

“WOMB TRANSPLANT BABIES”: A PRELIMINARY EXPLORATION OF RECENT BIOMEDICAL ADVANCES

PAIGE COMSTOCK CUNNINGHAM, JD
EXECUTIVE DIRECTOR

In September 2014, a little boy named Vincent was born prematurely, but healthy. While such a birth would usually attract the attention of family and friends, baby Vincent’s arrival made world news. He is the world’s first “womb transplant baby.” Like Louise Brown, Vincent is marked for history. Weeks after Vincent’s birth, two more women gave birth to boys, this time each mother carrying her child in the same womb in which she herself was gestated.¹

Of all the factors that contribute to infertility, Vincent’s mother’s is considered the most untreatable. She has “absolute uterine factor infertility,” indicating the absence of a uterus, which can be caused by a variety of diseases (such as cervical cancer), that lead to hysterectomy. Due to her Rokitansky syndrome, she was born without a uterus and only one kidney.² A woman with this condition may have functioning ovaries, permitting her to become a genetic mother, but not a biological mother able to gestate her own child. That is, until now.

This essay explores some of the research and issues raised by uterus transplantation. As is appropriate for an emerging biomedical technology, we approach these new developments with caution. My conclusions are preliminary. While I address some of the arguments pro and con, I will merely suggest some of the theological and biblical themes. These merit a lengthier treatment and charitable dialogue with others. As always, we invite readers to submit comments.

A Brief History of UTx

Details of the uterus transplants and Vincent’s birth were disclosed in a “proof of concept” paper shortly after the event.³ Vincent’s mother and eight other women are part of a groundbreaking research study in Sweden. The fifteen authors have expertise in Ob/Gyn, transplantation, anesthesiology and intensive care, IVF, and perinatal brain injury. Their research, unlike early attempts, was based on multiple studies in animal models.

The first reported uterus transplant (UTx) occurred more than a decade ago. In 2000, UTx was performed on a 26-year-old woman in Saudi Arabia who had undergone a hysterectomy after severe postpartum hemorrhage.⁴ The organ came from a living donor.⁵ The patient experienced serious blood clots, and necrosis of uterine tissue, necessitating a second hysterectomy to remove the uterus. Ten years later, a second transplant was attempted on a woman in Turkey, this time using an organ from a heart-beating, brain-dead 22-year-old woman. In 2013, the recipient became pregnant via IVF, but miscarried.⁶

Upending accepted standards of medical research, the first human womb transplant in Saudi Arabia was followed, not preceded, by more than a decade of animal research.⁷ Not only was it first attempted in a human subject, rather than in an animal, it was performed by a team with no relevant published research, and no ethics discussion. (When transplant surgeons were included in subsequent UTx attempts, rather than only ObGyn surgeons, success rates improved.) Most of the subsequent animal research used subjects that did not survive the experiment, by design or by necessity. Organs were retrieved and implanted in mouse, rat, rabbit, sheep, pig, and non-human primate (NHP) subjects. Pregnancy was achieved only in mice and rats. Their pregnancies were terminated mid-gestation. One research team that studied UTx in baboons stated that UTx in humans “should be preceded by extensive studies in non-human primate species.”⁸ Their recommendation has been affirmed by FIGO (the International Federation of Gynaecology and Obstetrics), which expressed concern that researchers have been pressured to act prematurely, experimenting on a woman without “significant research in animal models, including primates.”⁹

Long-term success after UTx is generally defined as resumption of menstruation. In a recent study using 16 baboons (one unsuccessful group of 6, and a second group of 10), only six resumed menstruation, and none achieved pregnancy, despite 61 mating attempts.¹⁰ Based on these results, the authors concluded that only the uterus should be

transplanted (without the oviducts), and that IVF should be used.

