

The Morality of Artificial Womb Technology

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Abstract. This paper explores the concept of ectogenesis in both the partial and the complete forms and argues for the moral permissibility of artificial womb technology in some restricted contexts. The author proposes that artificial wombs could licitly be employed for the purpose of saving the lives of infants born at very young gestational ages either by miscarriage or by delivery induced for very serious medical reasons. The author also proposes that artificial womb technology may be licitly used for the rescue of embryos created through in vitro fertilization and subsequently abandoned by their parents, but the technology would have no ethical application when used electively. *National Catholic Bioethics Quarterly* 10.3 (Autumn 2010): 515–528.

Human ectogenesis, or the gestation of a human being in an artificial environment, was imagined and written about as long ago as the sixteenth century, by the alchemist Phillip von Hohenheim, known as Paracelsus. Since the early part of the twentieth century, ectogenesis has been discussed seriously as a possible future technological development.¹ Research teams in several countries are actively engaged in bringing the concept to reality, and the ethical implications of the

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¹Scott Gelfand, "Introduction," in *Ectogenesis: Artificial Womb Technology and the Future of Human Reproduction*, ed. Scott Gelfand and John R. Shook (Amsterdam: Editions Rodopi B.V., 2006), 3.

technology continue to be disputed by philosophers, ethicists, physicians, scientists, and advocates of every variety.

The purpose of this paper is to argue that the use of artificial womb technology (AWT) would not be intrinsically evil and could have limited ethical applications despite its vast potential for abuse and misuse. To make this argument, I will discuss the concepts of both “complete ectogenesis” and “partial ectogenesis” using the definitions of these terms provided by Christopher Kaczor.² Complete ectogenesis would be the gestation of a human being entirely within the confines of an artificial womb, from the earliest embryonic stage to the equivalent of forty weeks’ gestation. Partial ectogenesis would mean some part of the gestational period spent outside the maternal womb. AWT, which could be applied in both partial and complete ectogenesis, refers to the technological solution that would allow the gestation of an embryonic or fetal human being in an artificial environment.³

I will not discuss research efforts that are focused on the regeneration of an entire uterus for transplantation into a woman who has lost her uterus to disease or injury, as transplantation of a replacement uterus would not be categorized as AWT. The creation of a replacement uterus would be commendable and perhaps realizable goal of adult-stem-cell research efforts, possibly using induced pluripotent stem (iPS) cells from autologous tissue which could somehow be coaxed into forming the desired organ. If this capability could ever be developed, it would enable the restoration of the natural reproductive function of the woman, and the implanted organ would be a real uterus—not a substitute, or “artificial,” womb. Regeneration of a uterus would thus be a morally licit therapy. Organ regeneration, however, is outside the scope of this paper.

As noted, research that could lead to the creation of artificial wombs is ongoing, and has been for several years. In 2002, Dr. Hung-Ching Liu of Cornell University reported her work on an artificial womb, which was constructed using a biodegradable scaffolding and human endometrial cells grown in culture to conform to the shape of the scaffolding.⁴ She then experimented with “surplus” human embryos obtained from fertility clinics, introducing them into the artificial uterus, where they were able to implant and grow for six days until the experiment was terminated. In 1997, Dr. Yoshinori Kuwabara, of Juntendo University in Japan, published his research on partial ectogenesis. The goal of the research was the creation of an artificial womb that could be used to save babies who would otherwise die through miscarriage or very premature delivery.⁵ He fashioned an artificial womb from a plastic container

²Christopher Kaczor, “Artificial Wombs and Embryo Adoption,” in *The Ethics of Embryo Adoption and the Catholic Tradition: Moral Arguments, Economic Reality and Social Analysis*, ed. Sarah-Vaughan Brakman and Darlene F. Weaver (New York: Springer, 2007), 309.

³Ibid.

⁴Gregory Pence, “What’s So Good about Natural Motherhood? (In Praise of Unnatural Gestation),” in *Ectogenesis*, ed. Gelfand and Shook, 77.

