

1-1-2016

Artificial Wombs: The Third Era of Human Reproduction and the Likely Impact on French and U.S. Law

Marion Abecassis

Follow this and additional works at: <https://repository.uchastings.edu/hwlj>

 Part of the [Law and Gender Commons](#)

Recommended Citation

Marion Abecassis, *Artificial Wombs: The Third Era of Human Reproduction and the Likely Impact on French and U.S. Law*, 27 *Hastings Women's L.J.* 3 (2016).

Available at: <https://repository.uchastings.edu/hwlj/vol27/iss1/1>

This Article is brought to you for free and open access by the Law Journals at UC Hastings Scholarship Repository. It has been accepted for inclusion in *Hastings Women's Law Journal* by an authorized editor of UC Hastings Scholarship Repository. For more information, please contact wangangela@uchastings.edu.

Artificial Wombs: “The Third Era of Human Reproduction” and the Likely Impact on French and U.S. Law

*Marion Abecassis**

INTRODUCTION

After the contraceptive pill, artificial insemination, in vitro fertilization, the next step will be ectogenesis, that is to say the artificial uterus.

– Henri Atlan

What if artificial wombs were available tomorrow? The arrival of such technology may well represent the zenith of the reproductive revolution.¹ According to experts it would mark the dawn of the “third era of human reproduction.”² No longer would fetus and mother have to “travel together” during the gestational period.³

In 1931, the English writer Aldous Huxley famously depicted artificial wombs in his novel *Brave New World*:⁴ “[T]here, in the crimson darkness, stewing warm on their cushion of peritoneum and gorged with blood-surrogate and hormones, the fetuses grew and grew.”⁵ The fiction was initially met with criticism and groups in the United States continue to

* Dedicated to Albert Abecassis. LL.M. Graduate, May 2015, Georgetown University Law Center; French Fulbright Grantee 2014-2015. The author is grateful for the encouragements of Professor Susan Crockin, Doctor Robert Stillman, Professor John Robertson, and Professor Henri Atlan. The author would like to add a special thank you to Ryan Cauley and Travis Hairfield who devoted time to proofread this article, and to Ali Nicolette, Co-Editor-in-Chief of the *Hastings Women’s Law Journal*, for her excellent corrections and comments.

1. See e.g. R. LEE & D. MORGAN, HUMAN FERTILIZATION AND EMBRYOLOGY: REGULATING THE REPRODUCTIVE REVOLUTION (2001).

2. S. Wellin, *Reproductive Ectogenesis: The Third Era of Human Reproduction and Some Moral Consequences*, 10(4) SCIENCE AND ENGINEERING ETHICS 615 (2004).

3. *Id.*

4. ALDOUS HUXLEY, BRAVE NEW WORLD (1931).

5. *Id.* at 99.

request its removal from circulation.⁶ In 2005, French biologist Henri Atlan—in his highly publicized book, *L'Uterus Artificiel*—attempted to pragmatically analyze the likely consequences of introducing artificial wombs into the reproductive technology market.⁷ His book generated spirited debate among French scholars in the bioethics field.⁸

Scientists and sociologists are growing increasingly concerned by the science of ectogenesis, a process in which an embryo grows independent of its mother's body.⁹ For some medical professionals, ectogenesis represents the logical evolution of neonatology, the modern technology that allows premature babies to survive.¹⁰ For others, the creation and use of artificial wombs are more closely related to the antiquated effort at disconnecting sexuality from procreation.¹¹ Regardless of the lens through which ectogenesis is analyzed, it has the potential to revolutionize our perspective on childbirth, medical technology, and the limitations of our current knowledge.

Ectogenesis is feared because it is difficult to distinguish between futuristic fantasy and scientific, and social, reality.¹² This article is based on the prediction that artificial womb technology will soon be introduced to the international market and that safety for the ectogenetic child will be successfully achieved.¹³ Although philosophical and social implications are necessarily invoked in a discussion of artificial wombs, this article addresses more fully the legal analysis and ramifications of such a practice. It must be finally noted that this article focuses primarily on full

6. Huxley's book was the 52nd most challenged book between 1990 and 2000, more than sixty years after its original publication. American Library Association, *The 100 most frequently challenged books of 1990-2000*, <http://www.ala.org/Template.cfm?Section=bbwlinks&Template=/ContentManagement/ContentDisplay.cfm&ContentID=85714> (last visited Apr. 4, 2015).

7. HENRI ATLAN, *L'UTERUS ARTIFICIEL* (Editions du Seuil, 2005).

8. Philippe Descamps notices that Atlan's book provoked a "wave of panic" among French thinkers in the field of bioethics. He also points out that the Report on family and children rights led by the French Assemblée Nationale in 2006 [hereinafter "2006 Report"] cites Henri Atlan's book and the artificial wombs as possible scientific advances that could challenge the structure of the family. Philippe Descamps, *L'inflation bioéthique dans la perspective de l'ectogénèse*, 28 *RAISONS POLITIQUES* 116 (2007); *RAPPORT NO. 2832 FAIT AU NOM DE LA MISSION D'INFORMATION SUR LA FAMILLE ET LES DROITS DES ENFANTS* 14 (2006), available at <http://www.assemblee-nationale.fr/12/rap-info/i2832.asp>.

9. See *infra* Part II.A.

10. Although critics see ectogenesis as an unnecessary next step. Reihan Salam, *The End of Pregnancy: And the inevitable rise of the artificial womb*, SLATE.COM (Oct. 23, 2014, 6:39 PM), http://www.slate.com/articles/news_and_politics/culturebox/2014/10/ectogenesis_is_the_end_of_pregnancy_and_the_inevitable_rise_of_the_artificial.html ("If ectogenesis . . . ever happens in the real world, it will be a more than just a banal next step from the other technologies that already keep premature babies alive.")

11. J.B.S. HALDANE, *DAEDALUS, OR, SCIENCE AND THE FUTURE* 17 (1923); ATLAN, *supra* note 7, at 9.

12. Terms used by Amel Alghrani in *The Legal and Ethical Ramifications of Ectogenesis*, 2 *ASIAN J. WTO & INTERNATIONAL HEALTH L. & POL'Y* 195 (2007).

13. For more on the "reasonable assurance" issue, see Jessica H. Schultz, *Development of Ectogenesis: How Will Artificial Wombs Affect the Legal Status of a Fetus or Embryo?*, 84 *CHI.-KENT L. REV.* 877, 894 (2010).

ectogenesis, as opposed to partial ectogenesis (the possible transfer of embryos once “natural gestation” has already started).

This article offers a comparative analysis of the prospective legal impact of the introduction of artificial wombs on the market in France and in the United States. Part I includes a background of the science of ectogenesis and a brief comparison of the current French and American positions vis-à-vis reproductive technologies. The following parts explore three main legal dilemmas that both French and U.S. law must resolve to sanction the use of ectogenesis: the status of the ectogenetic embryo, the concept of parenthood, and access to ectogenetic technology. This article offers potential guidelines and suggests specific legal reforms, such as the creation of a set of clear legal statuses for the embryos, for French and U.S. legislatures to implement in order to regulate ectogenesis as a reproductive method.

I. BACKGROUND

A. ECTOGENESIS & ARTIFICIAL WOMBS

The process of conception and gestation was once an opaque and particularly enigmatic phenomenon veiled by feminine mystery and divine intervention. Pregnant women in ancient Egypt turned to Isis, Goddess of Fertility and Motherhood and keeper of powerful magic, to keep them safe, and the moment of birth was considered an “Act of the Gods.”¹⁴ The advent of scientific information and medical technology, however, gradually separated any magical aspect attributed to female reproduction as the process of pregnancy and childbirth was increasingly controlled and tamed by Men. The myth of ectogenesis orchestrated by scientific means came to existence relatively recently and is heavily attributed to British scientist and professor John B. S. Haldane in the twentieth century. In 1923, Professor Haldane gave a conference entitled *Daedalus, or Science of the Future*, in which he imagined a student in the year 2070 talking about the landmark discoveries of the two last centuries.¹⁵ Haldane not only evoked the first ectogenetic child, that is to say the first child whose gestation would have occurred entirely in a laboratory, but also roughly explained the scientific progress that would enable the process of ectogenesis to become a reality.¹⁶

Ectogenesis involves the implantation and full development of the fetus outside the human body,¹⁷ by *in vitro* fertilization (“IVF”), in an artificial womb. The artificial womb is the technological device that carries the

14. Geoffrey Chamberlain, *Historical perspectives on health, Childbirth in Ancient Egypt*, THE J. OF THE ROYAL SOC'Y FOR THE PROMOTION OF HEALTH 284 (2004).

15. HALDANE, *supra* note 11.

16. *Id.*

17. “Able to live and develop outside a host.” *Ectogenous*, THE AMERICAN HERITAGE DICTIONARY (2nd ed. 1982); “The growth process of embryonic tissue placed in an artificial environment . . .” *Ectogenesis*, WEBSTER'S NEW WORLD COLLEGE DICTIONARY (4th ed. 1999).

extracorporeal gestation in lieu of the woman's uterus and mimics the structure of a natural uterus. The walls of the cavity, according to Henri Atlan, would be made of endometrial tissue, allowing the implantation of the fertilized egg.¹⁸ In the course of the gestation, the ectogenetic device would allow nutrient and hormone supply, as well as waste filtration.¹⁹ It would undertake multiple fundamental functions, which would evolve as the fetus grows, such as ensuring its protection against viruses and bacteria, and controlling light and temperature.²⁰ Full ectogenesis must be distinguished from the care of very premature babies²¹ because the early stages and the final stages of gestation demand varying conditions.²² Ectogenesis must also be distinguished from the gestation of a child outside his or her *biological* mother: for the last several decades, *in vitro* fertilization has allowed a fetus to grow outside the natural mother's womb, although it still requires the use of a woman's body for formal gestation.²³

Embryologists are able to grow an embryo *in vitro* for five days post fertilization. Medical teams in neonatology departments are able to care for babies born prematurely up to only twenty-two weeks of natural gestation.²⁴ Medical technology can now successfully maintain fetal life outside the woman's body between up to five days post fertilization and after twenty-two weeks natural gestation.²⁵ Advancements in ectogenetic technology have begun to fill in the gap between the fifth day after fertilization and the twenty-second week of natural gestation.