As of mid-2014, no pregnancy in primates, let alone successful birth, has been reported.¹¹ Research with NHPs is associated with additional problems. One transplant surgeon noted the “emotional difficulties” due to “their close kinship with humans.”¹² To summarize: despite lack of success with NHPs, UTx has been performed on eleven women: one in Saudi Arabia (uterus from live donor, unsuccessful, uterus removed); one in Turkey (uterus from dead donor, miscarriage after IVF pregnancy, not reported in the literature); and nine women in Sweden (all from living donors, two unsuccessful transplants requiring hysterectomies, and three live births to date) The womb that baby Vincent grew in was donated by a 61-year-old friend of his mother.¹³

In 2007, a team of researchers at New York Downtown Hospital announced research involving retrieval of the uterus. Of 1800 eligible patients, 150 were multi-organ donors, and of these, nine families consented to removal of the uterus.¹⁴ Some questioned whether the donor who consents to multi-organ retrieval would contemplate removal of her uterus, as that had not previously been attempted.¹⁵ No successful uterus transplant has been reported in the U.S.

The Best Case for Uterus Transplantation

Science, Research, and the Quest for Knowledge

We are designed to explore, to learn, to experiment, to press the boundaries of human knowledge. God has created us with a drive to develop our understanding of ourselves and the world around us. This may be understood as an impetus behind the technological imperative, a concept that has two dimensions: the continual expansion of the boundaries of what is technologically possible, accompanied by the inevitable pressure for societal adoption of the technology. Look at the global embrace of digital technology as a

current example.

But the reality of our fallen, rebellious state is that we do not want limits placed on what, how, and how far we may explore. The assumption seems to be that technology is neutral, and that its development is an unqualified good. This often translates into *that which can be done, must be done*. The temptation is equally applicable to medical research, perhaps even more compellingly, since human health, rather than convenience and comfort, is at stake.¹⁶ And yet, the benefits of biomedical technological innovations are remarkable for their disease-curing, injury-healing, and life-enhancing properties. The restoration of a womb to the womb-less may accomplish all of the above, and more. It can provide emotional, psychological,

“The assumption seems to be that technology is neutral, and that its development is an unqualified good. This often translates into that which can be done, must be done.”

and social healing as well, bringing the once-permanently infertile woman into the community of birth mothers.

The path from medical research to everyday medical practice is a relatively short one. In 1985, Dr. Robert Jarvik noted that the second surgery to implant an artificial heart was “routine,” and an assisting nurse called it “dull.”¹⁷ From the miraculous to the routine by the second experimental procedure. Could this be a harbinger of how we might view the ‘miraculous’ experiment that gave a uterus to a woman without a womb, and the hope of a child to the hopeless? The accelerating speed of front edge medical research turns ideas into experiments into treatments in micro-generations. Medical research can quickly be transferred into clinical practice, making the fruit of sophisticated, multi-specialized procedures available to many.

Medical research in one area may serendipitously benefit another

area, particularly here, where organ transplantation and assisted reproduction technologies converge. The technologies and specialties that converge to solve a problem as intractable as absolute uterine factor infertility (AUI) may one day be a bridge to other medical technologies. For example, deeper understanding of the vasculature and anastomosis techniques needed to attach the uterus to existing blood supply may contribute to the development of an artificial uterus. One might argue that there is a “transference” of ethical arguments as well. Foundational to developing an ethical rationale for UTx was the first successful transplant of a human hand in 1998, a nonvital organ transplant intended to improve quality of life. Once nonvital, life-enhancing transplants are

accepted in principle, the door opens up to myriad research possibilities.

Human Flourishing and Personal Benefit

From the recipient’s perspective, UTx offers what was once unthinkable, the possibility of experiencing pregnancy and childbirth. The mother has the opportunity to bond with her child during pregnancy, initiating the maternal-child bond at least nine months earlier, and in a more intimate way, than other options such as adoption.