⁵Dr. Kuwabara died in 2000. Although his co-worker, Dr. Nobuya Unno, believes their technology could potentially help babies survive when born at only twenty weeks’ gestation,

filled with a solution mimicking amniotic fluid. Into this container he placed a goat's fetus, connected its umbilical cord to a sort of artificial placenta, and was able to "gestate" the goat for an additional three weeks, to an age where it would normally have been able to survive outside the womb.⁶

Methods used in these experiments and others like them involve the intrinsic evils of human embryo experimentation and destruction, but the early successes of the research indicate that effective AWT will eventually be developed. Considering the research efforts as well as ongoing advances in neonatology, it is likely that effective AWT will soon be a reality.

Many experts, however, remain skeptical. Dr. David Adamson, a prominent fertility expert in California, believes that a clinically successful artificial womb is still decades away because of issues related to immunology and cardiovascular development.⁷ Other experts, such as Dr. Stanley Korenman, an obstetrician/gynecologist and associate dean of ethics at the David Geffen School of Medicine at UCLA, and Dr. Randy Morris, associate clinical professor in the Division of Reproductive Endocrinology at the University of Illinois School of Medicine, question the ability of AWT to replicate the complex processes at work during natural gestation, as well as the capacity of AWT to maintain the volume of blood flow required to sustain a child throughout gestation.⁸ Dr. Nobuya Unno of the Kuwabara research group agrees with this assessment. He points out that, in addition to the technical challenges, the amount of extracorporeal blood required to sustain even one extrauterine pregnancy would be prohibitively expensive.⁹ Nevertheless, when AWT becomes a reality, a Catholic response will be necessary.

The Teaching of the Church

The magisterium of the Catholic Church has yet to provide a definitive pronouncement on the moral permissibility of AWT, although *Donum vitae* does refer to it directly:

Techniques of fertilization in vitro can open the way to other forms of biological and genetic manipulation of human embryos, such as attempts or plans for fertilization between human and animal gametes and the gestation of human embryos in the uterus of animals, or the hypothesis or project of constructing artificial uteruses for the human embryo. *These procedures are*

Dr. Unno has no interest in pursuing this research. Amel Alghrani, "The Legal and Ethical Ramifications of Ectogenesis," *Asian Journal of WTO and International Health Law and Policy* 2.1 (March 2007): 194.

⁶Colleen Carlston, "Artificial Wombs: Delivering on Fertile Promises," *Harvard Science Review* 22.1 (Fall 2008): 37.

⁷Christine Rosen, "Why Not Artificial Wombs?" *New Atlantis* 3 (Fall 2003): 67–76.

⁸Ontario Consultants on Religious Tolerance, "Ectogenesis (Using an Artificial Womb): Will It Make Abortion Illegal, or Unneeded?" *ReligiousTolerance.org*, <http://www.religioustolerance.org/abowomb.htm>.

⁹Alghrani, "Legal and Ethical Ramifications of Ectogenesis," 204.

*contrary to the human dignity proper to the embryo, and at the same time they are contrary to the right of every person to be conceived and to be born within marriage and from marriage.*¹⁰

This statement refers to AWT as “contrary to the human dignity proper to the embryo,” but other conditions to which the embryo is currently subjected, including long-term cryogenic storage, also offend against the proper human dignity of the embryo, and AWT might eventually be an appropriate response to these.¹¹ I will discuss this in more detail later in this paper.

The instruction *Dignitas personae* does not explicitly mention AWT, although one statement in particular, which refers to embryos abandoned in cryogenic storage, could be taken as an indication that AWT might be illicit, at least in the context of complete ectogenesis: “All things considered, it needs to be recognized that the thousands of abandoned embryos represent a situation of injustice which in fact cannot be resolved.”¹² Does this statement preclude all (even yet unimagined) attempts at resolving the injustice done to thousands of frozen, abandoned embryos, or does it simply reflect the situation that existed at the time of its writing? I interpret it as the latter, and consider the statement to be directed more likely at the actively debated issue of heterologous embryo adoption than at the future possibility of AWT. Since complete ectogenesis may be the one possible technology that could resolve the tragedy of abandoned human embryos (while avoiding violations of the goods of marriage), a more definitive statement of condemnation would be necessary before its future use could be completely ruled out.

