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NOT OF WOMAN BORN:* A SCIENTIFIC FANTASY

Jennifer S. Hendricks[†]

ABSTRACT

This Article explores the legal implications of a scientific fantasy: building artificial wombs that could gestate a human child from conception to birth. Because claims about the technological possibility of artificial wombs in the foreseeable future are likely overstated, the focus of the Article is the effect that the fantasy of artificial gestation has on the legal discourse about pregnancy and reproduction today.

* The title refers both to the riddle at the heart of *Macbeth* and to Adrienne Rich's classic distinction between the institution of motherhood as a form of social control and the practice of mothering as individual expression and empowerment. See WILLIAM SHAKESPEARE, *MACBETH* act 4, sc. 1 (Macbeth cannot be killed by any man "of woman born"); *id.* at act 5, sc. 7 (Macduff revealing that he was "from his mother's womb / Untimely ripp'd"); ADRIENNE RICH, *OF WOMAN BORN: MOTHERHOOD AS EXPERIENCE AND INSTITUTION* 13 (1976) (distinguishing between "the *potential relationship* of any woman to her powers of reproduction and to children" and "the *institution*, which aims at ensuring that that potential . . . shall remain under male control") (emphasis in the original); see also Andrea O'Reilly, *introduction* to *FROM MOTHERHOOD TO MOTHERING: THE LEGACY OF ADRIENNE RICH'S OF WOMAN BORN* 2 (2004) ("The oppressive and the empowering dimensions of maternity, as well as the complex relationship between the two, first identified by Rich in *Of Woman Born* have been the focus of feminist research on motherhood over the last two and a half decades.").

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The Article first places the fantasy of artificial gestation in the context of theories about reproduction that western science has propounded. The history of scientific theorizing about reproduction is a history of scientists emphasizing the male contribution and minimizing the degree to which men are dependent on women for the creation of their offspring. Feminist scientists and philosophers of science have demonstrated how this sex-based ideology has skewed and hampered scientific efforts to understand the biology of reproduction. Despite the progress that has been made, scientific pronouncements about the prospects for building artificial wombs continue to reflect the biases that have historically plagued reproductive science, making it likely that those prospects are systematically overstated.

The Article then turns to how the prospect of artificial gestation affects legal discourse about reproduction. For example, legal scholars increasingly cite the prospect of artificial wombs as a solution to the controversy over abortion, since the fetus could survive without requiring the pregnant woman to sustain it. Pregnant women seeking abortions could instead be required to choose between continuing the pregnancy or undergoing an extraction procedure in which the embryo or fetus would be transferred to an artificial womb. This predicted “solution” informs legal analysis of the scope of reproductive rights today by constructing the woman and the fetus as separate individuals with opposing interests. Similarly, comparisons between mechanical and human gestators shape legal rhetoric about commercial surrogacy and the legal control of pregnant women.

Feminist legal theory has demonstrated that the idealized autonomous individual is a myth; the fantasy of artificial gestation is a psychic representation of that myth. This myth both reflects and contributes to an ideology that minimizes the importance of the human connection of pregnancy.

“A theory about the stars never becomes a part of the being of the stars. A theory about man enters his consciousness, determines his self-understanding, and modifies his very existence.”¹

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INTRODUCTION

This Article explores the legal implications of a scientific fantasy: the fantasy of building artificial wombs that could gestate a human child from conception until birth.² *Fantasy* refers not only to an

¹ ABRAHAM JOSHUA HESCHEL, WHO IS MAN? 8 (1965), *quoted in* Athena Beldecos et al., *The Importance of Feminist Critique for Contemporary Cell Biology*, HYPATIA, Spring 1988, at 61, 73.

² Choosing simplicity over precision, this article refers to the culmination of artificial gestation as “birth” rather than using some other term, such as “decanting.”

ambition, but also to the creation of “unrealistic or improbable mental images in response to psychological [or, in this case, ideological] need.”³ Skeptical of claims that artificial gestation will be possible in the near future, this Article focuses on the effect that the fantasy of artificial gestation has on legal and scientific discourse about pregnancy today.

Part I describes the current lay of the land with respect to artificial womb technology: its definition, potential uses, and stage of development. This Part also explains some of the reasons for skepticism about claims that artificial gestation is imminent.

Part II places the fantasy of artificial gestation in the context of theories of reproduction that have been propounded by western science. The history of scientific theorizing about reproduction is a history of scientists emphasizing the male contribution and minimizing the degree to which men are dependent on women for the creation of their offspring. In recent decades, feminist scientists and philosophers of science have demonstrated how sex-based ideology has skewed and hampered scientific efforts to understand the biology of reproduction. Nonetheless, scientific pronouncements about the prospects for artificial gestation continue to reflect the biases that have historically plagued reproductive science, making it likely that those prospects are systematically overstated.

Part III shows how belief in the prospect of artificial gestation shapes current legal discourse and practices regarding reproduction. For example, legal scholars increasingly cite the prospect of artificial wombs as a solution to the controversy over abortion, since the fetus could survive without requiring the pregnant woman to sustain it.⁴ Pregnant women seeking abortions could instead be required to choose between continuing the pregnancy or undergoing an extraction procedure in which the embryo or fetus would be transferred to an artificial womb. This predicted “solution” informs legal analysis of the scope of reproductive rights today by constructing the woman and the fetus as separate individuals with opposing interests. Similarly, comparisons between mechanical wombs and human gestators shape legal rhetoric about commercial surrogacy and the legal control of pregnant women.

The fantasy of artificial gestation is both an artifact and an implement of a particular ideology of reproduction. This fantasy posits the embryo and fetus as essentially separate from the pregnant woman. This model of reproduction makes artificial gestation appear

³ WEBSTER'S NEW COLLEGIATE DICTIONARY 449 (9th ed. 1988).

⁴ See *infra* Part III.A.1 (analyzing this legal scholarship).

possible. Belief in artificial gestation, in turn, reinforces the underlying ideology, undermining alternative models of reproduction and gestation. In brief, the fantasy of artificial wombs is a psychic representation of our cultural myth of individual autonomy;⁵ invoking the fantasy further entrenches the myth.

I. THE FANTASY OF ARTIFICIAL GESTATION

This Part introduces the scientific and bioethics literature that proposes the creation of artificial wombs. Part I.A discusses the meaning of the term “artificial womb,” focusing on the use of artificial wombs for *ectogenesis* (human reproduction that occurs entirely outside the body). Part I.B summarizes the benefits that proponents cite to justify the development of artificial womb technology. Part I.C describes the technical barriers to artificial gestation and argues that proponents tend to emphasize the challenges of providing basic fetal life support but gloss over the developmental challenges that ectogenesis would entail. This point provides the foundation for Part II, which shows that this imbalance in emphasis reflects long-standing gender bias that has frequently skewed reproductive science.

A. *What Is An “Artificial Womb”?*

If a child could be created from gametes, without ever growing inside a person, the device that accomplished this feat would be considered an artificial womb. Such freestanding gestation is the ultimate goal of a few scientists who have designed their research specifically to that end.⁶ The technology that might accomplish this goal comes from two more general lines of research. First, the technology of *in vitro* fertilization and other research on embryos has lengthened the period of time that a fertilized egg can be kept alive and developing in a laboratory. Second, medical science strives to save premature infants at increasingly early points of delivery. If these two lines of research eventually met somewhere in the middle, we would have artificial wombs capable of complete ectogenesis—the creation of a human child without any period of gestation in a woman’s body.⁷

⁵ See generally MARTHA ALBERTSON FINEMAN, *THE AUTONOMY MYTH: A THEORY OF DEPENDENCY* (2004) (discussing the need for a paradigm shift toward a caretaking society).

⁶ See *infra* Part I.C. (discussing the work of Drs. Kyoshinori Kuwabara and Hung-Ching Liu).

⁷ See Scott Gelfand, *Introduction* to *ECTOGENESIS: ARTIFICIAL WOMB TECHNOLOGY AND THE FUTURE OF HUMAN REPRODUCTION* 1, 2 (Scott Gelfand & John R. Shook, eds., 2006)

At least some proposed uses for artificial wombs are more akin to neonatal medicine. An embryo or fetus that began its development inside a woman might be transferred to the device at some point during pregnancy.⁸ That possibility raises the question: What are the features that would make such a device qualitatively different from current neonatal intensive care practices and thus warrant the designation “artificial womb”? The distinction might lie in the nature of the technology, the gestational age and moral status of the fetus, or the practical impact of the technology.

With regard to the nature of the technology, techniques for rescuing premature infants might look like “artificial wombs” if they more closely resembled natural gestation. Many current treatments for premature babies resemble ordinary life support, only on a smaller scale. These techniques, however, may be reaching their limits. In the decades since *Roe v. Wade*,⁹ the threshold of fetal viability has barely moved, although survival rates for infants past that point have greatly improved.¹⁰ Many scientists believe they are reaching the limit of current technological approaches for sustaining premature infants, due to the need for a minimum level of lung development before an

[hereinafter ECTOGENESIS] (discussing the convergence of these two lines of research as the most likely path to complete ectogenesis); STEPHEN COLEMAN, *THE ETHICS OF ARTIFICIAL UTERUSES: IMPLICATIONS FOR REPRODUCTION AND ABORTION* 5 (2004) (discussing “indirect research” into creating an artificial uterus related to “solving the problems of human infertility . . . and research aimed at improving the survival rates of premature births”).

⁸ Transfer from a pregnant woman to a machine might be desired for medical reasons or in lieu of abortion. Proposals to use artificial wombs as alternatives to abortion are discussed *infra* Parts I.B and III.A. Depending on how the technology develops, a mid-pregnancy transfer to a machine might be either more or less difficult than mechanical gestation for the full term.

⁹ 410 U.S. 113 (1973).

¹⁰ Compare *id.* at 160 (“Viability is usually placed at about seven months (28 weeks) but may occur earlier, even at 24 weeks.”), with I. Glenn Cohen & Sadath Sayeed, *Fetal Pain, Abortion, Viability, and the Constitution*, 39 J.L. MED. & ETHICS 235, 236–37 (2011) (reporting that in the United States, resuscitation is usually not attempted before 23 weeks; that the survival rate for earlier resuscitations is probably between 1 percent and 20 percent; and that “a heavy majority of survivors born below 23 weeks gestation by LMP will sustain permanent cognitive and physical disabilities”). See Paul Reidinger, *Will Roe v. Wade Be Overruled?*, A.B.A. J., July 1988, at 66, 69:

The gist of all this is that the point of viability does not seem to be moving inexorably backward as Justice O'Connor suggested, indeed has moved barely at all since *Roe* was decided. The rates of survival for premature infants jump dramatically in most studies between the 24th and 28th weeks. One recent study showed that while only 20 percent of infants born at 24 weeks survived, 83 percent of those born at 28 weeks did.

See also Nancy K. Rhoden, *The New Neonatal Dilemma: Live Births from Late Abortions*, 72 GEO. L.J. 1451, 1452–1453, 1461 (1984) (noting that due to developments in perinatal medicine and associate technology that doctors are now able to save more babies born extremely prematurely).

infant can tolerate artificial ventilation.¹¹ To move the point of viability further back in pregnancy would require a quantum leap, a qualitatively different technology that would more closely mimic the womb and thus support the infant more comprehensively. It might involve providing oxygen other than through the lungs, and it might require submersion in a liquid that simulates amniotic fluid.¹² This technology might strike us as visually very similar to natural gestation. We would think of the submersion container as an artificial womb even if it could not substitute for a woman's body for the entire period of pregnancy.

Another basis for distinguishing artificial wombs from neonatal life support might lie in our beliefs or practices regarding the status of the fetus. We may be inclined to call a device an artificial womb, rather than merely another piece of neonatal technology, if it is able to take over from the human mother early enough that the embryo or fetus does not yet seem like a baby.¹³

Relatedly, neonatal medicine may become artificial gestation because of its practical impact. Today, neonatal technology defines not only the survival prospects of premature infants, but also the legality of abortion.¹⁴ If technology could gestate a fetus removed from a woman before twelve weeks of gestation, when the vast majority of abortions are performed,¹⁵ widespread acceptance of early

¹¹ See COLEMAN, *supra* note 7, at 8–9 (describing the continuing difficulties in delivering oxygen to premature babies and the use of steroids to accelerate lung development when premature birth is anticipated); Gregory Pence, *What's So Good About Natural Motherhood? (In Praise of Unnatural Gestation)*, in ECTOGENESIS 77, 86 (Scott Gelfand & John R. Shook, eds., 2006) (“For thirty years, viability of the lungs of the premature baby has been the absolute barrier to progress towards an artificial womb.”); Rhoden, *supra* note 10, at 1465 (“At present, fetal lung development is a limiting factor for neonatal survival because an infant whose lungs completely lack surfactant cannot survive.”).

¹² Alternative means of providing oxygen have been tried but have not yet surpassed ventilation as a means of effective treatment. For a discussion of alternative means of providing oxygen, see *infra* notes 56–60 and accompanying text.

¹³ Cf. Joyce M. Raskin & Nadav Mazor, *The Artificial Womb and Human Subject Research*, in ECTOGENESIS, *supra* note 7, at 159, 168 (“We will become more sympathetic and attribute greater moral value to the fetus, growing in a glass tank, as it gains the shape of a human being.”); Mark A. Goldstein, Note, *Choice Rights and Abortion: The Begetting Choice Right and State Obstacles to Choice in Light of Artificial Womb Technology*, 51 S. CAL. L. REV. 877, 921 (1978) (concluding that a fetal development standard should replace viability as the cutoff for legal abortion); Ken Martyn, Comment, *Technological Advances and Roe v. Wade: The Need to Rethink Abortion Law*, 29 UCLA L. REV. 1194, 1204 (1982) (same). This line of distinction is discussed further below, in connection with the effect of artificial wombs on abortion rights and the concept of viability in abortion doctrine. See *infra* Part II.B.

¹⁴ See *Planned Parenthood of Southeastern Pa. v. Casey*, 505 U.S. 833, 846 (1992) (reaffirming *Roe*'s holding that states may prohibit abortion after viability).

¹⁵ See *Facts on Induced Abortion in the United States*, GUTTMACHER INSTITUTE (Aug. 2011), www.guttmacher.org/pubs/fb_induced_abortion.html (demonstrating via a pie chart that the vast majority of abortions take place prior to the twelfth week of gestation).

abortion might lead us to view that technology as qualitatively different from neonatal medicine.

Artificial wombs might also take a variety of physical forms. This Article focuses on the prospect of freestanding wombs: human-made machines that could perform all the functions of gestation, either from conception or at least early enough to substitute for most abortions. There are also proposals, however, for what we might call quasi-artificial wombs, which straddle the definitional borders between artificial gestation, surrogacy, and surgical cures for infertility.

First, there is the possibility that an artificial, human-made womb could function inside a person's body. A person who was not otherwise able to gestate could use the device to do so. Depending on the path of technological development, this could be either more difficult than freestanding gestation (because it would require miniaturization of the device) or less difficult (because it would involve supplementing existing organs and bodily processes rather than building a device from scratch). The former path of development would necessarily encounter all of the questions and problems raised by complete ectogenesis. The latter path would be relatively unproblematic from a legal and cultural perspective, since the artificial components could be understood as treatment for infertility.¹⁶ We would not have to face the unique questions raised by ectogenesis because children would still be gestated inside an existing person's body.