One of the limited options currently available to women with AUI is to secure the services of a gestational surrogate. Assuming she has functioning ovaries, the woman and the father-to-be can provide the egg and sperm to create an embryo via IVF, to be transferred to the surrogate. They would have an ongoing genetic

relationship to the child, but not the biological connection of pregnancy. The introduction of a third party introduces uncertainty, such as the possibility the surrogate may refuse to relinquish the child, triggering a legal battle. Or, the surrogate may reside in a country that restricts gestational surrogacy and the emigration of children born to surrogates. The possibility of UTx eliminates these potential complications, giving peace of mind to the infertile couple.¹⁸

There are also ethical concerns about imposing the risk of pregnancy morbidity and mortality on the surrogate. Some women are willing to assume a risk for the sake of their own child that they would not ask of a woman who might gestate that child. When coupled with concerns about exploitation, disregard for the dignity of the surrogate, viewing her body instrumentally, and the potential for coercion, UTx becomes a more attractive alternative.

Ethical Concerns

Uterus transplantation raises a complex series of ethical questions. Michael Olausson, a member of the Swedish research team, noted that “without doubt, UTx covers all major aspects of human ethics including non-maleficence, autonomy, beneficence, justice, and dignity.”¹⁹ At the moment, these concerns seem to outweigh any of the benefits identified above.

Conflict of Interest

A research team may be driven by the desire to be the first to announce a breakthrough, to establish proof of concept. The Swedish team obliquely criticized the Saudi Arabian researchers who rushed to do the first uterus transplant without experience in relevant surgical technique, and despite the lack of research in animal models. The hubristic impulse to be “first in the world” can lead medical researchers to ignore the state of research, take ethical shortcuts, miscalculate potential risks and benefits, and, at worst, distort

the possibility of genuinely informed consent by the proposed recipient.

Selection of Women

Unlike traditional solid organ transplants, a uterus transplant is not performed to save a woman’s life. The goal of organ transplantation, and measure of its success, is a functioning transplanted organ. This, in turn, would imply elimination of the threat of death, or at least a reduction in the severity of the illness or symptoms. In the case of UTx, the goal is not ultimately the health of the recipient, even though it could be argued that the surgery restores a “lost” bodily function. Rather, the goal is pregnancy and the birth of a healthy child.

The transplant recipient is not selected because her illness has become life-threatening. In fact, to be considered for UTx, she needs to be in “extremely good general health,” cancer-free if her uterus was removed due to cancer, and <38 years old.²⁰ She needs adequate vascular structures to support the uterus (which the Saudi Arabian woman apparently did not have), and no scarring from previous surgery, such as oncological surgery. A solid organ (non-uterine) transplant recipient can have a healthy pregnancy and delivery if her body has not rejected the transplant

the donor or the donor’s next of kin. The demographic details of the eleven women have not been disclosed, but it is likely that they are educated and sufficiently informed about their health that they are able to understand their situation. These are women who are willing to go to any lengths and expose themselves to risks for the sake of having a child of their own. In the first case of the Saudi recipient, it was noted that the researchers were pressured to proceed without adequate animal studies and without the necessary transplant skill.

However, these women may not understand their participation as research subjects, rather than only as patients. When a physician prescribes treatment for a particular condition, the recommendation is based upon years of research in animal models, testing for benefits and efficacy, assessing proper dosages for particular populations, and evaluating the risk and severity of side effects. This is in marked contrast to the goals and design of medical research, where human subjects are used to determine risks and adverse effects. Were the eleven women who received womb transplants given genuinely informed consent? As the history of IVF illustrates, couples pursuing infertility treatment will say yes to almost anything they can afford, in the

The hubristic impulse to be “first in the world” can lead medical researchers to ignore the state of research, take ethical shortcuts, miscalculate potential risks and benefits, and, at worst, distort the possibility of genuinely informed consent by the proposed recipient.

within one year. Some drugs may be modified in anticipation of pregnancy, and these women have higher risks of complications.²¹

Informed consent is a bedrock principle of research ethics. Uterus transplantation would require the informed consent of a minimum of two people: the uterus recipient, and

pursuit of that which they deeply yearn for: a baby of their own. At least the risks of IVF are fairly well identified—if not adequately empirically studied—but womb transplant research is identifying risks case by case.

