singer, P. & Wells, D. (1984). The reproduction revolution: New ways of making babies (p. 135). Oxford: Oxford University Press; Mathison, E. & Davis, J. (2017). Is there a right to the death of the foetus? *Bioethics*, 31, 313–320.

⁴ Räsänen, J. (2017). Ectogenesis, abortion and a right to the death of the fetus. *Bioethics*, 31(9), 697–702.

⁵ Simkulet, W. (2019). Abortion and Ectogenesis: Moral Compromise. *Journal of Medical Ethics*, 46(2):93–98.

⁶ Smajdor A. (2016) Ectogenesis. In: ten Have H. (eds) *Encyclopedia of Global Bioethics*. Springer, Cham

advances in embryology, however, suggest that it may be technically feasible to sustain embryos in vitro for longer than this, and there are moves to extend the 14 day cutoff point accordingly.⁷ Thus, an increasing proportion of embryonic/fetal development can take place outside the human body.

While full ectogenesis is not possible at the moment recent advances in both animal studies and embryology suggest that the technology might become feasible at some point in the foreseeable future. When this happens, we should be ready for it. It is essential to consider the ethical implications of ectogenesis before we find that the technology is suddenly upon us.

This special issue of ectogenesis comprises eight papers from scholars working in bioethics, philosophy, law and neonatology. Our call for papers received considerable attention; by the deadline, we received 24 submissions. All manuscripts were first evaluated by us, the editors and if deemed suitable for the theme of the issue, by independent outside scholars. Each published paper was blind reviewed by two reviewers, and received positive verdicts from both. We thank the reviewers who contributed to this work.

The issue opens with Zeljka Buturovic's provocative article in which she compares two dichotomies: breast vs bottle feeding and natural gestation vs ectogenesis.⁸ Buturovic claims that breastfeeding is analogous to pregnancy as an experience, in its exclusiveness to women, and in its cost and the effects it has on equitable share of labor. Observing the history of formula feeding gives us insights that may enable us to consider the future of full ectogenesis. Buturovic suspects that in the long term, ectogenesis will fundamentally undermine the

⁷ Hyun, I., Wilkerson, A., & Johnston, J. (2016). Embryology policy: Revisit the 14-day rule. *Nature*, 533(7602), 169–171.

⁸ Buturovic, Z. (2020). Formula feeding can help illuminate long-term consequences of full ectogenesis. *Bioethics*, DOI: 10.1111/bioe.12687.

importance or even existence of the category of mother. Thus, she suggests that ectogenesis may render women vulnerable to either male assimilation or aggression.

In an article by Laura Kimberly, Meghan Sutter and Gwendolyn Quinn, the authors argue that if artificial womb technology is offered as a reproductive option to cisgender heterosexual individuals or couples desiring to become parents, we have a moral obligation to ensure that full ectogenesis will also be made available to individuals or couples identifying as members of sexual or gender minority groups seeking parenthood.⁹ The authors examine the history of access to different family building options such as other assisted reproductive technologies, adoption and surrogacy and conclude that there is no empirical evidence suggesting an increased risk of harm to children of people who identify as members of sexual and gender minorities. Therefore, they claim that an obligation to offer artificial womb technology as a reproductive option to sexual and gender minorities is grounded in social justice. If access to ectogenesis is restricted for individuals belonging these minorities, this would further stigmatize already marginalized people.

Kathryn MacKay argues in her article that the fundamental basis of women's oppression is the link between femaleness and reproduction.¹⁰ She urges that this link should be broken. Ectogenesis holds the potential to enable us to do this, by radically challenging the dominant notions of gender categories and family roles. On her view, since female biological functioning appears still to be one of the barriers to women's equality, ectogenesis could advance the separation of female reproductive function from 'woman,' and from 'mother.' Therefore, she suggests that ectogenesis should be pursued to help a feminist strategy for

⁹ Kimberly, L.L, Sutter, M.E & Quinn, G.P. (2020). Equitable Access to Ectogenesis for Sexual and Gender Minorities. *Bioethics*, DOI: 10.1111/bioe. 12723.

¹⁰ MacKay, K. (2020). The 'tyranny of reproduction:' Could ectogenesis further women's Liberation? *Bioethics*, DOI: 10.1111/bioe.12706.

equality by challenging patriarchal familial norms, especially around genetic relatedness and the concept of the parent.

Elselijn Kingma and Suki Finn analyze ectogenesis from the context of analytic metaphysics.¹¹ They suggest that the term ‘artificial womb’ should be put to rest and a more apt label would be ‘artificial amnion and placenta technology’. Kingma and Finn highlight important conceptual differences between fetuses in ‘natural’ wombs and artificial ones.¹² They argue that birth marks a substantive physiological transition which makes fetuses and neonates different from each other regardless of their development or gestational age. The authors claim that fetuses inside a female body are literally *part* of the pregnant woman and thus birth, is not just a change of location. It is not obvious what ethical implications follow from their analysis, but if the fetus is part of the mother, it could have interesting implications for many moral issues related to fetuses such as to the abortion debate.