Second, non-human animals could be used to gestate human infants. Ethicists consider this option ethically more problematic, even if it might be technologically easier, as compared to gestation in a machine.¹⁷

¹⁶ See BARBARA KATZ ROTHMAN, RECREATING MOTHERHOOD: IDEOLOGY AND TECHNOLOGY IN A PATRIARCHAL SOCIETY 257 (1989) (supporting gestational technology used within the body, including by men, but opposing extracorporeal gestation); Noa Ben-Asher, *The Curing Law: On the Evolution of Baby-Making Markets*, 30 CARDOZO L. REV. 1885, 1888–1906 (2009) (arguing that society is more willing to accept reproductive technologies that are perceived as cures for disease). Use of an artificial womb by a person otherwise considered male would raise cultural and legal questions similar to those that were raised in recent popular discussions of a pregnant transgendered man. See Russell Goldman, *It's My Right to Have Kid, Pregnant Man Tells Oprah*, ABC NEWS (Apr. 3, 2008), <http://abcnews.go.com/Health/story?id=4581943&page=1#.TyxuyFy0zQM>. (reporting on Thomas Beatie, a transgendered man whose pregnancy made headlines in 2008).

¹⁷ See COLEMAN, *supra* note 7, at 1–2 (excluding non-human gestation from the scope of discussion in a book-length treatment of ectogenesis because the use of animals raises additional ethical issues). Coleman does not specify whether he perceives the additional issues as pertaining to the animals' interests, the humanity of the resulting child, or both. For an interesting discussion of legal and cultural concerns about the use of animals in human reproductive processes, see Maneesha Deckha, *Holding onto Humanity: Animals, Dignity, and Anxiety in Canada's Assisted Human Reproduction Act*, 5 UNBOUND 21, 42–48 (2009) (discussing the Assisted Human Reproduction Act, which prohibits human gestation in a non-

Third, women who are brain dead or in persistent vegetative states could serve as gestational surrogates.¹⁸ Women could be asked in advance whether they would be willing to gestate a fetus after their own brain death, in the same way that people today are asked to consent to donation of their organs.¹⁹ Doctors have already successfully sustained pregnancies in women who were raped while in vegetative states²⁰ and others who were already pregnant when they experienced brain death.²¹ Initiating and staging an entire pregnancy in a brain dead woman would likely pose additional challenges, but it would be easier and cheaper than inventing and building gestation machines.²²

Each of these last three possibilities—prosthetic wombs, animal gestation, and post-mortem gestation—raises its own ethical, legal, and cultural questions. The focus of this Article, however, is on true ectogenesis—mechanical gestation outside the body, for all or a substantial portion of fetal development—and the questions it raises about gestation, mothers, and human connection and dependency. A true artificial womb would be able to grow a child from conception to birth, or at least be able to take over from the human mother by the end of the first trimester. The next Section discusses the reasons why we might want to build such a machine.

human life form).

¹⁸ See Rosalie Ber, *Ethical Issues in Gestational Surrogacy*, 21 THEORETICAL MED. & BIOETHICS 153, 164–65 (2000) (proposing that brain dead women or women in persistent vegetative states be used as surrogates).

¹⁹ See *id.* at 165 (noting that an additional sentence could be added to existing organ donor cards specifying whether they would be willing to gestate a fetus in the event of her brain death).

²⁰ See *Doe v. Westfall Health Care Ctr., Inc.*, 755 N.Y.S.2d 769, 771 (N.Y. App. Div. 2002) (ruling on a tort suit involving rape of a patient in a chronic vegetative state who became pregnant and gave birth); Daniel A. Manion, *Rights That Are Wrong*, 72 NOTRE DAME L. REV. 1, 4 (1996) (describing a case involving a baby born “to a comatose woman who was raped”).

²¹ See Julien S. Murphy, *Is Pregnancy Necessary? Feminist Concerns About Ectogenesis*, HYPATIA, Fall 1989, at 66, 69 (“[R]esearch techniques for sustaining pregnancies in brain-dead women have resulted in a few live births showing that fetuses can thrive in the bodies of brain-dead pregnant women if there is proper temperature regulation, intubation, and ventilation and all vital organs remain unharmed.”); James M. Jordan, III, Note, *Incubating for the State: The Precarious Autonomy of Persistently Vegetative and Brain-Dead Pregnant Women*, 22 GA. L. REV. 1103, 1106–1112 (1988) (discussing such cases in the context of the principle of bodily autonomy).

²² See Murphy, *supra* note 21, at 69 (noting that the researcher in one case, who was prepared to obtain a court order if any relatives of the brain dead woman tried to intervene, stated that the woman had no legal rights and that the bodies of brain-dead women are “the cheapest incubators we have”); Jordan, *supra* note 21, at 1110 n. 25 (comparing the cost of neonatal intensive care to the cost of maintaining a pregnant, brain dead woman on life support).

B. Uses and Benefits of Artificial Wombs

Most scientists whose research could lead to ectogenesis are focused on developing treatments either for infertility or for the complications of premature birth.²³ Bioethicists and legal commentators, however, have identified additional reasons for artificial gestation.²⁴ These reasons can be briefly stated as: better for women, better than surrogacy, better for babies, and better than abortion.

If artificial wombs were widely available, they could release the women who used them from the risks and burdens of even normal pregnancy, without transferring those risks to other, lower status women.²⁵ Artificial wombs could thus serve as a liberating

²³ Ethicists typically cite medically indicated surrogacy as the primary use for artificial wombs. This point is known as “the better surrogacy argument” for artificial gestation. *See, e.g.*, PETER SINGER & DEANE WELLS, MAKING BABIES: THE NEW SCIENCE AND ETHICS OF CONCEPTION 118 (1985) (“Medically speaking, ectogenesis offers an alternative to surrogate motherhood for women who are incapable of pregnancy or for whom pregnancy is not recommended on medical grounds.”); Rosemarie Tong, *Out of Body Gestation: In Whose Best Interests?*, in ECTOGENESIS, *supra* note 7, at 59, 70 (“[Because many women value a genetic connection with a child,] and because of serious concerns I have about one woman using another woman’s body to make a baby for her for money, I am prepared to accept the better surrogacy argument in favor of ectogenesis.”).

²⁴ All of the uses for artificial wombs described in the text involve producing children. In addition, artificial wombs could be used to create stem cells, organs, and other spare parts, rather than for the complete gestation of a new person. This might be feasible on a part-by-part basis, or it might require the intentional creation of brain dead, but otherwise complete, individuals. *See* SINGER & WELLS, *supra* note 23, at 132–35 (describing and partially rejecting this potential use of artificial womb technology). Singer and Wells argue that embryos could be used for these purposes as long as they are not yet in any way sentient. *Id.* at 133. On the prospect of creating intentionally brain dead babies to circumvent that barrier, they acknowledge that this would be permissible under their utilitarian framework but “emphatically urge caution” because of the potential collateral effects on people’s ability to bond with infants. *Id.* at 133. For a more detailed discussion that concludes with a more emphatic rejection of this path, see COLEMAN, *supra* note 7, at 163–65 (arguing against the use of partial ectogenesis to develop organs for transplant because “none of the usual justifications for killing a fetus seem to apply . . .”).

If artificial womb research is pursued, therapeutic and research uses would likely become feasible before complete ectogenesis is possible. Technically, the “spare parts” endeavor does not require an artificial womb; a live woman could work just as well. Presumably, not enough women would be willing to serve in this capacity for it to become widespread. *See* Raskin & Mazor, *supra* note 13, at 166 (“[C]onsidering that the in vitro fetus is no longer protected by the natural shield of a female womb, it is further exposed to the scientific hunger for research than the in vivo fetus.”). A woman might be willing to do so, however, if it were herself, her own child, or another family member who was in need of tissue or a transplant, or in desperate financial circumstances. *Cf.* Fazal Kahn & Brian Lea, *Paging King Solomon: Towards Allowing Parents to Donate Organs of Anencephalic Infants*, 6 IND. HEALTH L. REV. 17, 17–19 (2009) (discussing the use of anencephalic infants as organ donors and proposing a ban on the intentional creation of anencephalic fetuses).

²⁵ Contract surrogacy has been criticized for transferring the risks of pregnancy to lower status women. *See, e.g.*, Dorothy E. Roberts, *Spiritual and Menial Housework*, 9 YALE J.L. & FEMINISM 51, 65–68 (1997) (discussing the implications of turning pregnancy into a form of menial labor and arguing that “[c]ontract pregnancy treats women as objects rather than

technology for women. Shulamith Firestone promoted this view when she famously called pregnancy “barbaric” and looked forward to the day when technology would free women from the physical demands of reproduction.²⁶ She believed that sex equality would not be possible until technology equalized the sexes when it came to making babies.²⁷ Importantly, Firestone did not believe that the technology of artificial gestation, standing alone, would be liberating; she advocated a radical restructuring of society, including the abolition of the family as an institution, with freedom from pregnancy only one factor supporting women’s equality.²⁸ Other feminist writers, however, have more directly hailed reproductive technology as a path to sex equality.²⁹ By diminishing the mother’s role in the creation of a child, technology could free women from their disproportionate physical burden. It could also put men on an equal footing with women at the outset of family life, including by allowing a man to reproduce without a female partner or gestational surrogate.

One criticism of the claim that artificial wombs would be better for women is that they would probably be available only to the wealthy. Even medically indicated ectogenesis would be available only to the relatively well-off, as is true today for expensive treatments for neonates and for infertility. That more options are available to those with more wealth is, of course, nothing new, so an argument against ectogenesis on those grounds is no different from a similar argument against any advanced reproductive technology.³⁰ Nonetheless, wealth

valuable human beings by selling their capacity to bear children for a price”).

²⁶ SHULAMITH FIRESTONE, *THE DIALECTIC OF SEX: THE CASE FOR FEMINIST REVOLUTION* 226 (1970).

²⁷ *See id.* at 233–34 (emphasis removed) (arguing that women should be free “from the tyranny of their reproductive biology by every means available” and discussing “artificial reproduction” as one of those means).

²⁸ *See id.* at 233–37 (discussing four prerequisites for an alternative system favoring women’s equality); *see also* Murphy, *supra* note 21, at 78 (arguing that Singer and Wells’s claim that the technology would be liberating “ignores the theory of revolution implicit in Firestone’s support for ectogenesis”).

²⁹ *See, e.g.,* Marjorie Maguire Shultz, *Reproductive Technology and Intent-Based Parenthood: An Opportunity for Gender Neutrality*, 1990 WIS. L. REV. 297, 307–16 (arguing that the use of modern reproductive technologies leads to greater individual choice in the child bearing process). *But see* Vernellia R. Randall & Tshaka C. Randall, *Built In Obsolescence: The Coming End to the Abortion Debate*, 4 J. HEALTH & BIOMED. L. 291, 307–09 (2008) (arguing that apparent equalization would have disproportionate effects on women, especially poor women and women of color).

³⁰ *See* LAURA M. PURDY, *REPRODUCING PERSONS: ISSUES IN FEMINIST BIOETHICS* 229–30 (1996) (suggesting that pursuing reproductive technology diverts resources from other health care needs and is “not just a matter of letting the wealthy decide how to use their disposable income”); Joan Woolfrey, *Ectogenesis: Liberation, Technological Tyranny, or Just More of the Same?*, in *ECTOGENESIS*, *supra* note 7, at 129, 130–33 (arguing that ethical issues regarding resource allocation weigh heavily against pursuit of artificial womb technology). *But see*

disparities are a strong counterpoint to claims that artificial gestation would benefit women as a class. Practices that allow well-off women to buy their way out of femaleness tend to reinforce rather than undermine gender-based hierarchy, usually while also reinforcing class- and race-based hierarchies.³¹ As Firestone herself recognized, liberation requires social transformation in which technology can serve only as a tool, not as the transformation itself.

Wealthy women today can use surrogacy to liberate themselves from the burdens of pregnancy. Some bioethicists and legal commentators argue that artificial wombs would be better than the scantily regulated, globalized surrogacy industry that is currently developing.³² Those who view paid surrogacy as exploitive or otherwise problematic might prefer mechanical gestation.³³ Although poor women might not have access to the technology for themselves, at least they would no longer be induced to undertake the burdens and risks of pregnancy only to renounce the resulting child pursuant to a commercial contract. On the other hand, those who view contract surrogacy as legitimate or desirable might worry about the loss of this potential source of income for poor women.³⁴ The relationship between artificial gestation and human surrogacy is discussed in more detail in Part III.B.

Proponents of artificial wombs have also argued that artificial gestation would be safer for the fetus under a range of circumstances. Some of these proposals predictably reflect long-standing debates about control of pregnant women, suggesting that women who are

COLEMAN, *supra* note 7, at 38–41 (responding to the resource allocation objection to reproductive technology).

³¹ See ROTHMAN, *supra* note 16, at 206 (stating that “[p]oor women, women of color, are often valued for their nurturant qualities”); Roberts, *supra* note 25, at 66–67 (discussing racial implications of surrogacy).

³² See Kimberly D. Krawiec, *Altruism and Intermediation in the Market for Babies*, 66 WASH. & LEE L. REV. 203, 225 (2009) (stating that “surrogacy is increasingly being outsourced overseas”); Richard F. Storrow, *Parenthood by Pure Intention: Assisted Reproduction and the Functional Approach to Parentage*, 53 HASTINGS L.J. 597, 597 (2002) (stating that “[a]ssisted reproduction is widely used in this country and around the world”); Mike Celizic, *More and More Couples Finding Surrogates in India*, MSNBC, <http://www.msnbc.msn.com/id/23252624/print/displaymode/1098> (last updated Feb. 20, 2008) (“[C]ouples from the United States and elsewhere are increasingly turning to India for the ultimate outsource—surrogate mothers.”); *infra* Part III.B.1 (discussing the globalization of surrogacy).

³³ See, e.g., Tong, *supra* note 23, at 70 (“[Because many women value a genetic connection with a child,] and because of serious concerns I have about one woman using another woman’s body to make a baby for her for money, I am prepared to accept the better surrogacy argument in favor of ectogenesis.”).

³⁴ See Krawiec, *supra* note 32, at 245 (arguing that “legal rules limiting direct surrogate access to the marketplace increase the power imbalance between surrogate and intermediary”).

addicted to drugs or have other particular problems could be required to transfer their fetuses to artificial wombs.³⁵ Others have gone so far as to posit that ectogenesis would be safer for the fetus as a general matter, regardless of the mother's condition.³⁶ Artificial gestation would protect the fetus from various dangers, including irresponsible maternal behavior and "dietary fads" among pregnant women.³⁷ The fetus would be nurtured in a scientifically controlled environment, with exactly the right kinds and amounts of sustenance and stimulation.

These proposals for artificial gestation resonate with a prevailing cultural view of pregnant women as threats to their fetuses, a view that has been thoroughly critiqued in feminist legal literature.³⁸ In the context of ectogenesis, perhaps the most important critique is of the arrogance of both the medical and legal establishments about what they think they know. Many "dietary fads" among pregnant women and mothers—say, the "fad" for formula over breast milk, or the epidemic of cesarean sections in American hospitals—originate with

³⁵ See, e.g., Pence, *supra* note 11, at 82 (discussing women with drug addictions and HIV infection).