Women’s Health

As stressed above, UTx is not designed to treat a life-threatening condition.

It is an elective procedure to achieve a temporary goal. Advocates describe UTx as a quality-of-life or “life-enhancing” procedure.²² Furthermore, “uterus transplantation is the first ephemeral type of transplantation that has been introduced in which the graft is not intended for lifelong use.”²³ Whether or not pregnancy is successful, the womb must be removed.

As with any surgery, the recipient undergoes the risks of serious surgery. There is a greater risk of hemorrhage, and a risk of infection. Even if the surgery is immediately successful, she may experience a post-surgical infection as tissue from the uterus and surrounding structures necrotizes or dies. The recipient also bears the risks concomitant with solid organ transplantation. Because she receives an allogeneic (donor) organ, there is the risk of rejection, necessitating the use of immunosuppressive drugs.

Although there have been only three successful human births, the suggested

guidelines are that the woman retains the uterus for a maximum of two pregnancies. A second major surgery, a hysterectomy, would be required to remove the now-unnecessary organ. A minimum of two major surgeries—transplantation and removal—imposes twice the risks of ordinary organ transplantation. She will face those risks, regardless of the success of transplantation, which means a successful menstrual cycle, or pregnancy and childbirth. At the worst, she will undergo two major surgeries for a “quality of life” or “life-enhancing” procedure.

Because the procedure is so new, and trials in non-human primates are so limited, we do not know the long-term effects either on the woman’s health or the child’s health and well-being.

Uterus Donor

Most of the focus in the literature is on the recipient, but there is always a second party involved. Without a donor, there would be no uterus to transplant. In the

case of a deceased donor, concerns about surgical risk are eliminated, but “at brain death major systemic inflammatory changes occur which may negatively affect graft survival.”²⁴ If the time between brain death, organ recovery, and transplant could be shortened, the outcomes might improve. Because the traditional issues regarding consent apply, the deceased donor’s family may also be involved.

A living uterus donor is analogous to a kidney or partial-liver donor. A living donor may be older than 50, and her uterus could be rejuvenated for a successful pregnancy, as witnessed by the number of postmenopausal women who have given birth to their own grandchildren as surrogates, or who have given birth via IVF with oocyte donation. FIGO recommends against using a malformed uterus, or one from a young woman who has not completed childbearing.²⁵ Removal of the uterus of a living donor incurs the risks of hysterectomy. Although a major surgery, it is not uncommon; about

The Center for Bioethics & Human Dignity
Presents the 22nd Annual Summer Conference

SCIENCE, RESEARCH, AND THE LIMITS OF BIOETHICS



Call for Proposals

Proposals are now being accepted for the upcoming CBHD summer conference. All abstracts must be submitted prior to **January 31, 2015** | cbhd.org/cfp for more information.

35% of women in the U.S. have had a hysterectomy by age 60.²⁶ Removal of the uterus for transplantation takes longer than a hysterectomy, and involves more tissue (arteries and veins), but the complication rate does not appear to be elevated.²⁷ Unlike women who undergo hysterectomies for serious health reasons, removal of a healthy uterus for any reason is rare, and there is no published data about risks for the latter group.

The donor may benefit psychologically. Often, she is the mother or close relative of the recipient, and alleviating a loved one's distress may motivate the donor. She may feel particularly close to the child, who might be seen as a "miracle baby," particularly if she is the grandmother. On the other hand, if the transplant fails, she may feel devastated. Obviously, there is no data about the social impacts of a child being gestated in the same womb that carried his mother, either for him, his parents, or his grandmother. (To date, all children born from UTx are boys.) If altruistic

are less obvious. There does not seem to be a compelling reason for a child to be intentionally created via IVF and implanted in an 'ephemeral organ' as a subject of innovative medical research. It might be argued, on metaphysical grounds, that existence, regardless of risk, is preferable to non-existence. But such a position effectively sacrifices multiple ethical and theological goods on the altar of one specific good. How can we then say that womb transplantation is such a good that it trumps all other goods? How does the couple articulate their particular understanding of the good that is being pursued?