The most outstanding work in this area is a set of studies performed by Dr. Helen Liu in 2002 at Cornell University's Centre for Reproductive Medicine and Infertility. Dr. Liu, an embryology specialist, developed a growing interest in the mechanism of implantation, or how a fertilized egg successfully attaches itself to the endometrium in the women's womb.²⁶ She sought to develop an external and computerized device composed of tissues extracted from a woman's uterus, and she studied the interactions between this potential "artificial womb" and a fertilized egg.²⁷ She ultimately claimed that she was able to grow a human embryo up to ten

18. ATLAN, *supra* note 7, at 48.

19. ATLAN, *supra* note 7, at 48.

20. *Id.*

21. *See e.g.*, Schultz, *supra* note 13, at 880.

22. This is why Henri Atlan suggests development of two types of artificial wombs: scientists, such as Liu, focused on the "early" womb ("l'utérus artificiel précoce"), while the team led by Kuwabara concentrated on the "late" womb ("l'utérus artificiel tardif") with fetuses already developed. ATLAN, *supra* note 12, at 42–48.

23. *See e.g.*, Alghrani, *supra* note 12, at 196. Like artificial wombs, surrogacy allows the intended mother to have a genetic child although she did not carry the fetus during gestation (but unlike artificial wombs, surrogacy still requires a woman's body and is not totally "artificial").

24. Neil Marlow, *The Elephant in the Delivery Room*, 372 N. ENGL. J. MED. 372, 1856–1857 (2015).

25. Descamps, *supra* note 8, at 112.

26. L'UTERUS ARTIFICIEL (ARTE 2001), available at <https://www.youtube.com/watch?v=WEaefApW7Oc>.

27. Christine Rosen, *Why Not Artificial Wombs?*, 1 NEW ATLANTIS 1, 67 (2003).

days, the maximum allowed by law, in the artificial womb.²⁸ Dr. Helen Liu was even more successful with mouse embryos, for which the U.S. legislation does not restrict the duration of the experiment. Her most notable achievement was an almost complete term of twenty-one days gestation of a mouse in an artificial womb. However, as she stated later in an interview for a French documentary, the mouse embryo growing in her artificial incubator was subject to severe malformation.²⁹

In Tokyo, Dr. Kuwabara, chairman of the Department of Obstetrics and Gynecology at Juntendo University, tried to build a sustainable artificial womb using goat fetuses for the purposes of his studies.³⁰ In 1997, he was able to keep a seventeen-week-old goat fetus in extra uterine incubation for three weeks.³¹

It is yet uncertain when artificial wombs will be effective and available for widespread consumer use. In 1996, Arthur L. Caplan, director of the Center for Bioethics at the University of Pennsylvania, told the *New York Times* that he predicted the first experimental protocols being available within thirty years. For him, like for many other scientists, the creation of artificial wombs was already “technologically inevitable” as he noticed spectacular advances in neonatology.³² Today, numerous complex issues remain to be solved in order to make artificial wombs a reality, such as determining the exact quantity of oxygen, nutrients and hormones needed by the embryo at the different stages of gestation.³³ We may not yet have the tools necessary to unlock all the mysteries behind human gestation,³⁴ and some scholars are still skeptical of ectogenetic technology. There is genuine hope in the scientific community, however, that these technical and biological barriers will be successfully overcome in the next two decades.³⁵

B. FRANCE AND REPRODUCTIVE TECHNOLOGIES

The French approach to the use of reproductive technologies tends to be guided by prudence. The basis of this approach is to avoid playing the “sorcerer’s apprentice” to the detriment of ethical standards simply to

28. *Id.* at 69.

29. Schultz, *supra* note 13, at 882.

30. Jeremy Rifkin, *The end of pregnancy*, THE GUARDIAN (Jan. 16, 2002, 9:22 PM), <http://www.theguardian.com/world/2002/jan/17/gender.medicalscience>.

31. *See e.g.*, Alghrani, *supra* note 12, at 196. Some videos of Dr. Kuwabara’s experiments can be accessed on line: L’UTERUS ARTIFICIEL, *supra* note 18, at 0:19. On another note, the Raëlian movement, which believes that life on Earth was created by a species of extraterrestrials, issued a 2003 press release seeking the help of scientists to create an artificial womb named “BABYTRON.” Rosen, *supra* note 27, at 70.

32. Perri Klass, *The artificial womb is born*, N.Y. TIMES, Sept. 29, 1996, at SM-117, available at <http://www.nytimes.com/1996/09/29/magazine/the-artificial-womb-is-born.html>.

33. Scott LaFee, *Will Artificial Wombs mean the end of pregnancy?*, U-T SAN DIEGO F-1 (Feb. 25, 2004), available at <http://legacy.utsandiego.com/news/science/20040225-9999-mz1c25womb.html>.

34. The hormonal mechanisms allowing changes in the composition of the amniotic fluid during pregnancy are not well known at this time. *See e.g.*, ATLAN, *supra* note 7, at 45.

35. *See e.g.*, Rifkin, *supra* note 30; Rosen, *supra* note 27, at 70; Alghrani, *supra* note 12, at 197.

satisfy the wish to have children.³⁶ Although the benefits of reproductive technologies for society have been widely recognized since the birth of the first French “test tube baby” under the supervision of Dr. Frydman in 1982,³⁷ the French legislator strictly limits their availability. Indeed, as stated at the beginning of the chapter dedicated to assisted reproductive technology in the French Code of Public Health, such technology shall be used only to remedy medically diagnosed *pathological* infertility or to avoid transmitting a very serious disease to the unborn child or the other member of the couple.³⁸ More generally, the last decade has been marked by a legislative and regulatory inflation circumscribing—rather than prohibiting—various bioethical practices.³⁹

The use of assistive reproductive technologies (“ART”) in France illustrates the tension between the conservative, restrictive legislative push in reproductive technology and the reality of a popular, well-used technology. The French social security system covers all the costs generated by *in vitro* fertilization (up to four attempts) for female residents before age forty-three.⁴⁰ France has historically one of the highest fertility rates of Europe.⁴¹ In fact, one out of thirty-five babies born in France in 2012 was conceived with the help of assisted reproductive technologies,⁴² compared with only one out of every hundred babies in the United States.⁴³

France occupies a middle position and “accepts ARTs but strongly resists more novel reproductive technologies.”⁴⁴ France’s attitude toward surrogacy is much less nuanced than toward *in vitro* fertilization. Since 1991, the French Supreme Court (Cour de Cassation) has considered surrogacy an act against the French fundamental principle of “non-commercialization of the human body.”⁴⁵ A provision was later added in the French Civil Code that

36. The 2006 Report is very meaningful on this point: “in the field of reproduction . . . the Legislator avoid playing the sorcerer’s apprentice and must maintain ethical safeguards.” RAPPORT NO. 2832, *supra* note 8, at 15.

37. Amandine, the first French “test tube baby” was born in 2013 the aid of Dr. Frydman. *Amandine, premier bébé-épreuve français, donne naissance à une fille*, LE MONDE, (June 16, 2013, 5:54 PM), http://www.lemonde.fr/sante/article/2013/06/16/amandine-premier-beb-e-eprouvette-francais-donne-naissance-a-une-fille_3430992_1651302.html.

38. CODE DE LA SANTÉ PUBLIQUE [C.S.P] [Code of Public Health], Art. L.2141-2 (Fr.).

39. Descamps, *supra* note 8, at 111.

40. LE COÛT D’UNE FIV, <http://www.fiv.fr/cout-fiv/> (last visited Apr. 5, 2015).

41. French Ministry of Foreign Affairs and International Development, *With 2.01 children per woman, France has one of the highest fertility rates in Europe*, <http://www.diplomatie.gouv.fr/en/french-foreign-policy-1/economic-diplomacy-foreign-trade/facts-about-france/one-figure-one-fact/article/2-01-the-average-number-of> (last updated Oct. 2013).

42. Agence Française de la Biomédecine, LE RAPPORT MÉDICAL ET SCIENTIFIQUE DE L’ASSISTANCE MÉDICALE À LA PROCRÉATION ET DE LA GÉNÉTIQUE HUMAINES EN FRANCE 9 (2012), available at <http://www.agence-biomedecine.fr/annexes/bilan2013/donnees/procreation/01-amp/synthese.htm>.

43. See *infra* Part I.C.

44. John A. Robertson, *Reproductive Technology in Germany and the United States: An Essay in Comparative Law and Bioethics*, 43(1) COLUM. J. OF TRANSNATIONAL L. 189, 191 (2004).