³⁶ See *id.* at 82 (arguing that ectogenesis would allow for "careful monitoring and study of the best possible nutrients for the fetus") (emphasis in the original); Amel Alghrani, *The Legal and Ethical Ramifications of Ectogenesis*, 2 ASIAN J. WTO & INT'L HEALTH L. & POL'Y 189, 205 (2007) (quoting Edward Grossman, *The Obsolescent Mother: A Scenario*, THE ATLANTIC, May 1971, 39, 48) ("An efficient artificial womb, far from increasing the incidence of birth defects, would reduce them by keeping the [fetus] in an absolutely safe and regular environment . . .") (emphasis omitted).

³⁷ Emily Jackson, *Degendering Reproduction*, 16 MED. L. REV. 346, 360 (2008) (quoting ROGER GOSDEN, DESIGNER BABIES: THE BRAVE NEW WORLD OF REPRODUCTIVE TECHNOLOGY 179 (Phoenix 2000) (1999)) (criticizing the view that fetuses need to be protected from their mothers as a general matter); see also Scott Gelfand, *Ectogenesis and the Ethics of Care*, in ECTOGENESIS, *supra* note 7, at 89, 102 (arguing that it is reasonable to assume that ectogenesis would be healthier for both the mother and the child and "would in all likelihood protect the fetus from second-hand smoke, alcohol, and an unhealthy diet").

³⁸ See Jackson, *supra* note 37, at 360–61 (applying those critiques in the context of ectogenesis); see also, e.g., April Cherry, *Maternal-Fetal Conflicts, The Social Construction of Maternal Deviance, and Some Thoughts About Love and Justice*, 8 TEX. J. WOMEN & L. 245, 257 (1999) ("If we really loved women and cared about justice for them, we would be more apt to respect their bodies, their self-determination, and their choices, even when we don't agree with the choices made."); Dorothy E. Roberts, *Punishing Drug Addicts Who Have Babies: Women of Color, Equality, and the Right to Privacy*, 104 HARV. L. REV. 1419, 1482 (1991) ("The first principle of the government's response to the crisis of drug-exposed babies should be the recognition of their mothers' worth and entitlement to autonomy over their reproductive lives"); Reva Siegel, *Reasoning From the Body: A Historical Perspective on Abortion Regulation and Questions of Equal Protection*, 44 STAN. L. REV. 261, 342 (1992) (arguing that "selective regulation of women's conduct is justified on the grounds that pregnant women have a unique physical capacity to harm children, when the regulation may in fact reflect the view that pregnant women have a unique social obligation to protect children"); Dawn E. Johnsen, Note, *The Creation of Fetal Rights: Conflicts with Women's Constitutional Rights to Liberty, Privacy, and Equal Protection*, 95 YALE L.J. 599, 600 (1986) ("Any legal recognition of the fetus should be scrutinized to ensure that it does not infringe on women's constitutionally protected interests in liberty and equality during pregnancy.").

the medical industry and are reinforced by the legal system.³⁹ Barbara Katz Rothman explains the risks of relying on mass-scale, technological solutions to complex and difficult questions about creating and sustaining life:

We cannot know who will be right, but we do know that, inevitably, anyone making these decisions will sometimes be wrong. To me, it comes down not to whose *judgment* we trust, but whose *mistakes*. . . .

Why, then, do I trust the idiosyncratic mistakes of parents? Precisely because they are idiosyncratic. The mistakes of medicine and those of the state are systematic, and that alone is reason not to trust.⁴⁰

A downside of a perfectly controlled, scientifically calibrated environment for producing babies is that whatever mistakes are made will be made on a large scale. For these reasons, claims that artificial wombs should be welcomed because they will produce a superior product should be greeted with skepticism.

Even if ectogenesis is not preferable to natural gestation, it might be good enough to serve as an alternative to abortion. In the case of medically necessary abortions, the artificial alternative would be analogous to neonatal care. In addition, some women who today might give birth and place their children for adoption might prefer an earlier divestiture. For example, a woman who was opposed to abortion but became pregnant through rape might find the alternative

³⁹ See *Fejes v. Gilpin Ventures, Inc.*, 960 F. Supp. 1487, 1491–92 (D. Colo. 1997) (holding that breastfeeding is not a medical condition related to pregnancy and therefore, it is not within the scope of the Pregnancy Discrimination Act); Tong, *supra* note 23, at 65–66 (summarizing the history of the medical establishment’s assertion of control over pregnancy, including telling pregnant women “when to eat, sleep, exercise, have sex, and the like”); Beth A. Burkstrand-Reid, *The Invisible Woman: Availability and Culpability in Reproductive Health Jurisprudence*, 81 U. COLO. L. REV. 97, 140–46 (2010) (summarizing cases of court-ordered c-sections); April L. Cherry, *Roe’s Legacy: The Nonconsensual Medical Treatment of Pregnant Women and the Implications for Female Citizenship*, 6 U. PA. J. CONST. L. 723, 736–39 (2004) (discussing the negative impacts of nonconsensual medical treatment on women); Linda C. Fentiman, *Marketing Mothers’ Milk: The Commodification of Breastfeeding and the New Markets for Breast Milk and Infant Formula*, 10 NEV. L.J. 29, 36–38 (2009) (describing the medical industry’s promotion of formula over breastfeeding); see also N.J. Div. of Youth and Family Servs. v. V.M., 974 A.2d 448, 449 (N.J. Super. Ct. App. Div. 2009) (per curiam) (affirming, on other grounds, decision by trial court declaring mother unfit and removing her child because she had refused a c-section recommended by her doctor, even though the baby, delivered vaginally, was unharmed). The V.M court affirmed the ruling of the lower court, but declined to rule on whether the mother’s refusal to undergo a c-section could be considered as evidence of neglect. *Id.*

⁴⁰ ROTHMAN, *supra* note 16, at 193.

of artificial gestation to be an acceptable compromise.⁴¹ For the most part, however, writers who posit artificial gestation as an alternative to abortion contemplate outlawing abortion and requiring women instead to undergo a fetal extraction and transfer procedure.⁴² This idea is discussed in detail in Part III.A.

Of these four possible reasons for building artificial wombs, the first two—“better for women” and “better than surrogacy”—contemplate the voluntary use of technology by prospective parents. Coercion could still be a concern; for instance, employers might become more reluctant to allow maternity leave when a substitute womb is available, or social norms might come to condemn natural gestation as animalistic.⁴³ The second two—“better for babies” and “better than abortion”—are more explicitly aimed at overriding women’s decisions. Although some women might choose artificial gestation for these reasons, proponents of these rationales contemplate the coercive removal of embryos and fetuses from women’s bodies to be gestated by machine.⁴⁴

C. Technological Prospects

Since at least the 1920s, scientists have claimed that the technological capacity for ectogenesis is imminent,⁴⁵ but the years

⁴¹ This is assuming that the victim did not want to raise the resulting child. See generally Shauna R. Prewitt, Note, *Giving Birth to a ‘Rapist’s Child’: A Discussion and Analysis of the Limited Legal Protections Afforded to Women Who Become Mothers Through Rape*, 98 GEO. L.J. 827 (2010) (examining state laws related to women who become pregnant as a result of rape).

⁴² See, e.g., SINGER & WELLS, *supra* note 23, at 119–120 (discussing the implications of ectogenesis on the need for and debate over abortions).

⁴³ See, Gelfand, *supra* note 37, at 98–103 (discussing problems involving employers and insurance); ALDOUS HUXLEY, *BRAVE NEW WORLD* 1–19 (Harper & Bros. 1946) (1932) (describing a futuristic society in which humans are gestated outside the body in hatcheries).

⁴⁴ See, e.g., SINGER & WELLS, *supra* note 23, at 126 (discussing common objections to ectogenesis) (arguing that ectogenesis would be beneficial because it would “eliminate the wastage of embryonic life now caused by abortion” and would “reduce the possessiveness of natural mothers”).

⁴⁵ See Tong, *supra* note 23, at 60–61 (citing SUSAN MERRILL SQUIER, *BABIES IN BOTTLES: TWENTIETH-CENTURY VISIONS OF REPRODUCTIVE TECHNOLOGY* (1994)) (discussing theories on ectogenesis in the 1920s). The earliest documented claim for artificial gestation was a sixteenth-century recipe for creating a human form by allowing a man’s semen to putrefy in the sealed womb of a horse. The resulting creature, however, was believed to lack a soul. Gelfand, *supra* note 7, at 3. Interest in and anticipation of ectogenesis has come in cycles, with a spate of interest in the 1920s, another in the late 1970s and early 1980s, and the current cycle, which began around the turn of the millennium. See Tong, *supra* note 23, at 60–67 (describing the three periods). These cycles are reflected in spurts of interest in ectogenesis in law reviews in the late 1970s and again in the last five years. See Alghrani, *supra* note 36, 192–208 (focusing on the science behind ectogenesis as well as the legal implications); Michael Buckley, Note, *Current Technology Affecting Supreme Court Abortion Jurisprudence*, 27 N.Y.L. SCH. L. REV. 1221, 1239–49 (1982) (discussing the possible effects of ectogenetic technology on the Supreme Court’s abortion jurisprudence); Jackson, *supra* note 37, at 356–65 (discussing the

come and go and no artificial wombs are built. Great progress has been made in both embryonic research and care for premature infants. Recent anticipation of ectogenesis among ethicists and legal scholars, however, appears to be overly optimistic.

Non-biologists writing about law or ethics, rather than scientists, have made the most frequent announcements of imminent ectogenesis.⁴⁶ Recent popular and academic discussions of the advent of artificial wombs typically cite the same two researchers, Dr. Yoshinori Kuwabara of Juntendo University, Tokyo and Dr. Hung-Ching Liu of Cornell University.⁴⁷ Dr. Kuwabara's research approached ectogenesis from the direction of fetal survival, trying to push back the point of viability for premature babies. He predicted in 1997 that partial ectogenesis—from the sixteenth week of pregnancy—would be possible in about ten years.⁴⁸ Dr. Liu worked from the other direction, developing techniques for maintaining embryos and encouraging them to implant in artificial environments. She, too, has predicted that her techniques would lead to complete artificial wombs within a few years.⁴⁹ Both of these lines of research

potential effect of ectogenesis on gender roles in the reproductive process); Randall & Randall, *supra* note 29, at 293 (arguing that emerging medical technology will essentially end the debate over abortion by allowing a woman to choose to terminate a pregnancy without terminating the life of the fetus); Goldstein, *supra* note 13, at 891–98 (discussing the effect of ectogenesis on the concept of viability); Martyn, *supra* note 13, at 1202–14 (discussing potential changes in the law influenced by developments in ectogenetic technology); Jessica H. Schultz, Note, *Development of Ectogenesis: How Will Artificial Wombs Affect the Legal Status of a Fetus or Embryo?*, 84 CHI.-KENT L. REV. 877, 883–901 (2010) (discussing a number of legal issues related to ectogenesis); Eric Steiger, Note, *Not of Woman Born: How Ectogenesis Will Change the Way We View Viability, Birth, and the Status of the Unborn*, 23 J.L. & HEALTH 143, 158–63 (2010) (discussing ways in the law could adapt to accommodate ectogenetic technology).

⁴⁶ See, e.g., Gelfand, *supra* note 7, at 1 (stating that “it is likely that an artificial womb designed for human use will be developed in the near future . . .”); SINGER & WELLS, *supra* note 23, at 116–118 (discussing scientific prospects for ectogenesis); Goldstein, *supra* note 13, at 880 (stating that “[p]ractical applications of [ectogenesis] may occur in the very near future . . .”); Martyn, *supra* note 133, at 1204 (speculating that “[i]f technological improvements move to the point of viability to a time within the first twelve weeks of pregnancy” that the state’s interest in protecting the fetus will attach during that period); Steiger, *supra* note 45, at 144 (stating that “[s]cientists predict that safe, reliable, and complete ectogenesis will be available within the next thirty years, and perhaps within as little as ten or five”).

⁴⁷ See COLEMAN, *supra* note 7, at 11–12 (discussing the work of Dr. Kuwabara); Alghrani, *supra* note 36, at 194–95 (discussing the work of Dr. Kuwabara and Dr. Liu); Jackson, *supra* note 37, at 358 (referring to Dr. Liu); Randall & Randall, *supra* note 29, at 297–98 (discussing the work of Dr. Kuwabara and Dr. Liu); Schultz, *supra* note 45, at 881–82 (discussing the work of Dr. Kuwabara and referring to the work of Dr. Liu).

⁴⁸ See Gelfand, *supra* note 7, at 2 (“In 1997, Kuwabara believed that it would take about ten years to develop an artificial womb that could be used to bring a sixteen-week fetus to term.”).

⁴⁹ See *id.* (relating Liu’s prediction).

are provocative enough to have captured press attention periodically.⁵⁰

Indeed, their work continues to be cited even though Dr. Kuwabara died in 2000 and Dr. Liu has not published her results.⁵¹ This pattern suggests that the level of popular and intellectual fascination with artificial wombs is out of proportion to their technological feasibility.

None of that, of course, means that artificial gestation is impossible. Technical barriers to creating artificial wombs can be thought of as falling into two categories: life support barriers and developmental barriers. The phrase “life support barriers” refers to the difficulties involved in artificially performing the ordinary bodily functions that the developing fetus cannot yet do for itself. These are familiar from neonatal intensive care: the body must have mechanisms for absorbing oxygen, taking in nutrients, and expelling waste. The phrase “developmental barriers” refers to difficulties in directing the growth of a fertilized egg so that it correctly follows the path from embryo to fetus to healthy infant.

This dichotomy between life support barriers and developmental barriers is, however, artificial. In natural gestation, the uterus performs both life support and developmental functions, and it would be difficult to draw a clear line between the two categories. My distinction between the two categories is intended only to draw attention to a feature of the legal and ethical literature of artificial wombs. In that literature, discussions of the technological prospects for ectogenesis tend to focus on the life support barriers that are familiar from neonatal care. While they acknowledge the concern that artificially gestated fetuses will experience developmental problems,

⁵⁰ Those of us who are interested in the legal and ethical problems of artificial reproduction may be eager to seize on the promise of technological imminence. For example, Stephen Coleman’s book devoted to ectogenesis canvasses the state of current research in the field. COLEMAN, *supra* note 7, at 5–14. His survey includes the usual citations to the work of Dr. Kuwabara, as well as an embryo study by Dr. Carlo Bulletti in Bologna. *Id.* at 11–13. The only other current research cited is what Coleman describes as “the patented theoretical work of Dr. William Cooper,” as evidenced by a 1991 patent application for a “placental chamber.” *Id.* at 12. As best as can be determined, Dr. Cooper is an obstetrician with no apparent research credentials who practiced in Tulsa, Oklahoma under the business name Christian Fertility Institute. According to the website of the Oklahoma Medical Board, his license was revoked in 1998 following disciplinary actions in Georgia and Pennsylvania for “[f]ailure to provide a proper setting and assistive personnel for medical act,” “[f]raud [o]btaining [l]icense [c]redentials,” and “[u]nprofessional [c]onduct.” OKLA. BD. OF MED. LICENSURE AND SUPERVISION, www.okmedicalboard.org/licensee/MD/15621 (last updated Feb. 13, 2012).