On the other hand, as a resident in the donated uterus, the child would be subjected to potential harms, such as those experienced by other solid organ transplant recipients: miscarriage and induced abortion, preeclampsia, hypertension, diabetes, C-section delivery, prematurity, and low birth weight²⁹ (although outcomes notably have been improving for solid organ

been reported at the time of writing. There are additional concerns about breastfeeding and the exposure of the child to immunosuppressive drugs.³²

Justice and Resource Allocation

A familiar bioethical principle is justice, which attends to circumstances beyond the individual patient or research subject. Fair allocation and distribution of resources is of particular concern when dealing with matters relating to life and death, treatment of disease, alleviation of pain and suffering, and restoration of function. In evaluating all the possible avenues of research, how do we determine not what we *can* do, but what we *ought* to do? And, among the identified obligations, how do we determine what we can *afford* to do? These are not abstract questions to be determined by the research team, or by the patient and her physician. They require us to articulate a vision of the common good, and how a particular proposal advances that vision.

In the U.S., we have a commitment to remedying congenital malformations such as cleft palate, clubfoot, and the more costly spina bifida. Does being born without a uterus fit into the same category? If so, what about a uterus that is removed due to cancer? From the perspective of the woman currently without a uterus, there is no compelling reason to make a distinction as to the reason. To do otherwise might provoke claims of discrimination and denial of equal treatment. Once UTx becomes as "routine" and "boring" as Dr. Jarvik's artificial heart transplant, would it be made available to remedy other uterine malformations that adversely affect fertility, such as a septate uterus or fibroids? We have seen all too many times how a bright ethical line dims and is redrawn to accommodate newly induced demand or appetite for previously "miraculous" medical technologies. When it comes to mainstreaming experimental technologies, particularly if they can be adapted to a profitable business model, the slippery slope argument does have

Little attention is paid in medical, ethical, or popular discussions to the benefits or risks to the child. . . . There does not seem to be a compelling reason for a child to be intentionally created via IVF and implanted in an 'ephemeral organ' as a subject of innovative medical research.

surrogacy by family members is in any way analogous, caution is warranted, as familial or friendship arrangements can create more emotional and ethical complications than commercial surrogacy.²⁸

For the Child

Little attention is paid in medical, ethical, or popular discussions to the benefits or risks to the child. Many of the ethical commentaries focus on the emotional state of the recipient, as if the most important ethical consideration is the desire of a woman to experience pregnancy. Specific benefits for the child

recipients). Some of the higher risks for other organ recipients may be due to the underlying disease that necessitated the transplant, but the risk of exposure to immunosuppressant drugs remains for UTx recipients. These effects include "decreased vascular plasticity, placentation defects, and loss of innervation."³⁰ Vincent's mother experienced pre-eclampsia, mild headache, proteinuria and lowered platelet count, which necessitated the premature delivery at 31 weeks and 5 days.³¹ Clinical data on the second and third women in the Swedish study who each gave birth to a son recently, has not

traction.

Another aspect of the common good is the commitment to care for the most vulnerable, the marginalized, and the disadvantaged. Is this situation analogous to orphan diseases that affect only a handful of people worldwide, and for which it is prohibitively expensive to develop drug therapies? The scope of the problem is unclear. One study estimates the number of women affected is more than 12,000 in the U.K., and “several thousands” in the U.S.,³³ while another suggests as many as 9 million women of reproductive age in the U.S. have had a hysterectomy,³⁴ although it is unclear how many had completed their intended childbearing.