In 2002, Bishop Elio Sgreccia, then vice president of the Pontifical Academy for Life, gave an interview to Vatican Radio in which he condemned AWT, saying, “It is a purely technological procedure, to the detriment of a human creature. It doesn’t take too much effort to understand that this artifice of the laboratory must be condemned also by law.”¹³ While rightly denouncing AWT as “dehumanization,” specifically in the context of complete ectogenesis, Bishop Sgreccia was also quick to recognize that the ability to gestate a child outside its mother’s womb has the potential to invalidate several of the arguments used to justify the practice of abortion. He observed, “From now on, I don’t know who will be able to state that the human embryo does not have its own individuality, its own capacity to develop, given that it can develop even outside the mother’s body. . . . A paradoxical situation is created: on one hand, the authentic nature of the embryo is manifested, its human individuality, its capacity to develop in an autonomous manner from the moment of fertilization; and on the other, it is treated in an inhuman way, leaving it at the mercy of technology.” I will discuss the effects of AWT on abortion later in this paper.

¹⁰ Congregation for the Doctrine of the Faith, *Donum vitae* (February 22, 1987), n. 6, original emphasis.

¹¹ Tadeusz Pacholczyk, e-mail message to David Reiber, July 3, 2009.

¹² CDF, *Dignitas personae* (September 8, 2008), n. 19.

¹³ “‘Artificial Womb’ Seen as Step toward Dehumanization,” *Zenit*, February 11, 2002, <http://www.zenit.org/article-3655?l=english>.

Partial Ectogenesis

With continuing advances being made in the field of neonatology, partial ectogenesis might be closer than complete ectogenesis to becoming a reality. It is already possible to keep premature infants alive outside the womb from as early as twenty-four months' gestation with the use of technologies such as incubators, ventilators, extracorporeal membrane oxygenation, and novel medicines and medical techniques. With earlier and earlier viability made possible by newer and newer technology, the treatment of premature infants may soon be classifiable as a type of AWT, if it is not already.

Although advances have been impressive, neonatal life-support technology is certainly not perfect, and the current survival rate of infants born at twenty-four weeks' gestation is only slightly more than 50 percent. Those babies who do survive have high rates of complications, including major disabilities in 20 percent and mild to moderate disabilities in an additional 20 to 30 percent.¹⁴ In concept, however, the technology of partial ectogenesis, when mature, will be entirely different from the technology used in a modern neonatal intensive care unit. Instead of treating the medical effects and disabilities of prematurity with a variety of instruments and techniques, the artificial womb would replicate the uterine environment to safely nurture its occupant to full term.¹⁵

Since modern neonatal life-support technology is considered morally good when used in a proportionate manner, we can reasonably conclude that AWT, when used in such a way, would also be morally good. The technology would be ordered toward the survival of prematurely delivered infants (a moral good), and the technology itself would not be intrinsically evil. And in the case of partial ectogenesis, there would be no perceived entanglement with the evils of in vitro fertilization (IVF), as there might be in the case of complete ectogenesis. These facts lead me to conclude that the use of AWT for partial ectogenesis to ensure a child's survival after early fetal delivery would be morally licit and commendable, and that the technology is worthy of serious efforts toward realization.

Benefits and Challenges

The most obvious benefit of partial ectogenesis would be the ability to save the lives of babies born at extremely early gestational ages, and as I have stated, the technology would be morally permissible when used for this purpose. Some serious questions could still arise, however. For example, if a miscarriage, or spontaneous abortion, were to occur because of profound fetal anomaly, would it be appropriate to use AWT to attempt to rescue the fetus, or should the child be allowed to die as perhaps God intended? If AWT actually functions as it is imagined, would it be ethical to use it to bring to term a severely disabled child who would not have

¹⁴Alistair G. S. Philip, "The Evolution of Neonatology," *Pediatric Research* 58.4 (October 2005): 807.

¹⁵Alghrani, "Legal and Ethical Ramifications of Ectogenesis," 193.

survived without it? Does the natural process of spontaneous abortion due to fetal anomaly serve God's purpose, and would unreasonably early interventions frustrate His plan? What criteria could be used to determine which spontaneously aborted babies would be rescued and which would not?