⁵¹ See Alghrani, *supra* note 36, at 194 (noting Dr. Kuwabara’s death and that Dr. Liu’s work was unpublished). A member of Dr. Kuwabara’s research team stated that their approach might be able to push the point of viability back to twenty weeks but that he personally had no plans to pursue that line of research. See *id.* Twenty weeks is only slightly earlier than the current survival point for premature birth. See *supra* note 10 and accompanying text.

they generally do not treat embryo development as one of the functions of the uterus; the implicit assumption is that if the life support functions are performed correctly, proper development will occur. Part II argues that this implicit assumption reflects a long-standing ideological view of gestation that is likely inconsistent with the scientific facts.

From a life support perspective, a successful artificial womb would have to be able to perform the functions of the placenta, as well as protect the fetus with something akin to amniotic fluid.⁵² Neonatologists have had greatest success when they approach such tasks in a manner that mimics ordinary gestation, rather than treating the newborn as one would treat a fully developed infant.⁵³ For example, doctors provide nutrition to very premature infants intravenously, rather than relying on their incomplete digestive systems.⁵⁴ Similarly, premature infants' fragile skin is protected by a moist environment or even by creams that can mimic amniotic fluid.⁵⁵ In these respects, current technology foreshadows artificial wombs by mimicking the natural womb in form as well as function.

The exception to this pattern is the provision of oxygen.⁵⁶ Rather than mimic the placenta by supplying oxygen through the bloodstream, doctors treat premature babies with high-frequency ventilators.⁵⁷ This approach requires additional treatment to encourage the lungs to develop as quickly as possible.⁵⁸ Although in the past there has been research on how to provide oxygen through the bloodstream, the techniques that were developed failed to outperform ventilators.⁵⁹ The need for sufficient lung development to tolerate a ventilator is thus the most important factor in setting the current limit of fetal viability.⁶⁰

⁵² COLEMAN, *supra* note 7, at 7 (“The amniotic fluid acts to regulate foetal temperature, to prevent dehydration, and as a barrier to infection.”).

⁵³ *See id.* (“When treating extremely premature newborns, neonatologists attempt to mimic the uterine function when treating problems of these types.”).

⁵⁴ *See id.* at 7–8 (discussing the delivery of nutrition to premature infants).

⁵⁵ *See id.* at 8 (“The immaturity of the skin of the premature infant is also a problem that the neonatologist must deal with.”).

⁵⁶ *See id.* at 9 (“The treatment of respiratory problems in premature infants is clearly quite different from the treatment of most other problems, as the treatment relies exclusively on the body system that is responsible for oxygenation of the blood after birth; the lungs.”).

⁵⁷ *Id.* at 8–9.

⁵⁸ *See id.* at 9 (describing surfactant replacement therapy, which is used with a ventilator to “help the lungs absorb oxygen”).

⁵⁹ *Id.* at 9–11 (describing research into artificial placentas in the 1950s and 1960s and finding that “attempts to keep the subject attached to the artificial placenta for longer periods inevitably resulted in death”).

⁶⁰ *See* Pence, *supra* note 11, at 85 (“For thirty years, viability of lungs of the premature baby has been the absolute barrier to progress towards an artificial womb. Reports of success using liquids to substitute for the mother’s placenta have usually been exaggerated.”); *see also*

Given the difficulties of artificially recreating the uterine environment in order to sustain a mid-term fetus, it almost begins to look easier to rely on natural processes by initiating the pregnancy *in vitro* and allowing the mechanisms for sustaining the fetus to develop organically. If an embryo could implant in an artificial container that behaved like a womb, the blood vessels and other connections necessary for sustaining life could grow themselves. In this scenario, the difficulty would lie in directing fetal development: the artificial womb would have to deliver the correct hormones and growth factors at the correct times.⁶¹ This developmental challenge, however, has received little attention in the popular, ethical, and legal literature about artificial gestation, which focuses on life-support issues.⁶² There is an underlying assumption that providing the proper climate and nutrition will enable the embryo's development to unfold naturally and of its own accord. As Part II will show, this assumption is more ideological than scientific.

Contemplating artificial gestation from a developmental perspective also has important implications for ethical barriers to this sort of research. When the focus of research is on life support measures for saving premature infants, there are opportunities for doctors to experiment with new methods. If an infant is certain to die without intervention, researchers can attempt even an untested technique. Through this process, the technique may become tested.⁶³ By contrast, experimentation is more fraught when it attempts to make a baby from scratch and simulate the maternal—fetal signaling that shapes development. Errors may or may not be detectable immediately and could result in seriously damaged children.

Even if developmental barriers were overcome, at least some of the proposed uses for artificial wombs would require more sophisticated technology. For example, in order for artificial gestation to substitute for abortion, scientists would have to recreate placental connections once the original placenta has been severed from the

supra note 11 (describing the difficulties associated with providing oxygen to premature lungs).

⁶¹ See Jackson, *supra* note 37, at 358 (describing Dr. Liu's research agenda and explaining that directing the development of organs in the early embryo would be "an exceptionally complex task").

⁶² See, e.g., COLEMAN, *supra* note 7, at 5–13 (describing life-support issues in detail without mentioning hormonal or other developmental processes as background to a book on the ethics of artificial gestation).

⁶³ This is not to suggest that ethical decisions about the treatment of imperiled newborns are easy ones. See, e.g., Cohen & Sayeed, *supra* note 10, at 236–37 (reporting that the few infants who survive being born before twenty-three weeks gestation are likely to suffer serious impairments). They are, however, beyond the scope of this article.

natural womb. They would also have to develop techniques for safely removing the embryo or fetus from the pregnant woman. In order for artificial wombs to be a plausible alternative to most abortions in the United States, these techniques would have to be usable in the first trimester.⁶⁴ At this stage, the embryo or fetus is already embedded in the uterus but is still quite small and not highly differentiated, both of which would make locating and transferring it difficult.

In the end, the best argument for the likelihood of ectogenesis is generalized faith in scientific progress and capacity: science has accomplished many things that would have been thought impossible before they were done; why should this be any different?⁶⁵ That is not an argument, however, for expecting the technology to be available in the near future. As Part II discusses, optimistic predictions about the imminence of artificial womb technology are probably exaggerated by the gender bias that has historically plagued reproductive science.

II. THE FANTASY AS A DREAM DIARY

A dream diary is a journal in which a person records her dreams, usually for the purpose of gaining insight into her own psychological state and processes. The practice of keeping a dream diary is based on the theory that our dreams reflect and reveal our psyches. This Part situates the science of artificial wombs in the history of reproductive science and argues that the legal/scientific fantasy about artificial gestation can be read as a dream diary, reflecting and revealing a prevailing ideology about sex, gender, and reproduction.

Feminist scientists and philosophers of science have demonstrated how sex-based ideology has frequently skewed and hampered scientific efforts to understand the biology of reproduction. In particular, since Aristotle, philosophers and scientists have theorized reproduction through a series of related dichotomies that minimize the role of gestation: the physical versus the spiritual or cognitive; the passive versus the active; the female versus the male; and the pregnant woman versus the fetus. Relying on these dichotomies—and despite what might seem overwhelming evidence to the contrary—scientists long theorized men's role in reproduction as greater and more important than women's, particularly minimizing the role of gestation.

⁶⁴ See sources cited *supra* notes 13–15.

⁶⁵ See, e.g., Gelfand, *supra* note 7, at 1 (noting that the first successful cloning of a sheep took many scientists by surprise); Alghrani, *supra* note 36, at 192 (invoking this reason for expecting success with ectogenesis).

Only in the last century or so has women's lesser contribution (and general inferiority) ceased to be an axiom of scientific inquiry.⁶⁶ The relaxation of that axiom has coincided with, and gradually enabled, better science. Nonetheless, early assumptions die hard. The scientific, legal, and ethical speculations about ectogenesis reflect the same dichotomies and biases that have long plagued reproductive science. It is therefore likely that the prospects for building artificial wombs are systematically overstated.

A. *From Ancient Times: Theorizing Reproduction Through Aristotle's Dichotomies*

Western reproductive science begins with Aristotle, whose model of conception is reminiscent of Genesis.⁶⁷ Just as God formed Adam from the dust of the earth, Aristotle believed that a man's semen contained the motive force that acted upon the raw materials contained in a woman to form a new being.⁶⁸ His model thus established two dichotomies as the basic framework for understanding reproduction: one between the active male and the passive female, and another between the immaterial life force of the man and the physical body of the woman. Although some other classical theorists believed that both parents contributed to fetal development, "they uniformly held that woman's contribution was weaker than that of man."⁶⁹ Aristotle's model of reproduction is considered "epigenetic," in that it supposes the embryo to be "newly produced through gradual development from unorganized material."⁷⁰ The organizing motive force comes from the outside and gives form to the raw materials.

Epigenetic models of reproduction fell out of favor in the seventeenth and eighteenth centuries because they appeared to require a non-mechanical, spiritual force to mold the new being. Enlightenment scientific theory favored the clockwork universe.⁷¹ The epigenetic theory of reproduction was, therefore, replaced by

⁶⁶ Cf. Nancy Tuana, *The Weaker Seed: The Sexist Bias of Reproductive Theory*, 3 HYPATIA, Spring 1988, at 35, 41 (1988) ("We can see from such inconsistencies in Aristotle's theory that the doctrine that the female sex was inferior to the male was not a premise to be proved or justified, but was rather an implicit belief underlying Aristotle's development of his biological theory and an axiom upon which he founded his theory of reproduction.")

⁶⁷ See *id.* at 38 (making this comparison).

⁶⁸ See *id.* at 38–40 (summarizing Aristotle's writings on reproduction).

⁶⁹ *Id.* at 41.

⁷⁰ SHIRLEY A. ROE, MATTER, LIFE, AND GENERATION: EIGHTEENTH-CENTURY EMBRYOLOGY AND THE HALLER-WOLFF DEBATE I (1981).

⁷¹ See *id.* at 8–9 (describing the conceptual problems with explaining epigenesis within the framework of a mechanical universe); Tuana, *supra* note 66, at 51 (linking preformationism to belief in the clockwork universe).

“preformation” doctrine.⁷² Preformationists believed that fetal development consisted solely of the “growth or unfolding of pre-existing structures”⁷³

Originally, preformationists believed that the form of the fetus was contained within the mother’s egg and that the father’s semen provided the trigger to stimulate growth.⁷⁴ It followed that an egg contained a series of Russian nesting dolls, with all the generations of humanity contained originally in Eve’s eggs. This “ovist” view of reproduction, however, was “almost uniformly rejected” once sperm was observed and recognized as the male analogue to the egg.⁷⁵ The pre-existing fetus was quickly transferred to the sperm. A famous eighteenth-century illustration of the preformationist view depicts a tiny man squatting in the head of a sperm, his own head either replaced by or enclosed in an oversized bulge.⁷⁶ This small creature was believed to take root and grow in the mother “just as the seed does in the field.”⁷⁷

Female inferiority continued to function as an axiom to justify preformationist theory. Erasmus Darwin, grandfather of Charles and a proponent of preformation, held “that the embryo is produced by the male, and the proper food and nidus by the female.”⁷⁸ As support for his view that the female contributes no part of the embryo, he offered a proof by contradiction: If the female as well as the male helped to constitute the embryo, then the female’s overall contribution would be greater than the male’s; she would give both form and nutrition, he only form. That cannot be. QED.⁷⁹ The pre-existing embryo thus assumed the role of Aristotle’s motive force, while the pregnant

⁷² See Tuana, *supra* note 66, at 51 (“The idea of an evolution of complexity from unstructured material lost favor toward the end of the seventeenth century as a result of the general scientific commitment to a mechanistic worldview and the insufficiency of mechanical explanations of the gradual development of living organisms.”). See also ROE, *supra* note 70, at 4 (describing Rene Descartes’s unsuccessful effort to reconcile an epigenetic theory of reproduction with a mechanistic, particle-based theory of matter); *id.* at 23 (noting that Albrecht von Haller, an eighteenth-century embryologist, believed that “almost everyone” believed in preformation). Haller himself started as a preformationist, briefly converted to epigenesist, and ended his life a staunch defender of preformation. *Id.* at 22–25.

⁷³ Tuana, *supra* note 66, at 51.

⁷⁴ *Id.* at 52.

⁷⁵ *Id.* at 52–53. The ovist view was briefly revived in the mid-1700s by a few embryologists who objected to the inefficiency of “animalculism,” the term for the theory that located the pre-existing embryo in sperm. *Id.* at 52–54. See also ROE, *supra* note 70, at 9 (noting that preformation was widely accepted by the beginning of the eighteenth century, and that animalculism was a minority viewpoint).

⁷⁶ To view this illustration, see Tuana, *supra* note 66, at 54.

⁷⁷ *Id.* at 55 (quoting Martin Frobenius Ledermuller).

⁷⁸ *Id.* at 55–56 (quoting ERASMUS DARWIN, *ZOONOMIA, OR THE LAWS OF ORGANIC LIFE* (AMS Press 1974)).

⁷⁹ *Id.* at 55.

woman remained a source of nutrients and other raw materials for sustaining growth. The dichotomy between these two parental contributions remained intact.

B. The Modern Era: Preformation and Genetic Determinism

Scientific discoveries can be hard on human sensibilities. Sigmund Freud explained:

In the course of centuries the *naïve* self-love of men has had to submit to two major blows at the hands of science. The first was when they learnt that our earth was not the centre of the universe but only a tiny fragment of a cosmic system of scarcely imaginable vastness. . . . The second blow fell when biological research destroyed man's supposedly privileged place in creation and proved his descent from the animal kingdom and his ineradicable animal nature.⁸⁰

Freud posited his own theories of the unconscious as the third major blow, "prov[ing] to the ego that it is not even master in its own house"⁸¹ Few of Freud's theories having attained a level of scientific acceptance equivalent to evolution or the Copernican model, a better candidate for the third great blow to *man* is the discovery of DNA in human eggs, which proved that women contributed equally (at least)⁸² to the genetic makeup of their offspring.

Preformation theory required that the motive force for a new being come from either the mother or the father, since the new being was envisioned as already complete. Like the ancients, the preformationists assigned the father this role, and they pointed to the active, swimming sperm as the vehicle for placing the new being inside the passive mother.⁸³ With the discovery that genetic coding resided in both the sperm and the egg, scientists and society at large were forced to accept that women contributed not just raw material but also form.

⁸⁰ 16 SIGMUND FREUD, *Introductory Lectures on Psychoanalysis*, in THE STANDARD EDITION OF THE COMPLETE PSYCHOLOGICAL WORKS OF SIGMUND FREUD 284–85 (James Strachey trans., 1963).

⁸¹ *Id.* at 285.

⁸² In addition to downplaying gestation as discussed in this Part, the popular cultural belief that a mother and father contribute equally to a child's DNA appears to be impervious to the discovery of mitochondrial DNA, which comes only from the egg. See W. Nicholson Price, Note, *Am I My Son? Human Clones and the Modern Family*, 11 COLUM. SCI. & TECH. L. REV. 119, 142–43 (2010) (discussing mitochondrial DNA and disputing the "common belief" that DNA exists only in the nucleus).

⁸³ See Tuana, *supra* note 66, at 52–53 (describing the work of Anthony van Leeuwenhoek and Louis Dominicus Hamm which found that "the nourishment of the masculine seed was the sole function of the female").