The medical resources, combined pool of expertise, years of animal research, and sums of money expended might be considered disproportionate to the nature of the problem being addressed. A proposed U.S. uterus transplant was estimated to cost \$500,000.³⁵ For the individual woman, the scenario might resemble a credit card commercial: the “cost” of the child is “priceless,” and for everything else, there’s MasterCard®. One might justifiably argue that no price tag can be attached to the value of a particular child. However, the avenues being pursued are initiated prior to the existence of any child, in order to create that child, and not to save the life of a child already in existence.

Considering the transfer of UTx technology to a low-income, low-resource, pronatalistic society such as Pakistan highlights some of the unanswered ethical questions.³⁶ For Pakistani women, adoption and gestational surrogacy are culturally foreclosed options; there is tremendous pressure on the new bride to be pregnant within months; and preference for sons dominates childbearing. The recipient may be pressured to undergo UTx, and unable to give truly informed consent. With its history of organ trafficking, there is reason to suspect that poor women could be exploited for their uterus. Finally, the healthcare team is

vulnerable to committing graft, and may be ill equipped for the complexities of UTx. In summarizing the potential negative impact of UTx, critics of introducing womb transplantation in Pakistan question, “should this technology *be developed [at] all?*”³⁷ I would suggest that this same question be asked before uterus transplants arrive in the U.S. It is not too late to reject this technology, perhaps not on quite the same grounds that would apply in Pakistan, but for serious reasons nonetheless.

Additional Reflections

None of the above arguments requires an explicitly Christian perspective, but there are important biblical and theological considerations to note. It would be helpful to sketch a brief theology of infertility.³⁸ Infertility must be understood within the context of the sin and brokenness that mars all of creation. God designed humankind to be fruitful and multiply, yet not every couple can anticipate a child. We must acknowledge that parenthood is a divine gift, not something we are owed. God sovereignly opens and closes the womb, enabling some women, but not others, to bear children. We cannot explain the mystery of God’s providence, but we must understand it in the context of God’s purposefulness. His ways and purposes are far above our own. From our limited human perspective, it is regrettable that for some couples, biological children may not be part of God’s good and gracious will. Nevertheless, we must acknowledge that his will is always good and gracious. Walking through the dawning realization of infertility is a trial that can motivate us to pray, whether we are the infertile couple or family or friends.³⁹ This pattern of humility and trust is radically at odds with the aggressive, and extravagantly costly, pursuit of a “child of one’s own” via uterus transplantation.⁴⁰ Elsewhere, we have cautioned against the introduction of third parties via use of donor gametes. The necessary participation of third parties in all assisted reproductive

technologies “break[s] the connection between love-giving and life-giving in marriage.”⁴¹ One might counter that a transplanted uterus would indeed permit the love-giving, life-giving act of procreation in the mother’s (transplanted) womb. While it does not contribute genetic material, a donated womb is a biological matrix surrounding the child, perhaps influencing him in ways we do not presently know. Furthermore, IVF has been deemed to be necessary for pregnancy after UTx, forestalling the possibility of in utero conception. At the very least, the involvement of a close relative such as a mother or sister as a womb donor sets up the possibility of future conflict.

The three “womb transplant” babies that have been born are each precious little ones, made in God’s image. While we can imagine their parents’ joy, we must not overlook the deeper Christian theological and ethical considerations that remain to be explored. Serious identified ethical concerns counsel that womb transplants should not be continued. The lack of a solid theological endorsement adds greater weight to the “do not touch” advice. I would conclude that Christians should avoid this tempting technology. ●●●