To make recommendations in such cases, competent medical experts would need to consult with trained and experienced bioethicists. Using the principle of proportionality to distinguish ordinary from extraordinary care, they would also have to evaluate the burdens that would be imposed by the outcomes. Well-reasoned bioethical guidance would be essential, because parents would have to make difficult decisions and be prepared to care for profoundly handicapped children who, without AWT, would never have been born. Perhaps fortunately, especially in cases of spontaneous abortion, proximity to the technology at the time of delivery would determine many outcomes.

Another type of premature delivery, with its own set of ethical challenges, would be the deliberate transfer of a healthy baby from its mother's womb to an artificial womb for medical reasons. While the use of AWT to save the *life* of the mother or the child might be clearly licit, would its use for other, less serious conditions, also be licit? Would it be ethical to transfer a baby to an artificial womb for corrective surgery that could not be performed in utero? What if the surgery were meant not to save the life of the child but to correct a severe disability, and the surgery would have a better outcome if done as early as possible before natural birth? In the case of a multiple pregnancy, would it be licit to transfer one or two babies out of their mother's womb to prevent complications to the infants or the mother? In a case of early preeclampsia, would transfer of the baby to an artificial womb be justified if the mother could thereby avoid months of hospitalization, complete bed rest, or long-term damage to her health?

Again, in each of these difficult cases, a competent medical authority in consultation with trained bioethicists would have to make recommendations, weighing the proportionality of the intervention along with the burdens of the outcome. Resolution of these types of ethical dilemmas will require much analysis, study, and prayer.

Development of an Artificial Womb

In my discussion of the use of AWT for partial ectogenesis thus far, I have assumed that the technology would be available in its fully developed form. It would obviously take some time for the technology to reach full efficacy, however, and the proportionality of its use would change as the technology matured. In its earliest stages, AWT would be permitted only as a research methodology. As the technology advanced and was used more frequently, with increasing efficacy, the use of AWT would change in category from nontherapeutic research to therapeutic research and finally to therapeutic practice.

During the initial stage, nontherapeutic research, experiments would be limited to the use of animals. Any attempt to use human embryonic or fetal subjects during the nontherapeutic stage would be morally illicit. As the technology advanced and success was achieved in animal models, it would become ethically permissible to use early-developmental-stage human fetuses in therapeutic research.

The secular bioethicists Joyce Raskin and Nadav Mazor suggest three possible cases that they consider appropriate for the use of human fetal subjects during this early stage of AWT research. The first is the case of an imminently dying mother carrying a very-early-developmental-stage fetus who will die without transfer to an artificial womb. The second is the case of a mother who will die if her early-developmental-stage fetus is not immediately delivered. And the third is the case of an early-developmental-stage fetus who will necessarily die because of a severe medical problem for which in vivo treatment is not possible.¹⁶

I believe that therapeutic research with AWT could licitly be pursued in the first case: the research is ordered toward the good of the baby (survival), and without it the baby would surely die along with his mother. Therapeutic research with AWT might also be licit in the second case if the justification for early delivery were the proportionate benefit of a life for a life—so long as the AWT was used in a rightly ordered attempt to save the baby's life. Use of AWT in the third case would probably be illicit, because there appears to be no reason other than the research to bring about the early delivery of the child. In this scenario, the child is afflicted with a severe medical condition that is not consistent with survival. If the child were to be delivered, the researchers would have to address the child's medical condition while attempting to accomplish gestation in the artificial womb. Induced delivery would not be a proportionate act in this case.

As knowledge and experience increase, AWT may begin to yield results that offer real medical benefit; Raskin and Mazor call this new stage of development the "hybrid phase" of therapeutic research. During this phase, the lines between research and practice will blur; because of the research goal of improving the technology, however, in each case where AWT is used, new research elements will be added that go beyond the scope of the case itself. Each case will require ethical review and informed consent, and an ethics committee will need to evaluate each new research element.

Eventually, as the technology becomes more and more effective, it will move out of the research stage and fully into the practice stage.¹⁷ At this point it may well become the standard of care for the treatment of premature delivery, whether spontaneous or induced. It is at this stage that abuses of the technology would most likely be attempted.

Potential Abuses of Artificial Wombs

Partial ectogenesis will provide opportunities for many potential abuses. Most of these will come about when the technology is completely mature and successful gestation is assured; however, one particularly egregious type of abuse will be likely to occur during the early development of the technology. Because fetuses will be much more accessible when exposed in artificial wombs, AWT will offer an

¹⁶Joyce M. Raskin and Nadav A. Mazor, "The Artificial Womb and Human Subject Research," in *Ectogenesis*, ed. Gelfand and Shook, 172.