Recall that Darwin's grandfather rejected this possibility because it led to the absurd result of the woman having a greater role in reproduction than the man.⁸⁴ But disproof of old-fashioned preformation did not mean that the culture was willing to concede that greater role; it avoided doing so by translating preformation into genetic determinism.⁸⁵ With the new understanding of genetic inheritance, the fetus could no longer be thought to have pre-existed the pregnancy. Instead, the essence of the fetus was its newly formed set of DNA, to which mother and father contributed equally. Thus, the fallback position, still in effect today, was to deny that women had a greater role in reproduction, and instead to insist on equality by further minimizing the importance of gestation and by equating biological parenthood with the contribution of nuclear DNA.⁸⁶ As Part III discusses, this new theory has had important implications for the legal regulation of pregnancy. The egg's DNA, rather than gestation, would now define female parenthood, setting the stage for cultural acceptance of phenomena like commercial surrogacy, artificial wombs, and the concept of maternal-fetal conflict that drives abortion bans and other fetal-protective legislation.

The continuity between preformation and modern genetic determinism can be seen in the metaphors that continue to influence our understanding of reproduction today. Preformationists believed that the little being inside the sperm "develop[ed] in the mother just as the seed does in the field."⁸⁷ Into at least the late twentieth century, children were taught that babies are made when "Daddy plants a seed

⁸⁴ See *supra* notes 78–79 and accompanying text (outlining Erasmus Darwin's conclusions).

⁸⁵ Jane Maienschein has also described the continuity between old-fashioned preformation doctrine and modern genetic determinism. See Jane Maienschein, *Cloning and Stem Cell Debates in the Context of Genetic Determinism*, 9 *YALE J. HEALTH POL'Y L. & ETHICS* 565, 574–75 (2009) (discussing "the preformism of genetic determinism"). After the heyday of preformation in the seventeenth and eighteenth centuries, nineteenth-century scientists returned to epigenetic theories. Epigenesis was no longer considered inconsistent with the clockwork universe because natural phenomena were understood as intrinsically organized rather than amorphous. See ROE, *supra* note 70, at 150–53 (discussing the rise of teleological epigenesis). As discussed below, however, preformation had sufficient hold on popular imagination in the United States to play a role in the criminalization of abortion in the nineteenth century. See Siegel, *supra* note 38, at 341–42 n.331–33 (discussing efforts to enact various fetal-protective regulations).

⁸⁶ See ROTHMAN, *supra* note 16, at 36–37 (emphasis in the original):

When forced to acknowledge that a woman's genetic contribution is equal to a man's, Western patriarchy was in trouble. *But the central concept of patriarchy, the importance of the seed, was retained by extending the concept to women. . . . Women do not gain their rights to their children in this society as mothers, but as father equivalents, as equivalent sources of seed.*

⁸⁷ Tuana *supra* note 66, at 55 (quoting Martin Froenius Ledermuller).

in Mommy.”⁸⁸ The lay cultural understanding of reproduction, and to some extent the scientific understanding, remains rooted in a DNA-based version of preformation.⁸⁹

This continuity extends back to Aristotle and his dichotomy between the active, spiritual force of the father and the raw material of the mother. In addition, a parallel dichotomy stretches forward to shape the cultural construction of childrearing. Barbara Katz Rothman and Dorothy Roberts have both described the cultural division of mothering work into what Roberts calls “spiritual” and “menial” categories.⁹⁰ This division allows privileged women to participate in public life while maintaining their identities as mothers; they can perform the spiritual role of mothers while hiring lower status women to perform the menial tasks.⁹¹ Rothman points out that this dichotomy enables higher status women to assume privileges that are traditionally male without challenging the basic structure of privilege that orders our gendered experiences of reproduction and care work.⁹²

Today, DNA is thought of as a blueprint or design—something more cognitive than physical.⁹³ As the design force, it is valued as the quasi-spiritual essence of identity and individuality. Once a new set of DNA is created in a zygote, it implants in the mother, and its developmental process unfolds under the guidance of its own unique set of DNA. We think of the fetus’s relationship with “the maternal environment” as similar to our own relationship with our surroundings. The mother is a source of needed inputs and outputs—food, oxygen—and protection from certain harms. She provides basic, “menial” services. The new being is, however, essentially complete, preformed. As Part III discusses, this conception of the embryo as

⁸⁸ Barbara Katz Rothman, *Daddy Plants a Seed: Personhood Under Patriarchy*, 47 HASTINGS L.J. 1241, 1244 (1996) (“In Western, patriarchal societies, the classic where-dobabies-come-from tale we tell children is a variation on ‘Daddy plants a seed in Mommy.’”).

⁸⁹ See Maienschein, *supra* note 85, at 575 (pointing out that the public was caught off guard by the success of cloning in part because they accepted the genetic determinist worldview); *id.* at 565:

[T]his emphasis on genetic determinism [by scientists] has reinforced a popular misconception that what matters about the life of an individual organism, including its form and function, is laid out fully in all relevant respects with fertilization, at the time that the full complement of chromosomes comes together from the two parents.

⁹⁰ Roberts, *supra* note 25, at 51–52.

⁹¹ *Id.* at 57 (“Today, the spiritual/menial split enables many professional women to go to work without disturbing the sexual division of housework or relinquishing their role as spiritual housekeepers.”).

⁹² See ROTHMAN, *supra* note 16, at 204–06 (describing “managerial mothers” who, like men have done previously, leave the nurturing of their babies to other women).

⁹³ See Maienschein, *supra* note 85, at 574–75 (“Today . . . the preformism of genetic determinism has overbalanced our understanding of complex developmental processes.”).

essentially complete, merely waiting to unfold, has important implications for the law's approach to issues such as abortion and surrogacy.⁹⁴ It is, however, an overly simplistic and systematically skewed model for understanding the creation of a new being.

C. The New Epigenetics: Science Resists the Dichotomies

In biology, epigenesis is on the rise once more, challenging and complicating the genetic determinism that took hold during the twentieth century. Today, the field of epigenetics studies how genes interact with environmental factors that influence gene expression—whether, when, and how particular genes are turned “on” or “off.”⁹⁵ Rather than study the individual as a predetermined entity whose essence was fixed when the parents' chromosomes combined, biologists study development as a complicated interaction between genes and other factors. The environment contributes not just raw materials but also form.

The interaction of genes and the environment breaks down the dichotomy between nature and nurture, between the cognitive blueprint and the physical implementation of a person. Epigenetics also challenges the prevailing cultural view that equates the genetic blueprint with parental inheritance and thus the essence of both identity and parenthood. The popular view is that genetic inheritance is fixed and that environmental factors, even if they operate on the genes, affect only the individual. The opposite, however, appears to be true. Epigenetic changes in gene expression affect not only the individual but also the individual's descendants. That is, environmental factors create heritable effects. Thus, a more formal definition of the modern field of epigenetics is “the study of heritable changes in gene expression that occur without a change in DNA sequence.”⁹⁶

For example, one frequently discussed study of epigenetics involved the genetic and epigenetic control of the color of a mouse's

⁹⁴ See *supra* Part III.A–B.

⁹⁵ See generally Alan P. Wolffe & Marjori A. Matzke, *Epigenetics: Regulation Through Repression*, 286 SCI. 481 (1999) (examining recent discoveries in the field of epigenetics). For descriptions of the field of epigenetics that are written to be understandable by a legal audience, see Fazal Khan, *Preserving Human Potential as Freedom: A Framework for Regulating Epigenetic Harms*, 20 HEALTH MATRIX 259, 266–76 (2010) (outlining new developments in the field of epigenetics); Maienschein, *supra* note 85, at 576–80 (describing historical developments in epigenetics and stem cell research); Mark A. Rothstein et al., *The Ghost in Our Genes: Legal and Ethical Implications of Epigenetics*, 19 HEALTH MATRIX 1, 4–23 (2009) (describing the science of epigenetics).

⁹⁶ Wolffe & Matzke, *supra* note 95, at 481.

fur.⁹⁷ The diet of a pregnant mouse can be manipulated so that her offspring are either black or yellow, even though they are genetically identical. Surprisingly, the difference in color is heritable: it persists into the next generation. The effect of the mother's diet is not "just" a matter of an environmental factor affecting a particular offspring; it becomes part of the heritable "instructions" that are passed down from one generation to the next. A similar process was likely responsible for a phenomenon observed in humans after the Dutch famine of 1944.⁹⁸ As one might expect, children who were in utero during the famine were adversely affected on several health measures. Surprisingly, however, the effect persisted into the next generation, with the children of the famine babies experiencing high rates of heart disease.

Just as the early version of preformation gave way to more nuanced genetic determinism, today's science is not Aristotle's epigenesis. Epigenetics does not displace the chromosome as the primary mechanism of biological inheritance. It does, however, challenge genetic determinism and the dichotomy between genes and environment. In the context of pregnancy and gestation, it challenges the dichotomy between form and matter, between genetic identity and the supportive environment of the womb.

This challenge to the genes–environment dichotomy should not be interpreted to mean that gestation is important because it can influence genetics. That conclusion would accept not only the dichotomy but also the associated valuation of genes over environment. It still makes sense to think of DNA as one thing and influences on expression as another. It may no longer make sense, however, to elevate genes as the higher, true essence of parenthood *because* they influence future generations; the environment, including the maternal environment, does that too. Rather, the conceptual dichotomy between genes and environment is a cultural construction that is often misleading. This dichotomy imagines genes as "instructions" or "blueprints," imbuing them with a cognitive, almost spiritual quality. Genes are thus deemed superior to the merely physical, including gestation, as a basis for identity. This dichotomy is artificial and resonates with other dichotomies that have harmful

⁹⁷ See generally Hugh D. Morgan et al., *Epigenetic Inheritance at the Agouti Locus in the Mouse*, 23 NATURE GENETICS 314 (1999) (describing the inheritance of epigenetic modifications in mice). For a more accessible explanation, see Barry Starr, *Ask a Geneticist*, THE TECH MUSEUM, (July 26, 2006), <http://www.thetech.org/genetics/ask.php?id=183> (discussing whether surrogate children share genes with the birth mother).

⁹⁸ See Starr, *supra* note 97 (noting that grandchildren of people who suffered in the Dutch famine were generally smaller than other children).

social effects, including the dichotomy of gender. Chromosomes are not, in fact, “blueprints” or “instructions,” to be consulted by a self-aware builder. They are made of sugar and protein; they are physical, tangible stuff. It is helpful, at times, for us to think of them metaphorically as design plans, but we should not allow the metaphor to replace the reality. Both gestation and the replication of chromosomes are physical processes that create us as ourselves.

The understanding of pregnancy that prevails today was formed through the lens of an artificial dichotomy between form and matter. In this understanding, the fertilized egg is self-contained and complete as a new, individual human being. The DNA in the genes provides the blueprint and operating instructions for turning the egg into a baby. The mother’s womb provides the raw materials and disposes of waste products. The embryo itself is thus self-executing. This construction of pregnancy makes an artificial womb seem relatively simple in concept, even if technically difficult to carry out. The technical problems would arise from complexity and from the microscopic scale of early development, but the basic tasks would be straightforward life support tasks.

This vision of fetal development, however, is warped by ideology. A gestating woman’s body shapes the fetus’s development in ways which cannot be starkly distinguished from genetic inheritance. This suggests that we could as easily think of artificial gestation as akin to reproduction with synthetic DNA, rather than merely the replacement of one machine with another. It is therefore likely that we are overestimating the feasibility of artificial wombs because science and culture have traditionally discounted the role that gestation plays in development. This does not mean that gestation is a mystical process that is inherently incapable of mechanization, any more than it is inherently impossible to synthesize usable human DNA.⁹⁹ But the dichotomy between genes and environment is not as simple as popular and legal discussions typically assume. Similarly, gestation is more complex and developmental than the traditional view of the pregnant woman as a container suggests. The bias that has long hampered reproductive science still colors our cultural and scientific understanding of gestation and continues to lead us astray.

III. THE FANTASY MADE REAL

On the strength of that same long-standing bias, the fantasy of artificial gestation has become part of legal discourse about abortion

⁹⁹ For a brief discussion of using synthetic DNA for human reproduction, see Jackson, *supra* note 37, at 352–56.

and surrogacy. Even if ectogenesis is unlikely to be possible in the near or even the foreseeable future, legal analysis is already anticipating the possibility and is affected by that anticipation. This Part argues that overestimation of the technological capacity for artificial gestation is not merely an artifact but also an implement of ideology. Part III.A shows how the prospect of artificial gestation taps into preformationist assumptions in the debate over abortion. Part III.B shows how these same assumptions can influence the law of surrogacy and hopes for “better surrogacy” by machine. These examples show how the fantasy of artificial gestation—itsself the product of ideology as much as science—can help to maintain its own ideological reality even before science can provide the practical reality.

A. Abortion

The most frequent invocation of artificial gestation in legal analysis is the hypothesis that artificial womb technology will eliminate the need for abortion and/or the need for the right to abortion.¹⁰⁰ This claim begins as a thought experiment: *What would the law of abortion be if there were artificial wombs?*¹⁰¹ The point of such a thought experiment is to deepen analysis by separating issues that are entwined in real life; the question seeks to disentangle the right to end a pregnancy from the right to end the life of the fetus. The thought experiment, however, eliminates context: it posits the appearance of artificial wombs without considering the experimental path that would be necessary for them to be built. Moreover, the thought experiment is often presented as not *merely* a thought experiment but as an imminent reality to be prepared for.¹⁰² The promise of imminence gives the scenario extra power and suggests that it offers essential truth: Because we will soon have artificial wombs, we should analyze rights and relationships today with artificial wombs as part of our understanding of reality. This line of speculation reveals as much about current ideology as about the

¹⁰⁰ See, e.g., SINGER & WELLS, *supra* note 23, at 119–20 (arguing that opponents of abortion “ought to welcome the development of ectogenesis”).

¹⁰¹ See, e.g., LAURENCE H. TRIBE, *ABORTION: THE CLASH OF ABSOLUTES* 220 (1992) (contending that the development of artificial wombs or placentas would drastically alter the clash over abortion).

¹⁰² See, e.g., *Roe v. Wade*, 410 U.S. 113, 161 (1973) (describing artificial wombs as a new medical technique); COLEMAN, *supra* note 7, at 13–14 (stating that a breakthrough in ectogenesis could “come at any time”); Gelfand, *supra* note 7, at 1 (discussing the possibility that an artificial womb designed for human use will be developed in the near future); SINGER & WELLS, *supra* note 23, at 117–18 (stating that ectogenesis is “already a partial reality,” and predicting that the need for a natural womb may be eliminated completely).

problems of the future. In particular, belief in the near-term invention of artificial gestation reflects an ideologically tinged tendency to devalue pregnancy. That belief, in its turn, reinforces the ideology.