- 1 Keith Perry, “Two Women Give Birth with Wombs Donated by their Mothers,” *The Telegraph*, December 2, 2014, <http://www.telegraph.co.uk/news/newstopsis/howaboutthat/11269613/Two-women-give-birth-with-wombs-donated-by-their-mothers.html>.
- 2 Mats Bränström et al., “Livebirth [sic] after Uterus Transplantation,” *The Lancet* published electronically October 6, 2014, doi:10.1016/S0140-6736(14)61728-1.
- 3 Ibid.
- 4 Lili Elbe is said to have died after a uterus transplant in 1931, due to organ rejection, but her case is not reported in the literature. She was born Einar Mogens Wegener, and underwent five surgeries to remove male sex organs and transplant ovaries and a uterus. HBS International, “Nicole Kidman as the World’s First Reported Woman with Surgically Corrected Harry Benjamin Syndrome,” *SHB Europe*, <http://www.shb-info.org/kidmanelbe.html>.
- 5 Wafa Fageeh et al., “Transplantation of the Human Uterus,” *International Journal of Gynecology and Obstetrics*, 76, no. 3 (2002): 245-251.

6 Bränström et al., "Livebirth after Uterus Transplantation"; Tara Brady, "Woman Who Fell Pregnant after Undergoing World's First Successful Womb Transplant Has Lost Her IVF Baby," *Daily Mail*, May 15, 2013, <http://www.dailymail.co.uk/health/article-2324950/Woman-22-underwent-worlds-successful-womb-transplant-loses-IVF-baby.html>.

7 Ash Hanafy et al., "Uterine Transplantation: One Human Case Followed by a Decade of Experimental Research in Animal Models," *Australian & New Zealand Journal of Obstetrics and Gynaecology* 51, no. 3 (2011): 199-203.

8 Liza Johannesson et al., "Uterus Transplantation in a Non-Human Primate: Long-Term Follow-Up after Autologous Transplantation," *Human Reproduction* 27, no. 6 (2012): 1641, doi: 10.1093/humrep/des093.

9 Hanafy et al., "Uterine Transplantation," 202.

10 Johannesson et al., "Uterus Transplantation in a Non-Human Primate," 1640-1648.

11 Iori Kisu et al., "Uterine Transplantation in Primates: A Mini-Review of the Literature," *Transplantation Proceedings* 46, no. 4 (May 2014): 1212-1216.

12 Andreas Tzakis, "Nonhuman Primates as Models for Transplantation of the Uterus," *Fertility and Sterility* 100, no. 1 (July 2013): 61.

13 Fageeh et al., "Transplantation of the Human Uterus"; Bränström et al., "Livebirth after Uterus Transplantation."

14 Giuseppe Del Priore et al., "Human Uterus Retrieval From a Multi-Organ Donor," *Obstetrics & Gynecology* 109, no. 1 (January 2007): 101-104.

15 Women's Health Policy Report, "New York Team to Attempt First U.S. Uterus Transplant, Raises Ethical Concerns," *National Partnership for Women & Families*, January 17, 2007, http://go.nationalpartnership.org/site/News2?abbr=daily2_&page=NewsArticle&id=9284.

16 Bjørn Hofmann, "Is There a Technological Imperative in Health Care?" *International Journal of Technology Assessment in Health Care* 18, no. 3 (2002): 675-689; Barbara A. Koenig, "The Technological Imperative in Medical Practice: The Social Creation of a 'Routine' Treatment," in *Biomedicine Examined*, ed. Margaret Lock and Deborah Gordon (Netherlands: Springer, 1988), 465.

17 Koenig, "The Technological Imperative in Medical Practice," 465.

18 Although uterus transplant obviously relates to female infertility, I prefer to speak of the infertile couple. For Christian married couple, infertility is a shared reality. Although historically it was assumed that the wife was always the responsible party, male factor infertility rates are the same as female factor.

19 Michael Olausson, "Ethics of Uterus Transplantation with Live Donors," *Fertility and Sterility* 102, no. 1 (July 2014): 40-43.

20 Mats Bränström et al., "Uterus Transplantation: Animal Research and Human Possibilities," *Fertility and Sterility* 97, no. 6 (June 2012): 1273.