Seppe Segers, Guido Pennings and Heidi Mertes tackle the prospect of ectogenesis in connection with the new possibilities it offers for treating fetuses as patients in their own right.¹³ Currently, any medical intervention on behalf of the fetus necessarily impacts the pregnant woman. Ectogenesis might seem to offer an ethically preferable solution. However, if a pregnancy starts in a woman's uterus, any subsequent removal of the fetus to an artificial womb for medical treatment will also involve health risks for the pregnant woman. As the authors observe, the dominant approach to the ‘fetal patient’ urges that where a *viable* fetus needs medical intervention, the pregnant woman should be ‘directively counselled’ to agree to

¹¹ Kingma, E. & Finn, S. (2020). Neonatal Incubator or Artificial Womb? Distinguishing Ectogestation and Ectogenesis using the Metaphysics of Pregnancy. *Bioethics*, DOI: 10.1111/bioe.12733.

¹² See also Romanis, E.C. (2019). Artificial womb technology and the frontiers of human reproduction: conceptual differences and potential implications. *Journal of Medical Ethics*, 44(11): 751–755.

¹³ Segers, S., Pennings, G. & Mertes, H. (2020). The ethics of ectogenesis aided fetal treatment. *Bioethics*, DOI: 10.1111/bioe. 12715.

this. With ectogenesis, however, the scope of viability becomes unclear. Thus, any pregnant woman might in theory come under pressure to submit to fetal removal if her fetus is deemed to need medical intervention. Ultimately, the authors suggest that ectogenesis does not offer easy ethical answers to existing challenges in fetal medicine, nor does it give any guarantees that pregnant women's autonomy will be respected.

Lydia Di Stefano, Catherine Mills, Andrew Watkins and Dominic Wilkinson also address the question of viability.¹⁴ Theirs is the only paper included in this special issue that incorporates an empirical element. The authors observe that viability plays a vital role in obstetricians' and neonatologists' decision-making and in abortion legislation. Questionnaires were used to explore the views of neonatologists and obstetricians working in Victoria, Australia. The findings reveal a tension between the ways in which 'viability' as a concept is understood, and the ways in which it is *applied* in practice. When asked about ectogenesis, participants agreed that it would change the lower threshold of viability, but expressed ambivalence about the desirability of ectogenesis. Respondents were divided as to whether the development of ectogenesis should lead to a change in abortion legislation. The authors suggest that further qualitative research is required in order to develop a fuller understanding of the ways in which ectogenesis will impact medical practice.

Johanna Eichinger and Tobias Eichinger explore the relationship between ectogenesis and medicine, asking whether it should be interpreted as a 'proper' use of medicine, or as enhancement.¹⁵ Ectogenesis does not fit neatly into the enhancement category, because its aim is not to improve a human capacity per se, but rather to bypass a function. Likewise, it does

¹⁴ Di Stefano, L., Mills, C., Watkins, A., & Wilkinson, D. (2020). Ectogestation ethics: The implications of artificially extending gestation for viability, newborn resuscitation and abortion. *Bioethics*, DOI: 10.1111/bioe.12682.

¹⁵ Eichinger, J. & Eichinger, T. (2020). Procreation machines – Ectogenesis as reproductive enhancement, proper medicine or a step towards posthumanism? *Bioethics*, DOI: 10.1111/bioe.12708.

not seem to fit within the orthodox boundaries of medicine, in that it does not treat disease. However, the authors suggest that the boundaries of medicine can be extended. We may pathologise conditions previously regarded as either normal or non-medical. (Treating shyness as a medical problem, for example.) Alternatively, we may extend the scope of medicine to include goals that are not specifically disease-related: medicalization. However, the authors are doubtful as to the ethical desirability of both alternatives. Pathologising pregnancy may devalue the importance it has to many women. Medicalization (in the somewhat special usage adopted by the authors here) raises questions about whether the social inequalities between men and women can really be attributed to women's gestational capacities.

In the final article in this special issue, Elizabeth Chloe Romanis considers whether the use of experimental artificial womb technology to 'save' premature neonates would constitute innovative treatment or medical research.¹⁶ The distinction is important because research subjects are entitled to stringent legal protections, and medical researchers must obtain ethical approval before embarking on projects that rely on human participants. Innovative treatment, in contrast, is often justified in relation to exceptional circumstances or urgent need, where the patient is expected to benefit, and other clinical options have been exhausted. A further difference is that innovative treatment is focused on *treatment* whereas research aims for generalizable conclusions that have the potential to change standards of practice. Romanis argues that on both these grounds, artificial womb technology should be conceptualized as medical research. It should therefore be subject to the same strict criteria as other medical research. This would pose serious challenges for researchers wishing to pursue the development of ectogenesis, as Romanis observes. However, such challenges – while

¹⁶ Romanis, E.C. (2020). Artificial womb technology and clinical translation: Innovative treatment or medical research? *Bioethics*, DOI: 10.1111/bioe.12701.

ethically demanding – are not necessarily insurmountable. They do, however, require careful consideration, which Romanis regards as a vital step towards any development and use of ectogenesis in practice.

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