¹⁷*Ibid.*, 172–173.

attractive opportunity for direct nontherapeutic research into their developmental processes—research invariably resulting in their deaths. Researchers will attempt to justify this sort of “extend to destroy” research by claiming that since the artificial womb gives the fetus a measure of life that it would not otherwise have, the fetus is no worse off when it is sacrificed in the experiment.¹⁸ Obviously, this sort of immoral reasoning is repugnant and should be condemned.

Other potential abuses of AWT have been posited by many commentators, some serious and some fanciful. One is the use of artificial wombs by women who wish to deliver their babies early for the sake of convenience or comfort or because of concerns about their appearance. Some commentators are concerned that women could be forced to use AWT by their employers to avoid lost work time due to pregnancy. Some also fear that insurance companies may exert coercive power over women by mandating AWT over pregnancy if the technology is found to result in fewer health problems, or that courts may order substance-abusing women to artificially gestate their babies to prevent harm to the children.¹⁹ Commentators point out that, unlike mothers, artificial wombs would not suffer from high blood pressure, gestational diabetes, or automobile accidents or expose babies to such things as crack cocaine, alcohol, or prescription medications.²⁰

These potential abuses could obviously be addressed with appropriate medical and legal regulation of the technology. But AWT will almost certainly develop as a medically controlled intervention, and it may never reach the point where it is sufficiently safe, available, and affordable to be an elective procedure.

Clearly, the only morally licit use of AWT will be to save babies delivered at an early gestational age either by spontaneous abortion or because of dire medical necessity. AWT must be strictly controlled, used only when, after careful analysis of the medical circumstances, competent medical authorities in concert with hospital ethics committees deem its use medically necessary.

Artificial Wombs and Abortion

As Bishop Sgreccia pointed out in his Vatican Radio interview, AWT holds the potential to invalidate some of the arguments frequently used to justify abortion. One of the most common arguments for abortion is that a woman’s right to autonomy trumps the fetus’s right to life—an argument advanced by Judith Jarvis Thomson in her analogy of the “famous violinist.”²¹ Thomson postulates that if one were to wake from a coma to find oneself in a hospital attached by tubes to a famous violinist, and was told that if the tubes were disconnected the violinist would die, one would be justified in disconnecting the tubes, even if the unintended but foreseen consequence was the violinist’s death. She also proposes that if the violinist were somehow to survive, one would not be justified in killing him.²² Thus, Thomson

¹⁸Ibid., 176–177.

¹⁹Carlston, “Artificial Wombs: Delivering on Fertile Promises,” 38.

²⁰Alghrani, “Legal and Ethical Ramifications of Ectogenesis,” 205.

²¹Judith Jarvis Thomson, “A Defense of Abortion,” *Philosophy and Public Affairs* 1.1 (Fall 1971), 47–66.

proposes a sort of principle of double effect: those desiring abortion only want to be free of the child, and its death after separation from the womb would simply be a foreseen yet unintended consequence of the action.

As secular bioethicist Peter Singer and his collaborator Deane Wells famously write, “Freedom to choose what is to happen to one’s body is one thing; freedom to insist on the death of a being that is capable of living outside one’s body is another.”²³ The autonomy argument, however, is a dishonest one, for it presupposes that the fetus could not survive separation from the mother. If AWT were available, the fetus could be delivered without dying, thus satisfying both of the supposedly competing rights of mother and child. Yet abortion supporters generally regard the prospect of fetal survival with horror, which thus exposes the autonomy argument as the lie that it is. For what women actually seek in abortion is not bodily autonomy but freedom from having a child. In the words of the secular ethicist and feminist Rosemarie Tong, “When a woman seeks an abortion, she probably has fetal extinction, and not merely fetal extraction, as her goal.”²⁴ This statement is supported by a study by Leslie Cannold of the responses of both pro-abortion and pro-life women to the idea of ectogenesis. Surprisingly, both groups were overwhelmingly opposed to the use of ectogenesis as a resolution for “unexpected” pregnancy. Both groups considered the placement of their unborn children in “incubators” equivalent to the shirking of their responsibility as mothers. While the pro-life group saw raising an unexpected child as their only responsible option, the pro-abortion group saw their responsible option differently. This group believed that the most appropriate expression of their motherly responsibility was to “prevent their child’s birth.”²⁵