45. Cour de cassation [Cass.] [supreme court for judicial matters], Ass. plén., May 31,

specifically states, “all agreements relating to procreation or gestation for the benefit of another are null.”⁴⁶ Interestingly, the European Court of Human Rights recently condemned the French position for not recognizing the establishment of a relationship between a father and his biological children born following surrogacy arrangements abroad.⁴⁷ The European Court of Human Rights (“Court”) gives considerable deference to the Member States to regulate surrogacy and ART’s because the Court is usually reluctant to get involved in reproductive technology law debates, preferring to leave coverage of sensitive policies to the Member States.⁴⁸ The Court will intervene, however, in instances of Convention violations.⁴⁹ Strong social support for the child’s best interests⁵⁰ combined with the increasingly wide interpretation of the right to privacy and family life⁵¹ provide ample justification for the Court to limit the ability of Member States to deny the effects of foreign decisions. Here, the Court limits the ability of France to deny the effects of a judicial decision regarding surrogacy issued abroad in the United States. While the Court does not legitimize surrogacy agreements, it implies that the biological father-child relationship established in the United States should be similarly recognized in France.⁵²

C. U.S. AND REPRODUCTIVE TECHNOLOGIES

The United States is characterized by a salient lack of federal regulation regarding reproductive technologies.⁵³ The Centers for Disease Control and Prevention (“CDC”) and the Food and Drug Administration (“FDA”) regulate only the safety of technological devices used in ART, not the overall use of such devices.⁵⁴ At the state level, the government

1991, no. 90-20.105.

46. CODE CIVIL [C. CIV.] [Civil Code], Art. 16-7 (Fr.).

47. European Court of Human Rights Press Release 185, Totally prohibiting the establishment of a relationship between a father and his biological children born following surrogacy arrangements abroad was in breach of the Convention 3 (June 26, 2014).

48. *Id.*

49. Here, “Convention” means the European Convention of Human Rights.

50. The principle of “child’s best interest” is a legal concept often used by the court in its decisions. In 1996, the Court underlined the importance of this principle susceptible to override the parents’ decisions in *Johansen v. Norway*. 23 Eur. H.RE. Rep. 33.

51. European Convention of Human Rights, Art. 8.

52. The Court held that, by not recognizing the biological father as the legal father of the children, France violated the child’s, not the intended parents’ rights, rights). *Mennesson v. France*, App. No. 65192/11 Eur. Ct. H.R. 100-101 (2004), available at [http://hudoc.echr.coe.int/eng?i=001-145389#{"itemid":\["001-145389"\]}](http://hudoc.echr.coe.int/eng?i=001-145389#{).

53. See, e.g., Kirsten Riggan, *Regulation (or lack thereof) of assisted reproductive technologies in the U.S. and abroad* (Mar. 4, 2011), <https://cbhd.org/content/regulation-or-lack-thereof-assisted-reproductive-technologies-us-and-abroad>.

54. The CDC must release an annual report on infertility procedures and their success rates; the FDA is responsible for approving certain products (drugs, biological products and medical devices if they meet specific conditions) before they can enter the market and for testing reproductive tissues before they are implanted. See AM. SOC’Y OF REPROD. MED., OVERSIGHT OF ASSISTED REPRODUCTIVE TECHNOLOGY 5 (2010), available at <https://www>.

regulates medical activity, which includes medical treatments to infertility, through licensing of practitioners, including suspension and revocation of licenses in instances of malpractice.⁵⁵ Finally, the use of reproductive technology is left to the self-regulation of the medical profession, such as the American Society for Reproductive Medicine, which issues standards regarding the use of *in vitro* fertilization.⁵⁶ Compared to European countries, the U.S. is viewed as a highly permissive country toward ART.⁵⁷ John A. Robertson, Professor at University of Texas Law School and Chair of the Ethics Committee of the American Society for Reproductive Medicine, when comparing the German and U.S. approaches to reproductive technology, notes “the reception of ARTs in the United States cannot be adequately understood without an appreciation of the country’s long tradition of individual liberty, free market and free enterprise orientation, and grants of wide autonomy to physicians and other professionals.”⁵⁸ Thus, American social values, as influenced by economic principles, more easily accept unregulated reproductive technologies and generally place more trust in the medical profession. In fact, in 2012, over 1% of all infants born in the U.S. were conceived through the use of assisted reproductive technologies.⁵⁹

Surrogacy is also a form of ART. Laws surrounding surrogacy agreements vary greatly from state to state. Some states, for instance, issued statutes that declare surrogacy contracts void and unenforceable (e.g., Louisiana), or even penalize parties to a surrogate contract (e.g., New York), while others distinguish between paid and unpaid surrogacy (e.g., Washington). Some states allow but regulate surrogacy (e.g., Florida) and some states are simply silent on the matter (e.g., Colorado).⁶⁰ Today, the U.S. (together with Canada) is the favorite destination of French couples seeking surrogacy.⁶¹ These discrepancies in law, theory, social values, and practice, both in the United States and France, illustrate the need for

asrm.org/uploadedFiles/Content/About_Us/Media_and_Public_Affairs/OversiteOfART%20%282%29.pdf.

55. AM. SOC’Y OF REPROD. MED., *supra* note 54, at 5. Although it must be noted that some states issued specific regulations regarding reproductive technology. *See infra* Part I.C. on surrogacy agreements.

56. AM. SOC’Y OF REPROD. MED., *supra* note 54, at 5.

57. Robertson, *Reproductive Technology*, *supra* note 44, at 191.

58. *Id.*

59. U.S. DEPT. OF HEALTH AND HUMAN SERV., CTR. FOR DISEASE CONTROL AND PREVENTION, ART SUCCESS RATES (Aug. 2015), *available at* <http://www.cdc.gov/art/pdf/2013-report/art-2013-fertility-clinic-report.pdf>.

60. *Surrogacy laws in the United States*, MILWAUKEE-WISCONSIN JOURNAL SENTINEL (Aug. 4, 2012), <http://www.jsonline.com/news/health/163772546.html>; Guide to State Surrogacy Laws, CTR. FOR AMERICAN PROGRESS (Dec. 17, 2007), <https://www.americanprogress.org/issues/women/news/2007/12/17/3758/guide-to-state-surrogacy-laws/>.

61. Estelle Saget, *Gestation pour autrui: la filiere americaine*, L’EXPRESS (Oct. 3, 2014, 11:01 AM), http://www.lexpress.fr/actualite/societe/famille/gestation-pour-autrui-la-filiere-americaine_1603640.html.

establishing uniform regulations before, or if ever, ectogenesis is a widely used practice.

II. REDETERMINING THE STATUS OF EMBRYOS

A. RENEWAL OF THE ABORTION DEBATE

Scholars initially limited their considerations of the potential legal implications of artificial wombs to the consequences on the topical subject of the abortion debate. The possibility for the embryo to survive outside the woman's body—although relying on another kind of “host,” the ectogenetic incubator—implies profound changes, especially in the U.S., in the way abortion is regulated. The American standards for abortion were set by the landmark decision *Roe v. Wade*, wherein the U.S. Supreme Court (“Supreme Court”) recognized the constitutional right to have an abortion.⁶² *Roe*, and the subsequent case *Planned Parenthood v. Casey*,⁶³ established two main principles: the right to abortion as an extension of the woman's right to privacy,⁶⁴ and the viability standard.⁶⁵ Both principles are threatened by the introduction of artificial wombs in several respects.

First, the principle of viability means that a state has a legitimate interest in preventing a woman from terminating her pregnancy once the embryo is deemed viable.⁶⁶ For the Supreme Court, the line of viability must be drawn at “the time at which there is a realistic possibility of maintaining and nourishing a life outside the womb.”⁶⁷ It must be noted that an increasing number of studies suggest that a fetus is deemed viable after only twenty-two weeks of gestation.⁶⁸ Also notable is that judges have long acknowledged that the viability standard largely depends on the medical advances existing at the time of the litigation in question.⁶⁹ Certainly, none of the Justices at the time of the *Roe* and *Casey* decisions were imagining of the genuine possibility of the

62. More specifically, the U.S. Supreme Court held that the Texas criminal abortion statute violated the Due Process Clause of the Fourteenth Amendment, and that the abortion decision, at least during the first semester of pregnancy, belonged to the pregnant woman and her attending physician. *Roe v. Wade*, 410 U.S. 113, 164 (1973) (“For the stage prior to approximately the end of the first trimester, the abortion decision and its effectuation must be left to the medical judgment of the pregnant woman's attending physician.”).

63. *Planned Parenthood v. Casey*, 505 U.S. 833 (1992).

64. *Id.* at 871 (“The woman's right to terminate her pregnancy before viability is the most central principle of *Roe v. Wade*. It is a rule of law and a component of liberty we cannot renounce.”).

65. *Id.* at 870 (“We conclude the line should be drawn at viability, so that before that time the woman has a right to choose to terminate her pregnancy.”).

66. See e.g., Hyun Jee Son, *Artificial Wombs, Frozen Embryos, and Abortion: Reconciling Viability's Doctrinal Ambiguity*, 14 UCLA WOMEN'S L.J. 213 (2005).

67. *Casey*, 505 U.S. at 870.