1. *The Preformationist Rhetoric of Abortion*

Just as modern, gene-oriented views of reproduction derive from preformation doctrine, modern regulation of abortion derives from a preformationist understanding of the embryo as an essentially complete new being.¹⁰³ Opponents of abortion today continue to assert that life begins at conception as a matter of scientific fact. They insist that the combination of chromosomes created at conception is the essence of an individual human being, who needs only the opportunity to unfold over the course of nine months' gestation.¹⁰⁴

Reva Siegel's foundational work on abortion restrictions in the United States highlights the preformationist views on which the nineteenth-century anti-abortion movement was based. "Doctors premised their campaign on a scientific understanding of human development as continuous from the point of conception, a scheme in which 'quickening' had no special significance."¹⁰⁵ They analogized the fetus to a baby kangaroo or breast-feeding baby, arguing that the fetus was autonomous and not even actually attached to the woman.¹⁰⁶ The embryo was described as "self-sustaining" and "self-developing": "[W]hatever it may become . . . is, by growth and development of the original, and not by addition of *new* materials, or attributes . . ."¹⁰⁷ This is a classic statement of preformation doctrine, made shortly before the advent of genetic determinism. As Siegel summarized, nineteenth-century doctors "defended the claim that life begins at conception with an argument that life developed by autogenesis."¹⁰⁸ Their theory of reproduction "systematically discounted women's role in reproducing life."¹⁰⁹

Opponents of abortion continue to rely on the genetic-determinist version of preformation as the basis for their argument that

¹⁰³ See Siegel, *supra* note 38, at 288–90 (discussing the historical and modern use of the idea that an embryo has a separate and independent existence in arguments for the regulation of abortion.). Use of the genetic-determinist version of preformation by modern opponents of abortion is discussed *infra*, text accompanying notes 110–114.

¹⁰⁴ See *infra*, text accompanying notes 110–114 (discussing abortion opponents' support for this theory).

¹⁰⁵ Siegel, *supra* note 38, at 282.

¹⁰⁶ *Id.* at 289 (describing the "kangaroo analogy" used by members of the anti-abortion movement).

¹⁰⁷ *Id.* at 288 (quoting J. Boring, *Foeticide*, 2 *Atlanta Med. & Surgical J.* 257, 259 (1857)).

¹⁰⁸ *Id.* at 289.

¹⁰⁹ *Id.* at 291.

personhood begins at conception. For example, Robert John Araujo's argument against the right to abortion repeatedly invokes science as "inexorably" refuting *Roe*'s use of the term "potential life" to refer to a developing embryo or fetus.¹¹⁰ Similarly, Charles Lugosi begins his discussion of the question when life begins by asserting, "Science informs us as to the answer."¹¹¹ What science tells us, he says, is that a fertilized egg is a "unique individual" which "will develop according to its own genetic blueprint . . ."¹¹² A zygote is "internally activated"—i.e., the genetic blueprint itself, rather than the gestational process, triggers development—and the genome *itself* "assumes control of the whole morphogenetic process from the beginning of embryonic development."¹¹³ These claims are radically preformationist. According to Lugosi, the zygote proceeds to "execute a plan" that is best carried out "[u]ndisturbed by external intervention . . ."¹¹⁴ Ignored in this account is the zygote's need for several interventions: a uterine wall in which to implant; a protective bath of amniotic fluid; a constant supply of nutrients, oxygen, and waste elimination facilities; and a complex array of hormones and growth factors, all of which are provided by the body of the gestating woman. The embryo is seen as directing its own course of development, in isolation from the other factors that influence it. This insistence that the moral status of the embryo can be determined as a matter of scientific fact depends on a genetic determinist and genetic essentialist view of reproduction and individual identity.

The ideological descendants of preformation doctrine thus continue to influence the abortion debate today. Moreover, the preformationist framing of the debate sets the terms of discussion even for those who accept *Roe*'s terminology of "potential life." The prevailing legal analysis of artificial wombs, including among those who support the right to abortion today, is that they will eliminate both the need and the justification for abortion rights.¹¹⁵ Picking up on

¹¹⁰ Robert John Araujo, *Abortion—From Privacy to Equality: The Failure of the Justifications for Taking Human Life*, 45 HOUS. L. REV. 1737, 1763–66, 1785 (2009).

¹¹¹ Charles I. Lugosi, *Conforming to the Rule of Law: When Person and Human Being Finally Mean the Same Thing in Fourteenth Amendment Jurisprudence*, 22 ISSUES L. & MED. 119, 123 (2006).

¹¹² *Id.*

¹¹³ *Id.*

¹¹⁴ *Id.* at 124.

¹¹⁵ See, e.g., Goldstein, *supra* note 13, at 882 (arguing that states could insist that the termination of pregnancy be performed using artificial womb techniques); Christopher Kaczor, *Could Artificial Wombs End the Abortion Debate?*, 5 NAT'L CATH. BIOETHICS Q. 283, 284–85 (2005) (determining that both opponents and defenders of abortion could accept the permissibility of using artificial wombs in place of abortion).

the arguments of Judith Jarvitz Thomson,¹¹⁶ Laurence Tribe,¹¹⁷ and others that the right to terminate a pregnancy does not necessarily include the right to ensure the destruction of the embryo, commentators have suggested that artificial wombs could free women from unwanted pregnancies while allowing their embryos to survive,¹¹⁸ effectively “unbundling” the right to abortion.¹¹⁹ A woman would still have the right to end her pregnancy but would have no right to insist on the death of the embryo.¹²⁰ This discourse reflects and reinforces the preformationist theory of the embryo by positing that, throughout the entire course of pregnancy, abortion represents a fundamental conflict of interest between two individuals.

This conflict model of pregnancy contributes to a paradox of abortion jurisprudence that would be brought into sharper relief by the advent of artificial womb technology.¹²¹ Under current abortion

¹¹⁶ Judith Jarvitz Thomson, *A Defense of Abortion*, 1 PHIL. & PUB. AFF. 47, 66 (1971) (“[W]hile I am arguing for the permissibility of abortion in some cases, I am not arguing for the right to secure the death of the unborn child.”).

¹¹⁷ See TRIBE, *supra* note 101, at 222:

Either the development of an artificial womb or the perfection of embryo transfer technology beyond the first few days of pregnancy would in practical reality separate the two analytically distinct questions raised by the debate about abortion that have heretofore remained practically inseparable—the question of the imposition on a woman’s liberty, and the question of a fetus for which one is responsible.

¹¹⁸ See, e.g., Randall & Randall, *supra* note 29, at 292–93 (quoting Laurence H. Tribe, *The Supreme Court 1972 Term: Foreword: Toward a Model of Roles in the Due Process of Life and Law*, 87 HARV. L. REV. 1, 27 (1973) (alteration in the original)):

Once the fetus can be severed from the [womb] by a process which enables it to survive, leaving the abortion decision to private choice would confer not only a right to remove an unwanted fetus from one’s body, but also an entirely separate right to ensure its death.

¹¹⁹ See I. Glenn Cohen, *The Constitution and the Rights Not to Procreate*, 60 STAN. L. REV. 1135, 1139 (2008) (“unbundling” the rights to avoid genetic, gestational, and legal parenthood).

¹²⁰ She may be required to allow removal in a way that maximizes the chance of fetal survival, even if the necessary procedure is somewhat riskier to herself. See *Gonzales v. Carhart*, 550 U.S. 124, 168 (2007) (upholding the federal Partial-Birth Abortion Ban Act despite its lack of health exception); COLEMAN, *supra* note 7, at 81–83 (discussing the possibility that, although the transfer might be substantially more invasive than abortion, that it might nonetheless be required by law or by hospital policy); Jennifer S. Hendricks, *Body and Soul: Equality, Pregnancy, and the Unitary Right to Abortion*, 45 HARV. C.R.-C.L. L. REV. 329, 348 (2010) (arguing that *Gonzales v. Carhart* can be used to justify a high standard of medical risk).

¹²¹ For more extensive discussion of the paradox of viability doctrine, see, e.g., Bruce Ching, *Inverting the Viability Test for Abortion Law*, 22 WOMEN’S RTS. L. REP. 37, 38 (2000) (arguing that “[i]f the reasoning of *Roe* and *Casey* is taken at face value, then courts should strike down any regulation of post-viability abortion that does not include an exception for those procedures which offer fetuses a meaningful chance for survival and continued life”); Hyun Jee Son, Comment, *Artificial Wombs, Frozen Embryos, and Abortion: Reconciling Viability’s Doctrinal Ambiguity*, 14 UCLA WOMEN’S L.J. 213, 217–26 (2005) (outlining problems with the viability doctrine).

law, the fact that a fetus is viable justifies requiring the woman to continue the pregnancy. The right to elective abortion ends when the fetus reaches viability.¹²² Moreover, viability is defined by the current state of medical technology.¹²³ That is, the existence of technology that would permit the fetus to survive outside the womb justifies requiring the pregnant woman to continue to sustain the fetus inside the womb. Nothing in the viability rule is tied to the affordability of the technology that would be required to sustain the fetus.¹²⁴ Viability is treated as if it were a quality inherent in the fetus rather than a function of society's ability and willingness to provide the necessary technology. Neonatal technology therefore performs two functions: first, its intended function, of saving babies in emergency deliveries; and second, its legal function of marking the viability line beyond which woman may be forced to remain pregnant in the absence of medical emergency. The existence of the technology eliminates the possibility of its being used, except in those emergencies.

The availability of artificial wombs would make the abortion question harder, not easier.¹²⁵ Why does the right to abortion currently end at viability?¹²⁶ That appears to be the point at which we deem the pregnant woman a mother and believe that she has a duty to continue

¹²² See Ching, *supra* note 121, at 38 (examining *Roe*'s holding that the state's interest becomes compelling at the point of viability).

¹²³ See *id.* at 41 (“[C]ontinuing medical and technological advances in fetal care will have the legal impact of allowing states to prohibit abortion . . . at earlier and earlier stages of pregnancy.”). See also *Planned Parenthood Southeastern Pennsylvania v. Casey*, 505 U.S. 833, 860 (1992) (stating that the soundness of the viability doctrine “in no sense turns on whether viability occurs at approximately 28 weeks, as was usual at the time of *Roe*, at 23 to 24 weeks, as it sometimes does today, or at some moment even slightly earlier in pregnancy, as it may if fetal respiratory capacity can somehow be enhanced in the future”); *Roe v. Wade*, 410 U.S. 113, 163 (1973) (reasoning that the justification for drawing the line at viability is that “the fetus then presumably has the capacity of meaningful life outside the mother’s womb”).

¹²⁴ Commentators discussing forced ectogenesis as an alternative to abortion often assume that the state would be obligated to bear the costs. See, e.g., Goldstein, *supra* note 13, at 916–21 (arguing that the state would have to pay at least when the woman could not afford to do so). Commentators differ in their assumptions regarding whether the resulting child would be presumptively a ward of the state or be deemed the child of the formerly pregnant woman. Compare Goldstein, *supra* note 13, at 901 (arguing that the child would be the state’s responsibility), with Jackson, *supra* note 37, at 362 (arguing that the child would be the woman’s responsibility).

¹²⁵ For others reaching the conclusion that artificial gestation would complicate rather than resolve the abortion controversy, see, for example, Gelfand, *supra* note 37, at 104 ([T]he advent of ectogenetic technology . . . will require those who propose severance theories to determine the moral status of a fetus, an undertaking they hoped to avoid.”); Son, *supra* note 121, at 221–222 (arguing that the use of artificial gestation demonstrates the ambiguity in the *Casey* standard).

¹²⁶ Several commentators have discussed the tension between the viability doctrine and reproductive technology, as well as the general lack of a strong theoretical basis for using viability to define the scope of the right to abortion. See, e.g., Son, *supra* note 121, at 217–18 (providing an overview of the implications of ectogenesis for the viability doctrine.). But see TRIBE, *supra* note 101, at 207 (mildly defending the viability rule).

to gestate. Alternatively, the current point of viability serves as a marker for when we roughly believe the fetus to have human status. In addition, viability currently occurs at approximately the same time that carrying to term becomes medically safer than abortion for the pregnant woman.¹²⁷

For a Supreme Court that has never provided a convincing rationale for relying on viability, this coincidence provides convenient cover.¹²⁸ The advent of artificial womb technology would force us to confront questions about viability and abortion more thoroughly than we have so far.

2. Path Dependence and the Moral Status of Embryos

Although we do not have artificial wombs today, current technology also raises questions about the moral status of embryos—or at least pre-embryos—and the answers that have emerged are revealing in their implications for artificial gestation. Based on current practices, we appear already to have decided that the technological capacity to turn a fertilized egg into a baby does not imply a moral duty to do so. The process of designing and building artificial wombs would reinforce rather than undermine that consensus.

Proposals to substitute forced ectogenesis for abortion ignore what appears to be an increasingly strong social consensus about the status of embryos and pre-embryos in laboratories. Pre-embryos are routinely destroyed or frozen indefinitely in the course of *in vitro* fertilization procedures. It is unlikely that the state could seize them and distribute them to infertile couples in order for those couples to have babies.¹²⁹ Yet, we entertain the possibility that the state would

¹²⁷ See Nancy K. Rhoden, *Trimesters and Technology: Revamping Roe v. Wade*, 95 YALE L.J. 639, 639–40 n.9 (1986) (calculating that abortion is safer than childbirth until at least the twenty-first week); COUNCIL ON SCIENTIFIC AFFAIRS, AMERICAN MEDICAL ASS'N, *Induced Termination of Pregnancy Before and After Roe v. Wade: Trends in the Mortality and Morbidity of Women*, 268 J. AM. MED. ASS'N 3231, 3232 (1992) (discussing mortality data from legal abortions). The most recently published study of the relative safety of abortion and childbirth found that abortion was about fourteen times safer than childbirth but did not differentiate according to gestational age at either abortion or birth. Elizabeth G. Raymond & David A. Grimes, *The Comparative Safety of Legal Induced Abortion and Childbirth in the United States*, 199 OBSTETRICS & GYNECOLOGY 215 (2012).

¹²⁸ See Hendricks, *supra* note 120, at 345 (“The right to elective abortion has thus suspended much of the pre-*Roe* debate over the medical conditions justifying therapeutic abortion.”).

¹²⁹ At most, courts have been troubled about whether one of the genetic contributors ought to have the unilateral right to use or destroy the embryos. See, e.g., *Davis v. Davis*, 842 S.W.2d 588, 589 (Tenn. 1992) (addressing the question of who would have custody of seven frozen embryos stored in a fertility clinic after a couple filed for divorce). See generally Bridget M. Fuselier, *The Trouble With Putting All of Your Eggs in One Basket: Using a Property Rights*

forcibly seize aborted embryos, grow them in artificial wombs, and either give the resulting children to their progenitors or place them in orphanages to await adoption. The only important difference between today's frozen pre-embryo and the future's candidate for artificial gestation is that one started in a laboratory and one started in a woman. If that distinction confers personhood or the right to be nurtured into a baby, then the ectogenic solution to abortion is merely another manifestation of the ideology that motherhood is obligatory.

Moreover, a world with artificial wombs would be a different world than the world in which we live today. It would be a world with a history of the decisions, practices, and experiments that would be necessary to produce artificial wombs. That history, which we can ignore when we merely contemplate the fantasy of artificial gestation, would alter the cultural landscape around reproduction. Proponents of building artificial wombs are necessarily advocating extensive experimentation on embryos and fetuses at increasingly advanced stages of development. If the public interest in medical science justifies this experimentation, which would likely involve the destruction of many embryos created for precisely that purpose, it is unclear why the state interest in embryonic life should trump a woman's interest in controlling her reproductive process. A government that had condoned the experiments necessary to create reliable artificial wombs would be hard-pressed to justify using that technology to compel motherhood.