Another aspect of abortion “rights” which is invalidated by ectogenesis is the legal construct of fetal “viability” and its use as a cutoff point before which abortion is unrestricted. With the development of effective ectogenesis, the relevance of fetal viability as a boundary would be eliminated. Governments that use the concept of viability to define a period of time during pregnancy when abortion is permitted would be forced to either outlaw the procedure or change their laws.²⁶

The distress over the threat to abortion “rights” presented by ectogenesis is particularly animated among feminist thinkers,²⁷ but there is probably little for them to worry about. It would be naive to believe that technology could cause the outlawing

²²Scott Gelfand, “Ectogenesis and the Ethics of Health Care,” in *Ectogenesis*, ed. Gelfand and Shook, 103–104.

²³Peter Singer and Deanne Wells, “Ectogenesis,” in *Ectogenesis*, ed. Gelfand and Shook, 12.

²⁴Rosemarie Tong, “Out of Body Gestation: In Whose Best Interests?” in *Ectogenesis*, ed. Gelfand and Shook, 70.

²⁵Leslie Cannold, “Women, Ectogenesis, and Ethical Theory,” in *Ectogenesis*, ed. Gelfand and Shook, 50–56.

²⁶Alghrani, “Legal and Ethical Ramifications,” 200.

²⁷The feminist writer Sacha Zimmerman provides a representative quote: “The pro-choice movement is ignoring the prospect of ectogenesis at its own peril. If and when ectogenesis becomes a reality, it will redefine the abortion debate.” “Ectogenesis:

of abortion, given the deeply rooted political nature of so-called reproductive rights issues.²⁸ One need only look to the continuing practice of late-term abortion in the United States to understand that the lives of unborn children, even those who are seconds from natural birth, hold little or no value in our culture and among many of our current national leaders. Logical, well-crafted arguments against abortion using scientific data, natural law, and moral reasoning have consistently failed to influence this state of affairs. Arguments supported by new technology are likely to fail as well, so the effect of AWT on abortion would likely be minimal. Perhaps the most important thing that ectogenesis might offer to the few who are willing to notice would be an open window into the womb (albeit artificial), where the humanity of the tiny human being residing there would be exposed for all to see.

Complete Ectogenesis

Complete ectogenesis differs from partial ectogenesis in one very important aspect: In partial ectogenesis the subject of the procedure would have been conceived and implanted normally in its mother's womb, whereas in complete ectogenesis, the subject of the procedure would be conceived by IVF and never implanted in a womb. Complete ectogenesis, then, would be possible only after the intrinsic moral evil of IVF had been performed, and thus its ethically licit applications would be extremely limited. In fact, there seems to be only one possible moral application of this technology, and that is the rescue of embryos created through IVF and left unwanted, in storage, by their progenitors.

The moral permissibility of this application is quite rightly regarded with uncertainty, but I believe it is possible to make the case for its moral permissibility using the same argument that was used for partial ectogenesis in early fetal delivery: Given that a human embryo is truly a human being, and therefore worthy of the dignity due the human person, it follows logically that the human embryo would be just as worthy of life support and "rescue" from its life-threatening condition as would the fetal or the neonatal human being. Other than implantation in a woman's uterus (that of either the genetic mother or a surrogate), there would be no other way yet imagined to bring these embryos to term—in other words, to save their lives. Given the lack of other available and morally licit solutions, the use of a technological solution that has been meticulously designed for the survival of a human being (a moral good) would be morally permissible and perhaps even laudable.

In 2003, the number of human embryos in frozen storage was estimated to be as high as four hundred thousand in the United States alone²⁹; it is likely to be much

Development of Artificial Wombs—Technology's Threat to Abortion Rights," *San Francisco Chronicle*, August 24, 2003, <http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2003/08/24/IN273768.DTL>.

²⁸Alghrani, "Legal and Ethical Ramifications," 199.