68. See e.g., Marlow, *supra* note 24, at 1856–1857.

69. See e.g., *City of Akron v. Akron Ctr. For Reprod. Health, Inc.*, 462 U.S. 416, 458 (1983) (O'Connor, J., dissenting) (“As medical science becomes better able to provide for the separate existence of the fetus, the point of viability is moved further back toward conception.”).

creation of ectogenetic incubators. Yet, as Sacha Zimmerman noted, such technology will render fetuses technically *viable*⁷⁰ as soon as they are conceived,⁷¹ since they can potentially be removed from the woman's womb and be successfully maintained alive in an ectogenetic incubator.⁷² Conception, on the other hand, is widely understood as the moment from successful fertilization of the egg.⁷³ Therefore, a woman's right to an abortion could potentially be challenged by the State at any point of the pregnancy because viability would be determined as the moment of conception. Several scholars, however, temper this view and argue that it is very unlikely in practice.⁷⁴

The availability of artificial wombs would mark a decisive turning point in the right to abortion as an integral component of the woman's right to privacy. Tension exists as to whether the right to abortion is a right of evacuation ("the right not to be pregnant") or a right of termination ("the right not to procreate").⁷⁵ Until now, the distinction was purely theoretical as it was not possible to actually dissociate evacuation from termination of the embryo. However, the science of ectogenesis suggests that a fetus can be extracted from a woman's womb and be quickly re-implanted in an artificial womb, escaping the "death" of an abortion. If we consider that a woman only has a right of evacuation in the name of her bodily integrity, the only power she should have over her pregnancy is to decide whether or not she wishes to pursue it; the survival of the embryo, however, would fall outside of the scope of her decisional power.⁷⁶ As a consequence, the government could require the extraction of the fetus and his or her successful placement into an ectogenetic incubator, followed by a placement for adoption. These challenges to the principles at the core of the rationale of *Roe* and *Casey* led the most audacious commentators to claim that artificial wombs could well mark "the end of abortion."⁷⁷

The rise of artificial wombs also has the potential to equalize parental rights regarding decisions on the fate of the unborn child, as the gestation

70. The term "viable" is used here with the U.S. Supreme Court's own definition (i.e., capable of living outside the mother's womb). See *supra* note 67.

71. S. Zimmerman, *Fetal Position - The Real Threat to Roe v. Wade*, THE NEW REP., (Aug. 18 2003), <http://www.newrepublic.com/article/fetal-position>.

72. This also requires great advances in fetal surgery allowing surgeons to remove a fetus from a natural womb and successfully re-implant it in an artificial one. ATLAN, *supra* note 7, at 44.

73. There is an ongoing debate on the meaning of the term "conception." In Australia, the Children's Court of Queensland issued a particularly interesting decision in which the meaning of "conception" is discussed. See *LWV & another v LMH* [2012] QChC 26 (Austl.).

74. Alghrani, *supra* note 12, at 199.

75. CHRISTOPHER KACZOR, THE ETHICS OF ABORTION, WOMEN'S RIGHTS, HUMAN LIFE, AND THE QUESTION OF JUSTICE 245 (2015); Alghrani, *supra* note 12, at 196.

76. KACZOR, *supra* note 75, at 256.

77. However the majority of the doctrine finds it unlikely, as such a coercive power between the hands of the government would violate the parents' right to privacy and rights to chose different medical procedures, among other things. See Alghrani, *supra* note 12, at 199.

would be carried by “a neutral agent.”⁷⁸ If the right of termination, as described earlier, survives, the woman will no longer be the ultimate decision-maker when it comes to abortion since her bodily integrity will not be at stake.⁷⁹ But what is an abortion in the ectogenetic world? Can a couple simply ask for the machine to be switched off once gestation has already started? Would the action of “switching off” the machine be subject to abortion laws? Would therapeutic claims for abortion be different, as the physiology of the fetus would be potentially observable throughout gestation? To answer these important questions, regulators must balance the parents’ rights with the ectogenetic embryo’s interests.

B. PROTECTION OF THE ECTOGENETIC EMBRYO

The road to (relatively)⁸⁰ autonomous fetal existence will lead the public decision-makers to reexamine a fundamental issue: legal status of the embryo.⁸¹ There are two main issues to be addressed in light of ectogenesis: First, against what types of harm should ectogenetic embryos be protected? Second, would the attribution of personhood be a satisfying legal response?

The law must protect ectogenetic embryos against physical harm without involving the woman’s bodily integrity since, by definition, the existence of the ectogenetic embryo is physically independent from the woman’s body. This is a particularly important issue under French law, where the physical harm done to the unborn child only gives rise to civil compensation or criminal sanctions in the name of the pregnant woman, although the subsequent birth of the live child may trigger retroactive legal effects.⁸² In the U.S., most states have fetal homicide laws, which define the fetus as a “person”⁸³ for the purpose of criminal proceedings involving harm done to a pregnant woman that resulted in the death of the fetus she was carrying.⁸⁴ Under both U.S. and French law, human embryos occupy an “interim category,” being considered as more than mere human tissue, but less than actual persons.⁸⁵ The arrival of artificial wombs reinforces that regulators must put an end to the *status quo*, whereby fetuses in

78. *Id.*

79. Schultz, *supra* note 13, at 883–84.

80. The fetus is not completely autonomous since it cannot exist entirely on its own; its survival and growth depends on a matrix that imitates the characteristics of a natural womb.

81. Alghrani, *supra* note 12, at 198

82. See e.g., *Statut de l’embryo et du foetus (Rapport de l’Universite de Droit Paris V)*, LE JOURNAL DES FEMMES, <http://sante-medecine.journaldesfemmes.com/contents/730-statut-de-l-embryon-et-du-foetus-universite-de-droit-paris-5#l-rsquo-incertitude-du-statut> (last visited Apr. 18, 2015)

83. For instance, the Criminal Code of Alabama defines a person as “a human being, including an unborn child in utero at any stage of development, regardless of viability.” ALA. CODE § 13A-6-1(3) (2006).

84. NAT’L CONF. OF STATE LEGISLATURES [NCSL], FETAL HOMICIDE LAWS (Mar. 2015), <http://www.ncsl.org/research/health/fetal-homicide-state-laws.aspx>.

85. Katheryn D. Katz, *The Legal Status of the Ex Uteri Embryo: Implications for Adoption Law*, 35 CAP. U. L. REV. 303, 309 (2006).

gestation belong to a legal grey zone.⁸⁶

In addition, embryos' protection must be reflected in a robust and consistent liabilities system.⁸⁷ For instance, who should be held responsible if there is a power outage affecting the incubators? And to what extent should they be responsible if the ectogenetic fetuses die as a result?⁸⁸ These considerations make a clear distinction between embryos growing in ectogenetic incubators to meet a parental project⁸⁹ and embryos subject to alteration for research purposes.⁹⁰ This will spur regulators to consider the possibility of scientific research on growing embryos as opposed to frozen embryos.⁹¹

Another issue is the destination of the ectogenetic fetus if the couple that initiated the gestation subsequently separate or is no longer willing to pursue its parental project. Ectogenesis would force the courts (and quite possibly the Legislature) to strictly regulate the right to terminate the gestation of the fetus growing in the ectogenetic incubator. Contrary to abortion of a fetus growing in the mother's womb, termination of an ectogenetic fetus gives rise to a situation in which both parents are *a priori* equals in the decision to terminate the gestation. Thus, some authors suggest drawing inspiration for the disposition of ectogenetic fetuses from existing law surrounding frozen embryos.⁹² Yet, contrary to frozen embryos, ectogenetic fetuses are already implanted, growing and engaged in the process of meeting a parental project (many frozen embryos will in fact never be implanted and a portion of them will be destroyed).

86. The vagueness surrounding the status of embryos is exacerbated by the use of confusing terms in the law, such as the inclusion of fetuses in the definition of "persons" in 38 State criminal law, which was turned into an argument by pro-life advocates. See NCSL, *supra* note 84.

87. Schultz developed interesting comments on the potential application of existing legal doctrines to the situation of artificial wombs. Schultz, *supra* note 13, at 894.

88. "Assume that the machine will always work, electricity will never fail, and technicians will never turn the wrong switch or go off on a coffee break at the critical moment." G. COREA, *THE MOTHER MACHINE: REPRODUCTIVE TECHNOLOGIES FROM ARTIFICIAL INSEMINATION TO ARTIFICIAL WOMBS* 254 (1979).

89. The term "parental project" is used in French law to distinguish between supernumerary embryos that will be later implanted to become a child (meeting therefore the parental project of the couple who initiated the conception of the embryo) and supernumerary embryos that will either be destroyed or donated for the purposes of research with the consent of the couple. CODE DE LA SANTE PUBLIQUE [C.S.P.] [code of public health], Art. L.2141-3 (Fr.).

90. Human embryo research is permitted both in France and in the U.S. under specific conditions. There is an interesting polemic against President Obama for allowing funding in 2009 to the National Institutes of Health on embryonic stem cell provided, notably, that the embryos subject to alteration were initially created for reproductive purposes and subsequently donated for research. *Doe v. Obama*, 670 F. Supp.2d 435, 438 (D. Md. 2009); Guidelines for Human Stem Cell Research, 74 F.R. § 32,170 (July 7, 2009) (to be codified at 42 C.F.R. § 46.201-207).

91. Should such experiments be allowed? If yes, how should they be framed and until which stage of development should a growing embryo be subject to destruction for scientific purposes? Legislatures will have to give a clear answer on these ethical, and likely highly controversial questions.

92. See e.g., *Davis v. Davis*, 842 S.W.2d 588 (Tenn. 1992).

Therefore, respect for fetal life in the early stages of gestation requires the law to limit the parents' potential arbitrary decisions regarding the fate of the ectogenetic fetus, considering in addition that the separation of the fetus from a human womb (either the natural mother or a surrogate) can potentially cause the parents to feel less involved, less attached, and therefore consider the "pregnancy" as "less real." In fact, before allowing for the use of artificial wombs, the regulators must determine from which point there should be "no going back"—namely, whether the couple's consent to pursue the gestation until birth is irrevocable once the embryo is successfully placed in the artificial womb.⁹³ The Legislature would need to consider when there may be exceptions to this irrevocable consent, such as for therapeutic or extreme familial situations.