3. Alternatives to the Maternal-Fetal Conflict Model

Finally, proposals to substitute ectogenesis for abortion implicitly assume that the rate of pregnancy terminations would remain constant. This assumption reveals an important misunderstanding of the role abortion plays in women's lives. Women who consider abortion a moral option do so because their understanding of pregnancy, and thus of abortion, rejects the genetic preformationism that leads others to see the embryo as a distinct individual from the time of conception.

Again, consider the situation in terms of today's technology. Although we do not have any devices that we call "artificial wombs," we can rescue an infant delivered long before full term. After viability, the state may prohibit abortion. Yet, we do not see women who are barred from having post-viability abortions asking instead for

early induction of labor. Once abortion is ruled out, the factors affecting the woman's decisions about the pregnancy change: there is now a future child to consider. Most women would prefer to endure an unwanted but normal pregnancy rather than subject a child to the risks of prematurity.

What little research exists on attitudes toward artificial wombs suggests that they would elicit the same lack of enthusiasm as premature induction of labor: few women would consider artificial gestation an appropriate response to an unwanted pregnancy.¹³⁰ In the only empirical study of this question, women who were opposed to abortion rights stated that transferring a fetus to an artificial womb would be an immoral abandonment of maternal duty, even if it protected the life of the fetus.¹³¹ At the same time, women who supported abortion rights rejected artificial wombs for the same reasons that so many women choose abortion over adoption: they believed there is a relevant moral difference between a fetus and a baby and said they would be reluctant to give up a baby even if the pregnancy had been unwanted.¹³² Both groups of women saw themselves as responsible for making a moral choice regarding the potential child, and artificial gestation was inconsistent with how they perceived their obligation.¹³³ In practical terms, this suggests that to compel artificial gestation would be to compel motherhood (or illegal abortion) in our ectogenic future as surely as a ban on abortion does so today. Moreover, as with adoption, mandating ectogenesis would

¹³⁰ The only empirical effort to gauge women's responses to the prospect of ectogenesis as an alternative to abortion is Leslie Cannold's study of a small sample of Australian women. Leslie Cannold, *Women, Ectogenesis, and Ethical Theory*, in *ECTOGENESIS*, *supra* note 7, at 50 (describing the results of a survey of forty-five Australian women).

¹³¹ *Id.* at 55 ("For women opposed to abortion rights, good women make motherhood their top priority.").

¹³² *Id.* at 52 ("Over and over again women ground their rejection of adoption and ectogenesis in a belief that it would be morally irresponsible of them to bring a child into the world they were unwilling or unable to parent."); *cf.* ROTHMAN, *supra* note 16, at 107 ("If women took motherhood casually, abortion would be much less important.").

¹³³ Compare this reaction to the dilemma of ectogenesis to common assumptions about women seeking abortions, as reflected in comments such as: "Under state-mandated womb-emptying, the state would bear the responsibility of dealing with the resultant children, isolating the mother from the red-tape of adoption." Goldstein, *supra* note 13, at 901 (footnote omitted). The implication that women prefer abortion to adoption because of the "red-tape" reflects a common belief that women have abortions for relatively trivial and selfish reasons. *See also* Doe v. Bolton, 410 U.S. 179, 221 (1973) (White, J., dissenting) ("At the heart of the controversy [in *Roe v. Wade* and *Doe v. Bolton*] are those recurring pregnancies that pose no danger whatsoever to the life or health of the mother. . . . [The majority interprets the U.S. Constitution as] valu[ing] the convenience, whim, or caprice of the putative mother more than the life or potential life of the fetus . . .").

put the greatest pressure on women of color, whose children fare the worst in the adoption and foster care system.¹³⁴

The notion that the state could mandate artificial gestation is premised on the general notion that the state can act against the pregnant woman on behalf of the embryo or fetus.¹³⁵ This premise is different from the state acting on behalf of a future child, such as by supporting maternal health for the sake of the future child. Rather, the very question is whether the embryo is to become a child. The premise is thus that a woman seeking an abortion has an inherent conflict of interest with the embryo, a premise that is based on the preformationist ideology of reproduction. Rejecting that ideology and the dichotomy between the woman's body and the developing embryo also implies rejecting the suggestion that state-mandated ectogenesis could be a moral solution to unwanted pregnancy.

The concept of "maternal-fetal conflict" appears frequently in discussions of pregnancy and reproduction.¹³⁶ Such a conflict is in one sense inherent in every pregnancy. From the perspective of genes (rather than people), the fetus's genes "want" to use as much of the mother's physiological resources as they can, while the mother's genes "want" to invest appropriately in this potential offspring but also to preserve resources for existing and possible future children.¹³⁷ The same conflict of interest exists, however, with respect to any particular ovum or sperm, each of which contains genes that "want" to be reproductively successful. A person who uses birth control or seeks an abortion is making a decision not to create a child at a particular time in order to conserve resources (in a very broad sense of the word) for herself and for her family, including existing and future children.¹³⁸

A conflict of interest, in this sense, between a woman and the genes of the ova, sperm, zygote, or embryo contained in her body is not necessarily a conflict of interest between the woman and the

¹³⁴ See Randall & Randall, *supra* note 29, at 308 (arguing that mandatory ectogenesis would disproportionately affect women whose babies are less likely to be adopted).

¹³⁵ See *Roe v. Wade*, 410 U.S. 113, 150 (1973) (identifying the state interest in the potential life of the fetus).

¹³⁶ See Michelle Oberman, *Mothers and Doctors' Orders: Unmasking the Doctor's Fiduciary Role in Maternal-Fetal Conflicts*, 94 NW. U. L. REV. 451, 451-52 (2000) (summarizing circumstances in which maternal-fetal conflicts are identified).

¹³⁷ See RICHARD DAWKINS, *THE SELFISH GENE* 129 (30th anniversary ed. 2006) (discussing the maternal-child conflict with respect to when to wean the child). At some point, the fetus's genes actually prefer to allow the mother to care for siblings, but that point comes beyond the point where the mother's genes would prefer her to do so. *Id.* at 128.

¹³⁸ Cf. Cannold, *supra* note 130, at 54 (describing one of her study participant's expression of the view that abortion is a moral decision based on "an evaluation that continuing the pregnancy would harm her maternal/fetal-child unit").

inchoate child of which any of those genes might become a part. That would be so only under the genetic determinist view that vests individual identity in the embryo. To posit state-mandated artificial gestation as a legitimate alternative to abortion is to overlook the moral claim of a woman having an abortion to make a decision not to reproduce, taking into account her family interests as well as her own. It is a decision “that continuing the pregnancy would harm her maternal/fetal-child unit.”¹³⁹

For many women, an abortion is not a refusal to care for a child; it is a decision not to create a child.¹⁴⁰ Imagining a machine that could create the child in a woman’s stead, however, helps construct abortion as a refusal to provide sustenance to a life in being. The construction implies that refusal may be justified or within the woman’s rights, but it is nonetheless unfortunate that another individual life must pay the price for her refusal. This implicit presumption of a conflict of interest between the woman and the embryo is based on preformation doctrine. But calling the initial genetic contribution “nature” and everything else “nurture” is a cultural choice. If at some point in pregnancy it makes sense to think of the fetus as a separate being, science cannot tell us when that moment occurs.¹⁴¹ For the same reason, technology will not resolve the controversy over abortion.

B. Commercial Surrogacy

While legal scholars have been interested in artificial wombs primarily as a state-mandated alternative to abortion, others have focused on the voluntary use of ectogenesis as an alternative to human surrogacy. In this context, the prospect of artificial gestation heightens concerns about commodification of children but reaffirms the appropriateness of commodifying gestation. The hypothesis that machines can perform gestation provides reassurance that gestation is not a core or essential part of mothering.¹⁴² Pregnancy can be seen as “a mere biological function . . . and not also as a human bond in

¹³⁹ *Id.*

¹⁴⁰ See ROTHMAN, *supra* note 16, at 123 (challenging the distinction between “contraception, not letting this month’s egg grow, and abortion, not letting this month’s fertilized egg grow”).

¹⁴¹ Cf. R. Alta Charo, *The Hunting of the Snark: The Moral Status of Embryos, Right-to-Lifers, and Third World Women*, 6 STAN. L. & POL’Y REV. 11, 11 (1995) (criticizing the work of the National Institutes of Health’s Human Embryo Research Panel to determine the moral status of human embryos through the lens of scientific deduction).

¹⁴² See Richard F. Storrow, *Parenthood by Pure Intention: Assisted Reproduction and the Functional Approach to Parentage*, 53 HASTINGS L.J. 597, 619 (2002) (“This view of the primacy of genetics is only fed by attempts to render natural gestation fungible through the development of alternative means of gestation, namely artificial wombs, or to minimize its importance by pointing to the capacity of incubators to perform it in part.”) (footnote omitted).

formation of new life that can be had in no other way.”¹⁴³ Using Dorothy Roberts’s terms, gestation becomes one of the “menial” tasks of mothering rather than one of the “spiritual” components that make motherhood a desirable state.¹⁴⁴

1. Cost and the Globalization of Surrogacy

The existence of commercial surrogacy alongside ectogenesis would invite comparisons regarding both cost and quality. It is hard to predict which would be more expensive. Would a human surrogate be regarded as the preferred, “handcrafted” alternative to mass production, or as an undesirable risk who might damage the fetus?

In the United States, the surrogacy industry has tried to cultivate a norm of capping payments to surrogate mothers. These price caps help to avoid the stigma of baby-selling and are claimed to ensure that the surrogate will be a “good mother” who will not negligently or recklessly endanger the health of the fetus. A low price ensures that her motives are at least partially altruistic.¹⁴⁵ Discussions of artificial wombs often refer to a possible cost disparity between human and mechanical surrogacy; however, no one has argued that caps should be imposed to keep the price of ectogenesis artificially low, in order to ensure that the providers of that service act with the child’s best interests at heart.

The structure of the surrogacy industry, however, is in flux. The market for surrogacy is now global,¹⁴⁶ which has several implications for its operation. Social similarity, including racial similarity, between the buyers and sellers of reproductive services is reduced, and economic disparities are more pronounced.¹⁴⁷ To insist that the

¹⁴³ Murphy, *supra* note 21, at 79.

¹⁴⁴ See Roberts, *supra* note 25, at 65–68:

While the ‘surrogate’ provides the menial labor of gestating the fetus to term, the contracting wife is designated as the baby’s spiritual mother As the case of ‘gestational surrogacy’ illustrates, the background of racial inequality adds another, related set of concerns about contract pregnancy. ‘Surrogacy’ perpetuates the racial hierarchy within the division of reproductive labor, as well as the racist valuation of genetic material.

¹⁴⁵ See Kimberly D. Krawiec, *Altruism and Intermediation in the Market for Babies*, 66 WASH. & LEE L. REV. 203, 244–47 (2009) (discussing the market forces behind surrogacy and price caps on surrogacy).

¹⁴⁶ See *Ultimate Outsourcing: Wombs for Rent in India* (NBC television broadcast Feb. 20, 2008), available at <http://www.msnbc.msn.com/id/23252624/print/displaymode/1098> (discussing how surrogates in India provide a cheaper alternative for infertile couples).

¹⁴⁷ See Lisa C. Ikemoto, *Reproductive Tourism: Equality Concerns in the Global Market for Fertility Services*, 27 LAW & INEQ. 277, 308 (2009) (noting that racial differences may make international surrogacy more attractive since it weakens the perceived relationship between the surrogate and the child); cf. Leslie Bender, *Genes, Parents, and Assisted Reproductive*

surrogate's primary motivation is altruistic therefore becomes more difficult. In this new global manifestation of commercial surrogacy, costs are kept down not by formal price caps but by the poverty of the pool of potential surrogates. This change, in turn, presents the intended parents with a dilemma regarding quality control. With the commercial aspects of the transaction more salient, and the surrogate mother more definitively "other," contracting couples are more likely to worry about how well she will care for their embryo. As one might expect, transnational surrogacy increasingly involves daily supervision and control of the surrogate mothers to ensure the health of the babies they deliver.¹⁴⁸

Artificial gestation is thus consistent with trends in the surrogacy industry towards increasingly explicit commodification of pregnancy and control of gestational mothers. Ectogenesis appears to offer an escape from some of the problematic aspects of human surrogacy. At the same time, the promise of gestation by machine reinforces the idea that gestation is an essentially fungible service, rather than a form of parenthood.

2. *The Preformationist Rhetoric of Surrogacy*

The actual or potential availability of artificial wombs resonates with the ideology that supports commercial surrogacy. In the world of surrogacy, for example, "the woman gives the baby 'back to the father,' as if it came from him in the first place" in the classic preformationist sense.¹⁴⁹ The technological alternative also rationalizes thinking of the surrogate as a container, which in turn justifies controlling how she mothers the child she is creating.¹⁵⁰ Artificial wombs can encourage this perspective even before they exist, as long as we believe in their possibility and desirability. When we predict a future in which gestation is mechanical and controlled,

Technologies: ARTs, Mistakes, Sex, Race, and Law, 12 COLUM. J. GENDER & L. 1, 54–76 (2003) (discussing the role that race has played in custody battles involving surrogacy contracts and clinic mistakes).

¹⁴⁸ See ROTHMAN, *supra* note 16, at 204 (describing the common lack of trust for caregivers); Krawiec, *supra* note 145, at 225 & n.109 (noting that "the ability to supervise and control the behavior of the surrogate" is one of the reasons for outsourcing, since in India, "surrogates typically live together at the clinic or in a supervised home"). Here, too, the global division of reproductive labor echoes the division between a husband and wife, or a wife and a nanny.

¹⁴⁹ ROTHMAN, *supra* note 16, at 80 (emphasis in the original).

¹⁵⁰ See Murphy, *supra* note 21, at 79 (arguing that artificial gestation could "contribute to excessive concern for 'quality control' in fetal development").

we facilitate classifying gestation as one of the “menial” parts of mothering, and thus as a legitimate subject of a commercial contract.

The legal system enables this process of increasing commodification by drawing a sharp distinction between “traditional surrogacy” and “gestational surrogacy.” Traditional surrogacy relies on artificial insemination of the gestational mother, who is also the genetic mother. In the most famous case of traditional surrogacy, *In re Baby M*,¹⁵¹ the Supreme Court of New Jersey declared the surrogacy contract void as contrary to public policy and recognized the “surrogate,” Mary Beth Whitehead, as the legal mother of Baby M.¹⁵² Gestational surrogacy, on the other hand, uses *in vitro* fertilization to ensure that the gestational mother has no genetic claim to the child. Gestational surrogacy is what makes global surrogacy possible and attractive, especially across racial lines.¹⁵³ Sometimes the egg comes from the intended mother but it may also be purchased. Certainly, some intended parents might prefer to select an egg separately from selecting a gestational mother. As the law is developing, however, they are effectively required to do so in order to be recognized as legal parents and, especially, to be assured of defeating any claim attempted by the gestational mother.

Because of the variety of ways that people use reproductive technology, the emphasis on genetics in the law of surrogacy cannot be explained merely by judicial willingness to enforce the parties’ contractual intent. The parties in *Baby M* had the same contractual intent as in any other case, and the reason the contract was not enforced was because of Whitehead’s genetic connection to the child. In contrast, the parties in *Perry-Rogers v. Fasano*¹⁵⁴ had no contractual intent: Donna Fasano was undergoing *in vitro* fertilization and was mistakenly given one of the Perry-Rogers’s embryos along with her own.¹⁵⁵ She gave birth to twin boys who were genetically unrelated to each other. In the ensuing custody battle, genes won.