²⁹Rand Law and Health Initiative, "How Many Frozen Embryos Are Available for Research," Rand Research Brief RB-9038 (2003), summarizing D. I. Hoffman et al., "Cryo-preserved Embryos in the United States and Their Availability for Research," *Fertility and Sterility* 79.5 (May 2003): 1063–1069.

higher now. The origin of this egregious situation is the unregulated, irresponsible, and prevalent use of IVF as a remedy for infertility. The magisterium of the Catholic Church has spoken quite clearly on the immorality of IVF in numerous documents and instructions, but secular authorities and the public in general have had no desire to listen to moral reason. Without the political will to completely ban the procedure, it is imperative that legislation be enacted that would at least provide some reasonable regulation of IVF practice. This legislation should include, at a minimum, a prohibition on the freezing of embryos and some limits on the number of embryos that can be created in any single cycle of fertility treatment. The United States could use Italian law as a model for this legislation, under which it is permissible to fertilize no more than three eggs at a time, and all successfully created embryos are required to be implanted in the mother.³⁰ Such a law would help prevent the perpetuation of the vast, ongoing injustice to hundreds of thousands of human beings who are kept frozen in a sort of suspended animation in clinics around the country.

What, then, can be done about all these seemingly doomed lives? It is not my purpose in this paper to argue the moral permissibility of embryo adoption (also known as heterologous embryo transfer, or HET), but a brief discussion is necessary to emphasize my belief that complete ectogenesis is the best morally licit solution for embryo rescue.

Some prominent Catholic bioethicists have argued against the moral permissibility of implanting an IVF-created embryo even in the womb of its own mother, on the basis that embryo transfer in itself is intrinsically evil.³¹ Others, however, have argued that the Instruction *Donum vitae* implies that transfer to the mother's womb is the only morally licit way of remedying the situation.³² The Instruction states, "In consequence of the fact that they have been produced in vitro, those embryos *which are not transferred into the body of the mother* and are called 'spare' are exposed to an absurd fate, with no possibility of their being offered safe means of survival which can be licitly pursued."³³ The very best thing that could be done for abandoned embryos would be to transfer them into the wombs of their natural mothers so that they could be brought to term. Unfortunately, this is not a realistic possibility.

Because most of these embryos have been abandoned by their progenitors, it is highly unlikely that more than a very few will ever be gestated by their natural mothers. In light of this reality, the idea of HET was advanced, and Catholic bioethicists continue to debate its moral permissibility. HET can be performed in

³⁰Robert P. George and Christopher Tollefsen, *Embryo: A Defense of Human Life* (New York: Doubleday, 2008), 215–216.

³¹See, for example, Tadeusz Pacholczyk, "On the Moral Objectionability of Human Embryo Adoption," in *Ethics of Embryo Adoption*, ed. Brakman and Weaver, 79.

³²See, for example, Peter F. Ryan, "Our Moral Obligation to the Abandoned Embryo," in *Human Embryo Adoption: Biotechnology, Marriage, and the Right to Life*, ed. Thomas V. Berg and Edward J. Furton (Philadelphia and Thornwood, NY: National Catholic Bioethics Center and Westchester Institute for Ethics and the Human Person, 2006), 302.

³³CDF, *Donum vitae*, n. 5, emphasis added.

the context of embryo adoption, whereby the embryo is gestated in the womb of a woman who later, with her husband, adopts the child and raises it as their own, much like the adoption of a born child. It can also be done as a “rescue,” whereby a woman gestates the embryo to term and then, after birth, gives the child up for adoption; the analogy here might be foster parenting. From an emotional standpoint, the arguments clearly favor embryo adoption; however, the stronger moral reasoning in the debate appears to me to be on the side of those who argue against HET. Those who support HET seem to be saying that fertilization constitutes the whole of the procreative element, when in fact implantation and gestation are also included in this element. To parse out one part from the whole of the process is to parse too far; thus, I agree with the argument that HET violates the goods of marriage, is intrinsically evil, and is therefore not a morally licit way to address the problem of abandoned embryos.

When we consider the idea of complete ectogenesis for embryo rescue, it would not be morally licit to participate in any manner in the continuation or validation of the practice of IVF. Even the appearance of cooperation would have to be avoided to prevent scandal. Therefore, any use of complete ectogenesis would have to be very clearly separated from IVF practice and IVF clinics, and a clear statement of repudiation would be required.