C. CHANGES REQUIRED IN FRENCH AND U.S. LEGISLATION

The externalization of human gestation will shed a new light on the debates involving the beginning of human life and the attribution of personhood. Although applying the attribution of personhood to a fetus from conception is appealing, especially at a time when fetuses can potentially grow outside the woman's body,⁹⁴ it is not the most satisfying solution to ensure protection of ectogenetic fetuses.

The question of "the beginning of human life" is extremely complex and does not trigger a clear consensus.⁹⁵ According to the statement issued by the U.S. Congressional Report of 1981, which was supported by multiple medical, biological and scientific writings, the meeting of the human gametes creates a "being that is alive and is a member of the human species."⁹⁶ From a philosophical point of view, human embryos do not have the "conscious self-awareness" that characterize the human species; however, they bear in themselves the *potential* to become a rational being. The beginning of human life, therefore, could be essentially a matter of definition, *being* or *potential being*.⁹⁷ There are paramount practical consequences related to the attribution of personhood beyond the theoretical abstractions as to the beginning moment of human life. In particular, the law protects the right to life and the bodily integrity of every human being,⁹⁸ and provides them more generally with constitutional rights.⁹⁹ Therefore, attributing the personhood to embryos from the

93. Alghrani, *supra* note 12, at 203.

94. On that point, "[t]he Supreme Court has never ruled on the constitutional status of embryos *outside of the body* and most states have no law on the matter." John Robertson, *Embryo Stem Cell Research: Ten Years of Controversy*, 38 J.L. MED. & ETHICS 191, 193 (2010) (emphasis added).

95. *See supra* Part II.A.

96. S. COMM. ON SEPARATION OF POWERS, S. REP. NO. 97-158, at 7 (1981).

97. KACZOR, *supra* note 75, at 41.

98. CODE CIVIL [C. Civ.] [civil code], Art. 16 ("Legislation ensures the primacy of the person, prohibits any infringement of the latter's dignity, and guarantees respect for the human being from the outset of his life") (Fr.).

99. The Supreme Court "has ruled without a dissenting voice that fetuses are not persons within the meaning of the 14th Amendment, and *thus do not have constitutional rights as*

moment of conception would be very problematic for the sake of embryonic research, embryonic selection, or abortion. In addition, it would be absurd and extremely procedurally burdensome to consider each one of the thousand of frozen embryos stored in a fertility clinic's chamber as a person.¹⁰⁰

The grey area that surrounds the status of the embryos in both France and the U.S. leads to an unbearable legal uncertainty that will likely be exacerbated with the creation of artificial wombs. As highly publicized incidents involving fetuses in gestation or frozen embryos have made their way to the courtrooms or into the Legislature, forcing lawmakers to decide issues under intense social and political constraints, a patchwork of confusing and inconsistent standards has emerged.¹⁰¹ The current case-by-case approach is unsuitable because it does not take into account the situation of ectogenetic embryos, and should be replaced with the creation of a range of clear and innovative legal statuses specific to the embryos. These new statuses should be distinguished from the existing categories of "persons" and "things." Embryo status should be flexible enough to allow research and abortion/termination to a certain degree,¹⁰² while otherwise ensuring sufficient legal protection of the embryos. This legal protection should vary depending on different factors, justifying the creation of several statuses (or subcategories) rather than a single standard: one could, for instance, distinguish between "pre-implantation" embryos (fertilized eggs, frozen embryos) and "post-implantation" embryos (embryos successfully attached to a womb), which could be further separated between "intracorporeal" and "ectogenetic" embryos. This set of new legal statuses would better serve the purposes of the law because it takes into consideration the special place of embryos in the legal field rather than reducing them to an interim category,¹⁰³ and would be more suited to respond to the various and increasingly complex situations involving embryos and fetuses.

III. REDEFINING THE CONCEPT OF PARENTHOOD

A. COMPARISON BETWEEN THE USE OF ARTIFICIAL WOMBS AND SURROGACY

In Huxley's ectogenetic world, the concept of family is an archaic

such." One could wonder whether this reveals a "catch-22" situation, where the very reason the Court does not grant personhood to embryos is to prevent them from acquiring constitutional rights. Roberts, *Embryo Stem Cell Research*, *supra* note 94 (emphasis added).

100. Imagine, for instance, if frozen embryos had standing in court. The question was raised in *Doe v. Obama*, where the Court denied standing on the ground that it could not identify the embryo-plaintiff's particularized harm. *Doe v. Obama*, 670 F. Supp.2d at 160. Once again, the arrival of artificial wombs may reopen the debate due to the fact that ectogenetic embryos will be clearly identifiable once placed in the incubators.

101. Alghrani, *supra* note 12, at 200 (laws designed to protect embryos arose in the context of specific cases).

102. The right of abortion is limited in France and in the U.S., *see supra* Part II.B.

103. This creative legal status does not aim at imposing any scientific truth and therefore is a legal fiction.

notion, recalling a primitive model of society.¹⁰⁴ The emergence of reproductive technologies, however, actually has the potential to reinforce the family spirit.¹⁰⁵ An Australian surrogacy case decided in 2012 was introduced with these words: “[the child carried by the surrogate] is a long awaited and precious gift, much loved by his family and a miracle of modern medicine.”¹⁰⁶

In surrogacy, a surrogate, also called a gestational carrier, agrees to bear a child for a commissioning couple, also called the intended parents.¹⁰⁷ The child can be conceived using the gametes of the intended parents, donors’ gametes, or one parent’s gametes associated with one donor’s gametes, including the surrogate’s own egg, which would lead to “traditional surrogacy” as opposed to “gestational surrogacy.”¹⁰⁸ In gestational surrogacy, the surrogate is artificially implanted with an embryo conceived through *in vitro* fertilization.¹⁰⁹ For surrogacy pregnancies, an explicit agreement is signed between the parties involved in the process. Essentially, through such an agreement, the gestational carrier agrees to carry with all due diligence the intended parents’ child in exchange for compensation.¹¹⁰ The enforceability of surrogacy agreements, however, even where they are deemed legal, is subject to great controversy.¹¹¹

The similarities between ectogenetic incubators and existing surrogacy agreements justify the common application of some broad principles. First, ectogenetic incubators can be an alternative for surrogacy,¹¹² and as such, their use can give rise to the same parentage

104. HUXLEY, *supra* note 4.

105. For Chantal Collard, professor emeritus at Concordia, Montréal, who specialized in parentage, and Françoise Zonabend, an anthropologist who specialized in European societies, the rise of assisted reproductive technology did not destroy the notions of family and filiation. On the contrary, it gave birth to a new structure of the family where “the child ‘makes’ the parents.” CHANTAL COLLARD AND FRANÇOISE ZONABEND, *LA PARENTÉ* 89, 102 (2015).

106. *LWV & another v LMH* [2012] QChC 26 (Austl.).

107. SUSAN L. CROCKIN, *ESTABLISHING PARENTAGE IN GESTATIONAL CARRIER ARRANGEMENTS* § 3.1 (2nd ed. 2009).

108. *Id.* § 3.1- 3.2.

109. *Id.*

110. Two types of monetary compensation are generally distinguished: payment for medical, legal and psychological expenses reasonably incurred by the surrogacy itself versus extra payment to a surrogate and an agency thereby creating a “commercial surrogacy.” Certain States expressly prohibit commercial surrogacy due to its potentially exploitative nature. *See e.g.*, Katherine Drabiak, et al., *Ethics, Law and Commercial Surrogacy: A Call For Uniformity*, 35 J.L. MED. & ETHICS 301 (2007) (discussing how many companies are using the internet to circumvent state laws and exploit the lack of federal regulation of surrogacy).

111. In the U.S., laws regarding the enforceability of surrogacy agreements vary greatly from a state to another. *See supra* Part I.C. Other countries, such as the U.K., adopted innovative solutions, including where the surrogate must reconfirm after the birth that she wants to give up the child to the commissioning couple, regardless of the terms stipulated in the surrogacy agreement. *Surogacy Arrangements Act 1985*, c. 49, § 2 (Eng.).

112. Rosen, *supra* note 27, at 71.

consequences. When surrogacy is successful,¹¹³ neither the surrogate nor the eventual donors involved in the process have any parenting role toward the child. Instead, the intended parents are recognized as the child's legal parents.¹¹⁴ This recognition can occur through different legal means, which have developed over the time and could be used in the situation of artificial wombs, such as a pre-birth order.¹¹⁵

Second, the promise of artificial wombs could have considerable advantages over classic surrogacy. The use of ectogenetic incubators would suppress any concern regarding the gestational carrier's subsequent withdrawal of consent or willingness to pursue the pregnancy when the intended parents want it terminated.¹¹⁶ Additionally, the use of ectogenetic machines protects surrogacy mothers from psychological or economic exploitation by completely removing them from the equation.¹¹⁷

Despite its perceived advantages, the use of ectogenesis in lieu of surrogacy is not immune from constraints for the intended parents. Their decisions toward the ectogenetic child might, in this author's opinion, be monitored and contested in order to protect the fetus, even in the absence of a human surrogate. Interferences occur by operation of law, considerations of the medical team in charge of the artificial womb, or, more prosaically, the realities of the marketplace, specifically that artificial wombs potentially represent a lucrative business.¹¹⁸ Notwithstanding these constraints, the final agreement between the intended parents will not necessarily be enforceable in court, just like existing contracts determining the ownership of frozen embryos are sometimes held unenforceable for policy reasons.¹¹⁹

113. Here, "successful" means that the surrogacy process occurred peacefully, in a place where it is legal, and that the surrogate is willing to give up her legal rights on the child to the benefit of the intended parents even after the birth, etc.