21 Hanafy et al., "Uterine Transplantation."

22 Tzakis, "Nonhuman Primates as Models for Transplantation of the Uterus," 61.

23 Bränström et al., "Livebirth after Uterus Transplantation," 9.

24 Bränström et al., "Uterus Transplantation," 1273.

25 Jacques Millez, "Uterine Transplants: FIGO Committee for the Ethical Aspects of Human Reproduction and Women's Health," *International Journal of Obstetrics and Gynecology* 106, no. 3 (2009): 270; Hanafy et al., "Uterine Transplantation," 202.

26 Olausson, "Ethics of Uterus Transplantation with Live Donors."

27 Ibid.

28 Sam Everingham, "Use of Surrogacy by Australians: Implications for Policy and Law Reform," in *Families, Policy and the Law: Selected Essays for Contemporary Issues in Australia*, ed. Lana Hayes and Daryl Higgins (Melbourne, Australia: Australian Institute of Family Studies, 2014), 67-80; Matthew Tieu, "Altruistic Surrogacy: The Necessary Objectification of Surrogate Mothers," *Journal of Medical Ethics* 35, no. 3 (2009): 171-175. doi:10.1136/jme.2008.024679.

29 Sandor Nagy et al., "Pregnancy Outcome in Liver Transplant Recipients," *Obstetrics & Gynecology* 102, no. 1 (2003):121-128; Vincent Armenti et al., "Report from the National Pregnancy Registry: outcomes of pregnancy after transplantation," *Clinical Transplants* (2006):57-70. See also, Mahlia Ahmad and Ron Shapiro, "Transplantation and Pregnancy," *Medscape*, May 1, 2014, <http://emedicine.medscape.com/article/429932-overview?showall>.

30 Olausson, "Ethics of Uterus Transplantation with Live Donors," 42.

31 Bränström et al., "Livebirth after Uterus Transplantation," 6.

32 Kristina Muñoz-Flores Thiagarajan et al., "Safety Considerations: Breastfeeding after Transplant," *Progress in Transplantation* 23, no. 2 (2013):137-146, doi: 10.7182/pit2013803.

33 Hanafy et al., "Uterine Transplantation."

34 Anjana Nair et al., "Uterus Transplant: Evidence and Ethics," *Annals of the New York Academy of Sciences* 1127 (April 2008):83-91, doi: 10.1196/annals.1434.003.

35 Women's Health Policy Report, "New York Team to Attempt First U.S. Uterus Transplant, Raises Ethical Concerns."

36 Zubla Mumtaz and Adrienne Levy, "Ethics Criteria for Uterine Transplants: Relevance for Low-Income Pronatalistic Societies?" *Journal of Clinical Research & Bioethics* 2012: S:1, doi: 10.4172/2155-9627.S1-004.

37 Ibid., 4.

38 I am indebted to my friends Ben Mitchell and Joy Riley for their work in this area.

39 C. Ben Mitchell and D. Joy Riley, *Christian Bioethics: A Guide for Pastors, Health Care Professionals, and Families* (Nashville: B&H Academic, 2014).

40 Gilbert Meilaender, "A Child of One's Own: At What Price?" in *The Reproduction Revolution: A Christian Appraisal of Sexuality, Reproductive Technologies, and the Family*, ed. John F. Kilner, Paige C. Cunningham, and W. David Hager (Grand Rapids: Eerdmans, 2000): 36-45.

41 Ibid., 44.

Archives for *Dignitas* issues dating back to the Centers' introductory edition in 1994 are now available.

Visit:
cbhd.org/resources/dignitas
to access them.

Dignitas is the quarterly publication of The Center for Bioethics & Human Dignity, and is a vehicle for the scholarly discussion of bioethical issues from a Judeo-Christian Hippocratic worldview, updates in the fields of bioethics, medicine, and technology, and information regarding the Center's ongoing activities.

Subscriptions to *Dignitas* are only available to members of CBHD. If you need assistance in accessing the electronic archives, please contact membership@cbhd.org.