Possible Abuses

Complete ectogenesis represents the final step in separating procreation from the marital act and could be used in the continuing perversion of the natural order. Several possible abuses or misuses of the technology have already been described, although undoubtedly many more are possible. Many abuses of complete ectogenesis would be similar to those described for partial ectogenesis, so I will mention only a few examples that apply specifically to complete ectogenesis.

One of the most egregious abuses of complete ectogenesis would be its use to gestate cloned human embryos for the harvesting of their organs for transplant—a concept dubbed “pharming.” Attempts to justify this proposal are made with the false assertion that cloned embryos would not be real human beings and would therefore not be worthy of protection.³⁴ This immoral and ghoulish proposal must be outlawed before it has a chance to be put in practice.

Women and their partners might choose ectogenesis over pregnancy for a variety of self-serving reasons, such as to preserve the woman’s appearance; avoid restrictions on diet, alcohol consumption, and other activities; avoid the physical discomforts of pregnancy; and avoid the ordeal of childbirth. As with partial ectogenesis, the way to control such misuse of the technology would be to maintain it in a clearly medical context and closely scrutinize its use for appropriate indications of abuse. There can be no morally licit use of complete ectogenesis when it is chosen voluntarily, as this would necessitate the performance of IVF, which is an intrinsically evil act.

³⁴Georgia Right to Life, “Ectogenesis,” Personhood.net, 2010, http://www.personhood.net/index.php?option=com_content&view=category&layout=blog&id=105&Itemid=535.

Homosexual men could use the technology to “procreate” without the need for a woman to serve as surrogate. With the development of female oocytes from male-derived embryonic stem cells,³⁵ it might even be possible someday to create an embryo out of the genetic material of each of the homosexual partners (substituting iPS-derived oocytes) and transfer the embryo to an artificial womb to produce a child whose true genetic parents are both male. Such perversion of the natural order would be morally illicit, with a series of intrinsically evil acts required for its realization. Unfortunately, it is unrealistic to think that this abuse could be controlled by keeping AWT in a medical-use context. Many people, including some in the medical community, would celebrate the possibility of using AWT in this way and be willing to facilitate its accomplishment.

Ectogenesis, like IVF, could also lead to the perception that children are the result of a sort of manufacturing process. More troubling, the process itself could devolve into a manufacturing process reminiscent of that in Aldous Huxley’s *Brave New World*. If conducted in this way, it would eventually involve some element of fetal quality control, with specific developmental criteria that must be met at certain milestones and with the destruction of fetuses that fail to meet the criteria.³⁶ Despite the frightening and immoral aspects of such a scenario, it is hard to imagine a large-scale manufacturing effort for the production of infants, all requiring care and feeding, that a government or industry would undertake voluntarily. The industrial production scenario is probably fanciful, more aligned toward discouraging the idea of ectogenesis rather than describing a likely outcome of it.

Licit Uses of Ectogenesis

I have demonstrated that AWT, when used for either partial or complete ectogenesis, may have moral applications that could be pursued by Catholic health care workers in good conscience. In the case of partial ectogenesis, AWT could licitly be employed for very-early-developmental-stage fetuses when induced delivery is necessary to save the life of either the mother or the child, and for the rescue of spontaneously aborted early-developmental-stage fetuses. In the case of complete ectogenesis, AWT could licitly be used in the relatively narrow application of bringing to term the thousands of abandoned embryos created through IVF and kept in frozen storage in clinics around the world. It would be necessary for those using AWT for embryo rescue to scrupulously avoid the scandal of association with the IVF industry, but this is by no means an overwhelming impediment to its use.

Although the applications are narrow and the potential abuses are many, AWT is worthy of development as a means of last resort. It must never be allowed to become a substitute for the exceptional goods of motherhood, but when used as a desperate measure to bring an otherwise doomed child to term, it would serve a clearly moral purpose.

³⁵Rosen, “Why Not Artificial Wombs?”

³⁶Julien S. Murphy, “Is Pregnancy Necessary? Feminist Concerns about Ectogenesis,” in *Ectogenesis*, ed. Gelfand and Shook, 40.