¹⁵¹ 537 A.2d 1227 (N.J. 1988).

¹⁵² *Id.* at 1234. In an opinion infamous for its condescension, classism, and sexism, the courts held that Whitehead was the baby’s legal mother, awarded custody to the genetic father, and granted Whitehead visitation. *Id.* at 1253, 1261, 1263; see ROTHMAN, *supra* note 16, at 45–47 (criticizing the *Baby M*. court).

¹⁵³ This is not meant to suggest that culturally relevant racial categories have a natural or genetic basis. It is an observation that white American parents would not be having as many children through Indian surrogates if the children had to be created using the gestational mothers’ eggs. See Ikemoto, *supra* note 147, at 308 (noting the role that race plays in making international surrogacy attractive). Anxiety about maintaining racial categories probably plays a role in courts’ willingness to decide cases of disputed parentage on the basis of genetics. In the cases discussed *infra*, text accompanying notes 153–54, the Fasano family was white, and the Perry-Rogers family was African American. See Bender, *supra*, note 1477, at 1–3.

¹⁵⁴ 715 N.Y.S.2d 19 (N.Y. App. Div. 2000).

¹⁵⁵ *Id.* at 21.

The fantasy of an artificial womb depends on and maintains a patriarchal definition of parenthood and the reification of DNA as the essence of identity. The womb is seen as merely the maternal environment, separate from the fetus in the way we think of ourselves as separate from our environment. Genes, on the other hand, are imagined as cerebral rather than physical. They are a “blueprint,” not merely physical substances that take part in chemical reactions. In this cultural climate, the fantasy of the artificial womb helps us deny that gestation also shapes who we are, which is crucial to denying the parental status of a surrogate mother.

3. Responses to Epigenetics

While the cultural primacy of genes has facilitated the commodification of gestation through surrogacy contracts, discoveries in epigenetics have met with predictable responses in the reproductive technology industry. That is, the role of gestation in development has been either accepted or rejected depending on pre-existing ideology.

On the one hand, some businesses offering in vitro fertilization with purchased ova have seized on epigenetic discoveries to show their clients that they are the “real” mothers of the children they bear, despite the prevailing cultural fixation on DNA. For example, the “Recipient Information Sheet” for one egg broker includes a section titled “Women who give birth to donor egg babies are the biological moms.”¹⁵⁶ This section first discusses the importance of the gestational mother in providing the physical materials for constructing the child, invoking an analogy between the genes as blueprint and the gestational mother as builder.¹⁵⁷ It then goes on to explain epigenetics and the regulation of gene expression. This section concludes with the following passage, reassuring the gestational mother about her role:

A donor egg baby gets her genes from the donor; she gets the ‘instructions’ on the expression of those genes from the woman who carries her to term. . . .

The child who is born would have been a physically [and] no doubt emotionally different person if carried by his genetic mother. . . .

¹⁵⁶ NURTURE EGG DONOR PROGRAM, www.nurture.co.za/the-tricky-subject-of-disclosure (last visited Feb. 12, 2012).

¹⁵⁷ *Id.* (“[I]f you think of your dream child as your dream house, the genes provide merely a basic blueprint . . .”).

The implication of epigenetics is that the child inherits characteristics from the woman who carries the child even if the original DNA comes from a donor egg. In other words the birth mother influences what the child is like at a genetic level—it IS her child.¹⁵⁸

On the other hand, women participating as both gestational mothers and intended mothers in surrogacy contracts may reject this possibility. Responding to the passages quoted above, some participants on a surrogacy discussion board acknowledged “a fair bit of science” behind the claims, but others rejected them and the underlying science as flatly unacceptable.¹⁵⁹ Interestingly, some participants appeared to feel it was necessary to reject the scientific claim about genetic influence in order to reject the social conclusion—“it IS her child.”¹⁶⁰ On both sides, then, genes were seen as preeminent, so that genetic influence defined whose the child “IS.” This insistence on a biological answer to the question of ascribing parenthood is especially revealing in light of the fact that all the people in this discussion were involved in creating children through recently invented technologies that disrupt the biological mechanisms for reproduction in some fashion.

4. Artificial Gestation and the Ethic of Care

These responses to new scientific information are typical in that they seek to assimilate the new information into a pre-existing theory of reproduction; the tendency of a worldview to reinforce itself is one of the reasons that Firestone saw the potential for liberating uses of ectogenesis but did not expect the technology itself to produce liberation.¹⁶¹ Because of this tendency, the greatest opposition to ectogenesis among feminists comes from those who place a high

¹⁵⁸ *Id.*

¹⁵⁹ *Epigenetics—Importance of Birth Mother*, ALL ABOUT SURROGACY, www.allaboutsurgacy.com/forums/index.php?showtopic=42386 (last updated Aug. 4, 2008). One commenter asserted that epigenetic effects “can simply vanish” while genetic traits cannot. *Id.* Another acknowledged that environment could influence development but stated, “I do not believe for a second that I [sic] being the carrier does anything to change the genetics of the baby.” The same commentator drew a distinction between “epigenetics” and “ACTUAL genetics.” *Id.*

¹⁶⁰ *Id.*

¹⁶¹ See FIRESTONE, *supra* note 26, at 8–11 (arguing that “new technology, especially fertility control, may be used against [women and children] to reinforce the entrenched system of exploitation”). See also John A. Robertson, *Embryos, Families, and Procreative Liberty: The Legal Structure of the New Reproduction*, 59 S. CAL L. REV. 939, 1033 (1986) (“In the final analysis, the impact of noncoital technology on women depends on how it is used more than on what it is.”); see also Woolfrey, *supra* note 30, at 129–30, 134–37 (evaluating Firestone’s arguments in light of recent developments in ectogenesis).

value on cultural feminism's ethic of care.¹⁶² They fear that ectogenesis will be theorized and used in ways that further entrench an idealized norm of autonomous individuality that devalues connection, care, and dependence along with gestation.

Belongingness in a family can be analogized to belongingness in other political communities. In the United States, membership in a family and membership in the political community are defined through the same act of birth: "All persons born . . . in the United States . . . are citizens of the United States, and of the State wherein they reside."¹⁶³ In other words, if you are born here, then you are part of us. While this clause has rarely been construed by the Supreme Court, one of the Court's decisions about immigration law reveals the values embodied in the Citizenship Clause. In *Nguyen v. INS*,¹⁶⁴ the Court held that a child's connection with her mother, which arises from the act of birth, is an important part of the political connection that gives rise to the right to citizenship.¹⁶⁵

The family is also a political institution, and initial membership has, traditionally, been established according to *jus soli*: a child's family is defined according to the woman from whom she emerges. For the state to create a child in an artificial womb would be to create the family-level equivalent of a stateless person. Just as the state cannot deny citizenship to a child born here, the state should not be able to deny family membership to a child by creating her as an intentional orphan. The child would be "born without the presence of a woman who is most likely to have a physical and psychological bond to her."¹⁶⁶ While a stateless person might find a home and an artificially gestated child might find a family, this is not a condition to be desired or sought. State-initiated or state-mandated ectogenesis would thus threaten important values that are protected by family structure and parental rights.¹⁶⁷

¹⁶² See, e.g., ROTHMAN, *supra* note 16, at 241–42 (arguing against the surrogacy relationship because children "enter the world in . . . a physical and social and emotional relationship with the woman in whose body they have been nurtured").

¹⁶³ U.S. CONST. amend. XIV, § 1.

¹⁶⁴ 533 U.S. 53 (2001).

¹⁶⁵ See *Nguyen v. INS*, 533 U.S. 53, 64–68 (2001) (stating that the connection to the mother implies a connection to the United States, which justifies distinguishing between mothers and fathers with respect to their ability to transmit citizenship).

¹⁶⁶ Maureen Sander-Staudt, *Of Machine Born? A Feminist Assessment of Ectogenesis and Artificial Wombs*, in *ECTOGENESIS*, *supra* note 7, at 109, 124.

¹⁶⁷ State-controlled ectogenesis would also threaten the commitment to pluralism that requires deference to individuals on family matters. See Jennifer S. Hendricks, *Essentially a Mother*, 13 WM. & MARY J. WOMEN & L. 429, 481 (2007) (discussing how the market is not necessarily "committed to maintaining pluralism or ensuring the transmission of a variety of cultures").

In contrast, if ectogenesis were used voluntarily for procreation, in most cases the resulting child would be welcomed into a waiting family. Some parents might even feel more connected to a child developing in the machine than to one growing inside a partner or a paid gestational mother. Perhaps, for example, the machine would have a window; visually oriented people might feel closer because they could see the fetus.¹⁶⁸ Nonetheless, cultural feminist theories suggest ways in which the practice of ectogenesis could have harmful effects on the prospective parents, the resulting children, or society as a whole.

The practice of ectogenesis may actually encourage the parties involved to abandon the fetus. First, further commodification of reproduction might foster a consumer mentality among prospective parents. This attitude has already appeared in a few surrogacy cases, in which prospective parents have tried to insist on abortions or simply renege on taking legal custody of the child.¹⁶⁹ Second, because part of the promise of artificial gestation is “better babies,” the practice of ectogenesis might tend to lower the threshold at which parents decide to abort due to fetal anomalies.

Finally, with ectogenesis, everyone who participated in the child’s conception would have the physical ability to do what a pregnant woman cannot: walk away. It is easier to walk away from a microscopic embryo than from a newborn baby. Even later in the process, when abortion is less likely to be requested and may be prohibited, it is easier to walk away if you are a medical tourist in a poor country. And even when it is presumably hard to walk away, parents sometimes do. On the other hand, people who seek parenthood through technology have often exhausted other means and dearly wish to have a child. The vast majority of parents who rely on gestational surrogates raise the resulting child. While in a few cases intended parents have tried to refuse custody, they appear to have done so on the assumption that the gestational surrogate would

¹⁶⁸ See Beth A. Burkstrand-Reid, *The More Things Change . . . : Abortion Politics and the Regulation of Assisted Reproductive Technology*, 79 UMKC L. REV. 361, 369 (2011) (describing how seeing an embryo or fetus on ultrasound can influence a woman to think of herself as a mother, even before an *in vitro* embryo is implanted).

¹⁶⁹ See, e.g., *In re Marriage of Buzzanca*, 61 Cal.App.4th 1410, 1412 (Cal. Ct. App. 1998) (describing the facts of the case, in which a husband disclaimed responsibility to a child born pursuant to a surrogacy agreement after divorcing); Tom Blackwell, *Couple Urged Surrogate to Abort Fetus Due to Defect*, NAT’L POST (Can.), Oct. 6, 2010, at A1 (reporting that a Canadian couple discovered the fetus carried by their surrogate mother likely had Down’s syndrome, and that the couple then requested that the surrogate have an abortion).

otherwise keep the child.¹⁷⁰ Such abandonment might thus be less likely when it is clear that no other parent is available.

Some commentators have also expressed concern that a child created through artificial gestation would be a “little alien,” a stranger to the human family who arrives without the concrete connection of a blood and flesh relationship.¹⁷¹ This concern is not directed at concrete developmental impairments that might result from some reproductive technology; rather, the concern is an existential one. Does the creation of children in this way represent a fundamental rejection of human connectedness, our nature as social beings? This is an important question. But it is a leap to suppose that this existential question will inherently affect the individual child herself, as opposed to affecting the general society’s understanding of the human situation. Moreover, given that technology has a way of creating its own inevitability, it is unwise to suggest that a group of children—who may come into existence whether we approve or not—are in some way non-human.¹⁷²

Instead, these concerns should be directed at the larger society and how it might be affected if the fantasy of artificial gestation were realized. The connectedness and physical experience of pregnancy play an important role in cultural feminist theory. The experience of pregnancy and related biological functions are said to foster in women a greater sense of connection to others and a greater capacity for empathy.¹⁷³ If that is true, then frequent use of ectogenesis would decrease the quantity of empathy available in society as a whole. Overall alienation from the body and from others would increase.

On the other hand, it seems unlikely that the correlation between female embodiedness and relational capacity is created at the individual level. Girls and women may exhibit a typically “female” sense of connectedness without having experienced any uniquely female biological capacity beyond living in a female body.¹⁷⁴ The

¹⁷⁰ *But see Buzzanca*, 61 Cal.App.4th at 1413–1414 (expressing amazement that the intended father tried to disclaim the validity of the surrogacy agreement even after he encouraged the trial court to accept a stipulation that the surrogate and her husband were not the legal parents).

¹⁷¹ ROTHMAN, *supra* note 16, at 103.

¹⁷² Consider, for example, the dystopia in KAZUO ISHIGURO, *NEVER LET ME GO* 260–61 (2005), in which clones created through ectogenesis and raised in orphanages serve as organ donors because society believes them to lack souls. Consider also the medieval recipe for artificial gestation, which was said to produce a child without a soul. *See supra* note 45 (discussing this medieval belief).

¹⁷³ *See* Robin West, *Jurisprudence and Gender*, 55 U. CHI. L. REV. 1, 2–3 (1988) (outlining the connection thesis); Sander-Staudt, *supra* note 166, at 117 (“Care ethicists speculate that the physical aspects of women’s reproductive biology can contribute to the development of a relational ethical perspective.”).

¹⁷⁴ The foundational psychological work in this area, CAROL GILLIGAN, *IN A DIFFERENT*

association between pregnancy and a female capacity for relationship appears to operate at a cultural rather than an individual level. In recent years, many feminist theorists have moved beyond the essentialist version of cultural feminism that associates the ethic of care with female bodies. Instead, they emphasize the universality of vulnerability, connectedness, and dependence on others, a universality that is often masked by the cultural emphasis on individual autonomy.¹⁷⁵

As liberal feminists would point out, ectogenesis could be valuable precisely because it would disrupt the association of women with providing care. This disruption, however, would come at the cost of rejecting and devaluing embodied care itself. More fundamentally, it would also disrupt the association between being human and being *cared for*.¹⁷⁶ After all, it is not only women who experience the connection and dependency of gestation; it is everyone, at least so far. Rather than looking at pregnancy and concluding that *women* are especially connected to others, we could conclude that everyone begins in a fundamental state of connected dependence. Ectogenesis would deprive us of this shared archetype of human connection.

CONCLUSION

Artificial gestation, if technologically possible, is probably in our distant future. Nonetheless, the belief that it is just around the corner plays a role in the rhetoric that shapes our understanding of reproduction and our legal analysis of abortion and surrogacy. The result is the further entrenchment of the particular model of reproduction that gave rise to the fantasy in the first place—genetic preformationism—at the expense of other models of pregnancy as the gradual creation of a child and a fundamental experience of connection.

VOICE: PSYCHOLOGICAL THEORY AND WOMEN'S DEVELOPMENT (1982), focused on moral development in children. *See, e.g., id.* at 25 (describing an experiment which "suggest[ed] that the edge girls have on moral development during the early school years gives way at puberty with the ascendancy of formal logic thought in boys").

¹⁷⁵ *See, e.g.,* FINEMAN, *supra* note 5, at 30–40 (discussing the universality of dependency and the myth of individual autonomy).

¹⁷⁶ It is possible that this disruption would operate on the individual level by interfering with the ectogenic child's relational capacity. *See* Sander-Staudt, *supra* note 166, at 121 (expressing uncertainty as to how ectogenesis will "affect the relational potential of a child").