114. See e.g., *Johnson v. Calvert*, 851 P.2d 776, 782 (Cal. 1993) (where the court held that the woman "who intended to procreate the child—that is, she who intended to bring about the birth of a child that she intended to raise as her own—is the natural mother under California law.").

115. Pre-birth orders present multiple advantages. See Crockin, *supra* note 107, at § 3.2.2.

116. Recent cases showed the complexity of such situations from both legal and ethical standpoints. See e.g., Aly Neel, *Surrogate mother refused abortion: right? Wrong? Damned to hell?*, THE WASH. POST (Mar. 6, 2013) <http://www.washingtonpost.com/blogs/she-the-people/wp/2013/03/06/surrogate-mother-refused-abortion-right-wrong-damned-to-hell/> (the surrogate who refuses the abortion of the unborn child who presents severe medical conditions, although it was stipulated in the agreement between her and the intended parents, could physically seek refuge in a State that does not recognize such agreements).

117. Rosen, *supra* note 27, at 71. As Roger B. Dworkin said, "[t]he same concerns about women—that surrogacy reifies them, that these arrangements take psychological or economic advantage of them—that whole range of concerns is gone when you talk about artificial wombs." *Id.*

118. Indeed, the presumably high costs associated with ectogenesis would in practice prevent many persons from using artificial wombs as they wish.

119. Schultz, *supra* note 13, at 889–90 (2010). Schultz draws a parallel between situations where the fate of frozen embryos is uncertain due to the separation of the couple that initiated the parental project or the death of one of them. She also compares cases with

B. NEW CONCEPTION OF MOTHERHOOD

Mater semper certa est. This Roman maxim translates as, “The mother is always certain” (as opposed to the father). Based on this maxim—although it is highly called into question now that *in vitro* fertilization is available¹²⁰—French law established its main principles regarding filiation. The arrival of artificial wombs will likely be the final stone burying French family law in the tomb of obsolescence.¹²¹

The Cour de Cassation formally recalled in 2011 that “the principle under French law is that the mother of the child is the one who gives birth.”¹²² This conception of maternity is consistent with the wording of the French Civil Code. Article 332 allows maternity to be contested “by proving that the mother did not give birth to the child.”¹²³ Also, under French law, biology (here referring to the process of pregnancy) trumps genetics regarding motherhood. Indeed, a woman might use an egg donor and be the legal mother of the child to whom she gave birth. However, the woman who seeks surrogacy will not be recognized as the legal mother of the child under French law, even if the child has been conceived with her own egg.¹²⁴ This approach is consistent with the refusal of the French administration to recognize the legal effects of surrogacy agreements concluded abroad.¹²⁵

The French approach to motherhood is questionable in several respects. First, it introduces an unequal treatment between women and men, for whom biology and genetics are naturally intertwined regarding procreation. A good illustration of this unequal treatment lies in the fact that the genetic father of a child conceived through surrogacy abroad must now be recognized as the child’s legal father in France following the mediated *Mennesson* case decided by the European Court of Human Rights in 2014,¹²⁶ whereas the intended mother seems barred from this possibility.¹²⁷

different outcomes regarding the enforceability of the ownership contracts. *Id.*

120. Since a woman can give birth to a child conceived thanks to an egg donation.

121. The arrival of artificial wombs will likely be the final stone burying all European family law. See Richard F. Storrow, *The Phantom Children of the Republic: International Surrogacy and the New Illegitimacy*, 20(3) J. OF GENDER, SOC’L POL’Y & THE L. 561, 594 (2012).

122. Cour de Cassation [Cass.] [supreme court for judicial matters], 1e civ., Apr. 6, 2011, Bull. civ. I, No. 72 (Fr.).

123. CODE CIVIL [C. Civ.] [civil code], Art. 332 (Fr.).

124. Since surrogacy is not recognized in France, without distinction based on the potential genetic relation. See *supra* I.B.

125. Cour de Cassation [Cass.] [supreme court for judicial matters], 1e civ., Dec. 17, 2008, Bull. civ. I, no. 289 (Fr.) (where the national court gave right to the French authorities that refused to enter the birth certificates resulting from a surrogacy agreement in the French register of births).

126. *Mennesson v. France*, App. No. 65192/11 Eur. Ct. H.R. 100-101 (2004), available at [http://hudoc.echr.coe.int/eng?i=001-145389#{"itemid":\["001-145389"\]}](http://hudoc.echr.coe.int/eng?i=001-145389#{); European Court of Human Rights Press Release 185, Totally prohibiting the establishment of a relationship between a father and his biological children born following surrogacy arrangements abroad was in breach of the Convention 4 (June 26, 2014) (“In thus preventing the recognition and establishment of the children’s legal relationship with their biological father, the French State had overstepped the permissible margin of appreciation”). One must note that it is

This inequality will likely be exacerbated with the use of artificial wombs: It might be far easier for the biological father to be recognized as the legal parent of the ectogenetic child than the non-gestational mother, although the child may also carry her genes. Second, the availability of artificial wombs will create a novel legal dilemma, as the child whose gestation would have entirely occurred in an incubator will be technically born to a "machine." The current state of French law implies an absurd situation where the only potential "natural" mother of the child is not a human being.

C. CHANGES REQUIRED IN U.S. AND FRENCH LEGISLATION

Some philosophers have argued that artificial wombs will mark a new era in women's social liberation¹²⁸ by "freeing . . . women from the tyranny of their reproductive biology."¹²⁹ From a parenting perspective however, artificial wombs could well represent a new burden, especially for women. In light of the two problematic situations previously described,¹³⁰ the French Legislature is called to review the core concept of motherhood in the perspective of artificial wombs, while the U.S. Legislature is called to further the change it already initiated under the influence of surrogacy agreements.

One potential answer would be to consider the ectogenetic incubator as the extension of the intended mother's uterus. However, this is a legal fiction because there is no physical connection between the mother's uterus and the artificial womb, and will therefore be subject to many theoretical and practical problems. Considering the ectogenetic incubator only as the "extension" of a woman's (functional or dysfunctional) uterus is denying males, who by nature do not have a uterus, the right to use the machine to satisfy their wish to have a child on their own.¹³¹ Another imperfect

unclear what the solution should be if the child was conceived through sperm-donation.

127. In the cases previously mentioned, the European Human Rights Court ("ECHR") condemned France regarding the filiation with the biological fathers only. *See supra* note 123. Therefore, it appears French authorities are free to continue denying the intended mother the same right of filiation, even though the child in question might be her genetic child (if she provided her egg for the IVF). Once again, this inequity could be justified by the natural differences between female and male reproduction. *See* the biology/genetics discussion *supra* in Part III.B. However, it is unclear what the ECHR means by "biological parentage," which is viewed as a necessary component of each individual's identity justifying the condemnation of France. Press release, *supra* note 126, at 4. Is a genetic but non-gestational mother a biological mother for the Court? This raises the urgent need for a new definition of parentage. *See infra* Part III.C.

128. *See e.g.*, PETER SINGER & DEANE WELLS, ECTOGENESIS: ARTIFICIAL WOMB TECHNOLOGY AND THE FUTURE OF HUMAN REPRODUCTION 21 (2006) ("[W]e think women will be helped, rather than harmed, by the development of a technology that makes it possible for them to have children without being pregnant.").

129. SHULAMITH FRESTONE, THE DIALECTIC OF SEX (1970).

130. *See supra* Part III.B.

131. Artificial wombs could be the opportunity for male gay couples, or single men (although in France, assisted reproductive technologies are only opened to couples), to further reduce the presence of a woman in the equation of reproduction; the only female "contribution" would be the egg donation (until science finds they way to artificially create

solution would be to offer intended parents to adopt their ectogenetic child upon his or her birth. This solution is imperfect because adoption is a burdensome process both in France and in the U.S. and it is absurd for a couple, who provided its genetic materials and initiated the conception of the child, to adopt him/her upon his/her birth. A more suitable solution would be to broaden the existing definition of parents and found the use of the artificial womb on the preexisting model of surrogacy agreements. The U.S. Citizenship and Immigration Services issued a policy alert on October 28, 2014 formally stating that a “natural mother” or a “natural father” is a genetic parent or gestational parent.¹³² Ideally, regulations should supplement these efforts and recognize “intended” parents (as opposed to purely “genetic” or “gestational” parents) as potential legal parents. The recognition of “intended” parents as legal parents would reflect the change in the social conception of parenthood brought about by assisted reproduction.¹³³

The formal creation of the legal category of “intended parents” will require the implementation of robust safeguards against potential fraud. The definition of “intention” must be broad enough to answer the needs of the intended parents of an ectogenetic baby regardless of their genetic connections with the child.¹³⁴ On the other hand, it should be strict enough to prevent unscrupulous individuals from claiming a parentage right on any ectogenetic child. The development of “pre-birth orders”¹³⁵ could help secure the parent-child relationship and discourage potential fraud or child trafficking. Such an order should be subject to stringent conditions in order to protect the ectogenetic child, and the administrative process may benefit in borrowing concepts and procedures from both acknowledgment and adoption.¹³⁶

an egg from the genetic material contained in a sperm).

132. U.S. CITIZEN AND IMMIGRATION SERVICES, POLICY ALERT PA-2014-009 (Oct. 28, 2014), <http://www.uscis.gov/policymanual/Updates/20141028-ART.pdf>. The use of this definition, while there are many under the law in the U.S., is interesting because it acknowledges the separation between genetics and gestation.

133. See e.g., COLLARD AND ZONABEND, *supra* note 105, at 6.

134. This is important because intended parents may have used donors’ gametes to conceive.

135. Previously mentioned regarding surrogacy in the U.S. See *supra* Part III.A and CROCKIN, *supra* note 107, at § 3.1.

136. In France, acknowledgment of paternity and acknowledgment of maternity are opened to the members of an unmarried couple before the birth of the child. CODE CIVIL [C. CIV.] [Civil Code], Art. 316 (Fr.). However, such filiation can be later contested by proving that they are not the “natural” parents of the child. CODE CIVIL [C. CIV.] [Civil Code], Art. 333-335 (Fr.). The mechanism of adoption both in France and in the U.S. allows restricting the people eligible to establish an adoptive filiation. Although it is not developed in this article, one could imagine a similar—but lighter—procedure, where a committee would decide whether a couple or a person should access the artificial womb. I suggest that the administrative process borrow concepts from *both* acknowledgement and adoption law in order to settle on a middle ground that is more restrictive but more protective of the parents than simple acknowledgement, but less restrictive than adoption.

IV. REGULATING THE ACCESS TO THE TECHNOLOGY

A. RISE OF CONFLICTING RIGHTS AND ETHICAL FEARS

The difficulty with regulating access to ectogenetic technology lies in the interaction of conflicting rights¹³⁷ and fears for uncertain ethical potential. The role of public decision-makers is particularly tricky and requires rational consideration of various elements to strike a fair balance. This article works on the assumption that hard law¹³⁸ is the best tool to regulate access to artificial wombs; however, such regulation may also occur through medical deontology, private markets, or economic incentives.

U.S. and the French regulators must determine who is likely to use this new generation of reproductive technology. Three main ranges of potential users will be distinguished for the purpose of this article. The first category of potential users is women affected by medical conditions so serious that they render the possibility of pregnancy highly unlikely, impossible, or potentially life-threatening.¹³⁹ The second category of potential users is single men and homosexual male couples. Currently, gay male couples' parenting options are limited to (if not prohibited in their country of residency) adoption and surrogacy with a donor's egg.¹⁴⁰ Artificial wombs represent for these couples a valuable mechanical substitute for a female womb.¹⁴¹ The third category of potential users is women who do not wish to be pregnant for purely personal and/or professional reasons. Personal reasons range from personal comfort to consideration of the constraints traditionally associated with pregnancy and post-pregnancy (pain of delivery, weight gain, stretch marks, etc.).¹⁴² Also, pregnancy might prevent some women from working full time, or cause them to take an extended amount of time off of their career. For some women, multiple

137. That is to say mainly the rights of the fetus and the rights of each of the intended parents.

138. The delimitation of hard law/soft law is commonly used when dealing with international law. Hard law is defined as creating a legally binding obligation, as opposed to soft law, which are quasi-legal policies. See e.g., Andrew Guzman and Timothy Meyer, *International Soft Law*, 2 J. LEGAL ANALYSIS 171, 172 (2010).

139. For example, a woman who underwent a hysterectomy due to uterine cancer or women who suffered multiple miscarriages due to problems at the stage of embryo implantation or women inclined to develop pre-eclampsia at some stage of their pregnancy. Rosen, *supra* note 27, at 71. See also Alghrani, *supra* note 12, at 204 (Amel Alghrani also refers to diseases such as pre-eclampsia, gestational diabetes and HLLP syndrome).

140. In France, gay couples have only been able to adopt a child since 2013; surrogacy for gay couples, however, is still prohibited. Loi no. 2013-404 du 17 mai 2013 ouvrant le mariage aux couples de personnes de même sexe [Law 2013-404 of May 17, 2013 for the purpose of opening marriage to same-sex couples], JOURNAL OFFICIEL DE LA RÉPUBLIQUE FRANÇAISE [J.O.] [OFFICIAL GAZETTE OF FRANCE], May 18, 2013, p. 8253.

141. Rifkin, *supra* note 30.

142. See also, J. S. Lyons, *Artificial Wombs could take Pregnancy into Laboratory*, MERCURY NEWS 63 (Feb. 23, 2002), available at 2002 WL 14807658 (“Do we want a society where if someone doesn’t want to have stretch marks or weight gain, we use the technology?”).

pregnancies could be a serious threat to their careers.¹⁴³

Ectogenetic regulations must balance government policy directives as well as the individuals' interests it seeks to protect. Some scholars have commented that the financial cost of using artificial wombs may be a powerful barrier to access for most of the population.¹⁴⁴ This raises the question of whether it would be fair to allow only the richest individuals to access this gestational technology, while the rest of the population will be unable to afford it without further financial aid. One way to combat this financial inequity would be to compel healthcare insurances to cover the costs generated by the use of artificial wombs.¹⁴⁵

Legislatures must also examine the potential ethical implications of the use of, and access to, artificial wombs. A main controversy lies in the extent to which the welfare of the child should justify, or on the contrary deny, public access to artificial wombs. Ectogenetic incubators may be a safer and healthier environment, as opposed to a human womb, for embryos, thereby justifying public use and regulation of such incubators.¹⁴⁶ This argument, however, reveals a terrifying possibility: imagine a child whose condition has been seriously altered by his mother's conduct during pregnancy, and, facing criminal charges, the prosecutor claims infringement upon the fetus' right to gestation in a safe environment. Could the court enjoin the mother to place the fetus in an incubator in the name of the best interest of the child? Would the welfare of the fetus in this situation justify the use of an ectogenetic incubator? Various ethicists express concerns about the externalization of pregnancy, a crucial process for the unborn child,¹⁴⁷ and the mother-child relationship.¹⁴⁸ The negative consequences, if any, of artificial gestation on the psychological and physical state of the ectogenetic child, as compared to a naturally gestated child, are currently unknown.¹⁴⁹ Would the welfare of the infant in this case justify denial of public access to ectogenetic incubators?

143. On this point, see the offer of Facebook and Apple to finance egg-freezing for their employees. Salam, *supra* note 10.

144. N. Unno, *Development of an Artificial Placenta*, in EXT SEX: ARS ELECTRONICA 2000 69-70 (G. Stocker & C. Shopf eds., 2000) (cited in L. Aristarkhova, *Ectogenesis and Mother as Machine*, 11(3) BDOY & SOC'Y 43, 46 (2005)).

145. As previously mentioned, the French social security system covers the cost of IVF. LE COÛT D'UNE FIV, *supra* note 41. However, insurance coverage for assisted reproductive technology treatments remains rare in the United States. AMERICAN SOC'Y REPROD. MED., OVERSIGHT OF ASSISTED REPRODUCTION TECHNOLOGY (2010), https://www.asrm.org/uploadedFiles/Content/About_Us/Media_and_Public_Affairs/OversiteOfART%20%282%29.pdf.

146. Christine Rosen writes that embryos in artificial wombs are not threatened by the consumption of alcohol and illegal drugs. Rosen, *supra* note 27, at 72. She also draws an interesting parallel with the increasing use of genetic testing of unborn fetuses. *Id.*

147. Alghrani, *supra* note 12, at 206 ("because the technology is still in its early stages, it is impossible to accurately predict the outcome it may have on the children involved in the process.").

148. Rifkin, *supra* note 30.

149. Alghrani, *supra* note 12, at 206.

Another persistent concern is the fear to fall into a “manufacture of children” type of society.¹⁵⁰ Rare but concerning stories already occurred through the repeated use of surrogacy.¹⁵¹ Also, Henri Atlan underlines that artificial wombs will likely be associated with other controversial issues, such as human cloning and baby designing through genetic selection, rendered more easily accessible by the arrival of the ectogenetic incubators.¹⁵² Unregulated access to artificial wombs could be an open door to the industrialization of human procreation. To which extent should these “slippery slope” arguments be taken into consideration by the public decision-makers?

B. COMPARISON WITH ACCESS TO IN VITRO FERTILIZATION

A useful parallel can be drawn with the regulations of *in vitro* fertilization. IVF is now widely accepted across the world and more than five million babies have been successfully conceived through this technique.¹⁵³ Yet IVF's early stages were fraught with controversy. About forty years ago, the conception of Louise Brown, the first “test-tube baby,” raised many criticisms.¹⁵⁴ Will the gains artificial wombs represent progressively outweigh their dangerous and unnatural aspect in public opinion? Will this process of acceptance by society and its reflection in the law through the regulation of access to the technology be even quicker now that we have previously absorbed the idea of technological assisted human conception?

Like IVF, ectogenetic technology has the potential to overcome a natural inequality between fertile couples and infertile couples. Unlike IVF, which focuses primarily on fertilization, ectogenetic technology focuses on *both* the gestation period and fertilization. It addresses an additional type of infertility: “gestational infertility,” or the inability to carry a pregnancy.¹⁵⁵ We perceive gestation as more substantial than

150. Gene Edward Veith, *In loco parentis*, 18(42) WORLD MAGAZINE (2003), http://www.worldmag.com/2003/11/in_loco_parentis.

151. In August 2014, Interpol launched an investigation into an alleged “baby factory” as a Japanese businessman fathered 16 surrogate children. Kevin Rawlinson, *Interpol investigates ‘baby factory’ as man fathers 16 surrogate children*, THE GUARDIAN (Aug. 23, 2014, 8:49 AM), <http://www.theguardian.com/lifeandstyle/2014/aug/23/interpol-japanese-baby-factory-man-fathered-16-children>.

152. ATLAN, *supra* note 7, at 87–88.

153. Kate Brian, *The amazing story of IVF: 35 years and five million babies later*, THE GUARDIAN (July 12, 2013, 12:34 PM), <http://www.theguardian.com/society/2013/jul/12/story-ivf-five-million-babies>.

154. Louise Brown's birth was subject to important media coverage and generated strong opposition against assisted reproduction among religious leaders and private citizens, some calling her a “Frankenbaby” and sending her parents menacing mails. Victoria Ward, *Louise Brown, the first IVF baby, reveals family was bombarded with hate mail*, THE TELEGRAPH (July 24, 2015, 9:55 AM), <http://www.telegraph.co.uk/news/health/11760004/Louise-Brown-the-first-IVF-baby-reveals-family-was-bombarded-with-hate-mail.html>.

155. “Gestational infertility” is my own term. The WHO, for instance, adopted another classification of infertility that does not distinguish between the inability to become pregnant and the inability to carry the pregnancy. *WHO issues statements on use of reversible hormonal contraception* WORLD HEALTH ORG. (Oct. 21, 2015), <http://www.who.int/reproductivehealth>.

fertilization and it is widely recognized among prenatal specialists that an important bond is created between the woman and the child growing month after month in her womb.¹⁵⁶ What is unclear, however, is whether the environment surrounding fertilization and the first cell divisions really affect the development of the fetus. Social theorist Jeremy Rifkin notes that, “[w]e know that young infants deprived of human touch and bodily contact often are unable to develop the full range of human emotions and sometimes die soon after birth or become violent, sociopathic or withdrawn later in life.”¹⁵⁷ He pursues questioning the effects of growing a child in a “plastic box” on his emotional and social development: “What kind of child will we produce from a liquid medium inside a plastic box? How will gestation in a chamber affect the child’s motor functions and emotional and cognitive development?”¹⁵⁸

Nevertheless, it is superficial to perceive IVF technology as solely the union of sperm and egg in a laboratory. In practice, IVF technology implies further polemical elements such as the freeze, the destruction and the potential for genetic testing of human embryos.¹⁵⁹ Also, techniques closely associated with IVF are foundational to the Legislature’s ability to frame access to the technology. Bearing that in mind, the gap between artificial wombs and the current generation of assisted reproductive technology—regarding both their morality and potential negative consequences for the unborn child—is smaller than one might expect. As a result, access to artificial wombs should not differ greatly from access to IVF; the main difference, potentially, being the type of infertility they each intend to treat.¹⁶⁰

In France, access to IVF is clearly circumscribed both in terms of who can access it and for which purposes: only heterosexual couples, whose members are both alive and in the reproductive age, can seek medical assistance for reproduction.¹⁶¹ Besides, assisted reproductive technology is designed solely, in the eyes of the French Legislature, to remedy a medically diagnosed pathological infertility or to avoid transmitting to the unborn child or the other member of the couple a very serious disease.¹⁶² This means that mere difficulty in conceiving a child or early menopause does not grant a couple with automatic access to IVF. In the U.S., assisted

156. As a result, many experts advise prospective mothers to bond with their babies before birth, arguing that it is an important part of their emotional and social development. See e.g., Carol Sorgen, *Bonding with baby before birth*, WEBMD, <http://www.webmd.com/baby/features/bonding-with-baby-before-birth> (last visited April 4, 2015).

157. Rifkin, *supra* note 30.

158. *Id.*

159. See e.g., Lyria Bennett Moses, *Understanding Legal Responses to Technological Change: The Example of In Vitro Fertilization*, 6 MINN. J.L. SCI. & TECH. 508 (2005).

160. At least in France where assisted reproductive technologies can only be used to cure a couple’s infertility. See *supra* Part I.B.

161. CODE DE LA SANTÉ PUBLIQUE [C.S.P.] [code of public health], Art. L.2141-2 (Fr.).

162. *Id.* “Le caractère pathologique de l’infertilité doit être médicalement diagnostiqué” (“The pathological character of infertility must be medically diagnosed”). *Id.*

reproduction is much less regulated.¹⁶³ The private market (doctors, healthcare facilities) manages the service, using its own discretion to grant or not the requests of its patients, but is still subject to the general rules of torts and contracts.¹⁶⁴

C. IMPLEMENTING REASONABLE LIMITATIONS?

Haldane imagined that France would be “the first country to adopt ectogenesis officially, and by 1968 [would be] producing 60,000 children annually by this method,” however, “in most countries the opposition [would be] far stronger.”¹⁶⁵ In reality, France will likely be more reluctant than the U.S. to broaden access to ectogenetic technology, assuming that such technology is allowed in the first place. In fact, it is possible the U.S. will not issue particular legislation designed to restrict the use of artificial wombs.¹⁶⁶ But should the unregulated use of artificial wombs raise more concerns than the unframed use of IVF? Can we rely solely upon medical professionals to make the “right” choices when important public policy issues are at stake? Both the French and the U.S. regulators should intervene to frame the access to artificial wombs, however the legal interventions should differ in several respects due to opposing legislative cultures and views of reproductive technologies.

In France, artificial wombs will likely fall within the existing provisions of Title IV of the Code of Public Health, which regulates assisted reproductive technologies in general, unless artificial wombs are considered as a technology so invasive that it would represent more than a mere “assistance” to human reproduction.¹⁶⁷ As with IVF, access to artificial wombs would therefore be limited to pathologically infertile couples.¹⁶⁸ The mere fact that a man is naturally deprived of a uterus does not make him “infertile” under French law,¹⁶⁹ although by the time artificial wombs become available, French law may be revised due to intern and international pressures.¹⁷⁰ This article recommends the French

163. See e.g., Kirsten Riggan, *Regulation (or lack thereof) of assisted reproductive technologies in the U.S. and abroad* (Mar. 4, 2011), <https://cbhd.org/content/regulation-or-lack-thereof-assisted-reproductive-technologies-us-and-abroad> (many commentators in fact noticed that the U.S. implemented particularly few regulations compared to the other developed countries).

164. Robertson, *Embryo Stem Cell Research*, *supra* note 94, at 203.

165. HALDANE, *supra* note 11, at 17.

166. See *supra* Part IV.B.

167. CODE DE LA SANTÉ PUBLIQUE [C.S.P.] [Code of Public Health], Title IV (“Assistance médicale à la procréation”) (“Medical Reproductive Assistance”) (Fr.).

168. *Id.* Art. L.2141-2.

169. As a reminder, although same-sex couples have had the right to marry since 2013, they are not entitled to access IVF under French law at this time.

170. The ECHR leaves a broad margin of appreciation to the Member States when it comes to reproductive technologies; however the combination of Article 8 (right to privacy) and Article 14 (antidiscrimination provision) could legitimate the Court’s intervention to ensure equal treatment of homosexual and heterosexual couples. See European Court of Human Rights Press Release 185, Totally prohibiting the establishment of a relationship between a father and his biological children born following surrogacy arrangements abroad was in breach of the Convention 3 (June 26, 2014).

Legislature broaden the definition of “infertility” so as to encompass the physiological infertility of same-sex (male) couples and enable them to access IVF and artificial wombs for the purpose of their parental projects, if the use of artificial wombs were to be legalized.¹⁷¹

In the U.S., the prospective arrival of ectogenetic technology on the market makes federal regulation necessary in order to ensure a uniform application of use. Indeed, risks are attached to the use of such technology, such as the potential to “manufacture” children, potential risks for the ectogenetic infants, profound inequity between wealthy and poor couples,¹⁷² underline the need for legal safeguards regarding the access to the artificial wombs beyond the existing regulations of reproductive technologies.¹⁷³ Indeed, artificial wombs will likely raise deeper concerns than the current use of IVF and surrogacy.¹⁷⁴

VI. CONCLUSION

“[I]t is irresponsible to wait until the first child is born of ectogenesis before discussing how the law will, or should, treat that new form of assisted, and collaborative, reproduction.”¹⁷⁵ The French and the U.S. legislatures must ratify new laws, in light of the prospective availability of artificial wombs, with regards to the status of embryos, the concept of parenthood, and the access to new reproductive technologies. Ectogenetic technology is advancing rapidly, but federal legislation is notoriously slow. French and U.S. legislatures must begin contemplating the most effective ways to address the above concerns if we are to propose regulations for such advanced reproductive technology.

171. Another interesting point will be whether the risk to transmit AIDS to the child at the moment of delivery could legitimize a woman’s access to artificial wombs. Also, an important question to be considered is whether the French social security system should cover the costs of the use of artificial wombs (including limits and extents of certain factors, such as the number of attempts that would be covered under the system).

172. *See supra* Part IV.A.

173. The American Society Reproductive Medicine already acknowledged that it would be desirable to reinforce the legal arsenal regarding the use of ARTs in addition to their own practice guidelines. AM. SOC’Y OF REPROD, *supra* note 54, at 11.

174. Rosen, *supra* note 27, at 72 (“In the end, artificial wombs are different from current technologies like IVF and modern arrangements like surrogacy, because they represent the final severing of reproduction from the human body.”). It remains to be discussed under which legal theory the federal government should be allowed to intervene in this area and to which extent it can limit the decisions of the medical teams to operate artificial wombs.

175. *See generally*, MICHELLE HIBBERT, ARTIFICIAL WOMB TECHNOLOGY AND THE CONSTITUTIONAL GUARANTEES OF REPRODUCTIVE FREEDOM (2004).

