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Conceivable Changes: Effectuating Infertile Couples' Emotional Ties to Frozen Embryos Through New Disposition Options

Jody L. Madeira
Indiana University Maurer School of Law, jmadeira@indiana.edu

CONCEIVABLE CHANGES: EFFECTUATING INFERTILE COUPLES' EMOTIONAL TIES TO FROZEN EMBRYOS THROUGH NEW DISPOSITION OPTIONS

Jody Lyneé Madeira*

I. INTRODUCTION

In mid-April of 2010, Reuters reported a thought-provoking scientific breakthrough: British scientists at Newcastle University had "mastered a controversial technique in cloning technology" to prevent inherited mitochondrial diseases by "swapping DNA between two fertilized human eggs."[1] According to the news report, an estimated one in 6500 children are born with mitochondrial diseases, which are caused by malfunctioning mitochondrial DNA and result in "fatal heart problems, liver failure, brain disorders, blindness, and muscular weakness."[2] "There has been very limited success in devising effective treatments for mitochondrial disease."[3] Mitochondrial DNA is passed down through the maternal line, so mitochondrial disease can be detected in the eggs of affected women.[4]

For the benefit of readers unversed in the finer points of genetics, the article analogized mitochondrial DNA to "tiny energy-generating batteries inside cells," so that switching DNA between two embryos becomes like "changing the battery on a laptop."[5] The exact technique, however, is a bit more complex. Within a day after joining a female egg with male sperm through in vitro fertilization ("IVF"), scientists remove the nuclear DNA from the embryo and implant it into a donor egg whose nucleus has been removed and discarded.[6] Posing the question "Two or Three Parents?" for dramatic effect, the article reassured readers that children born from embryos whose diseased mitochondrial DNA had been exchanged for healthy donor mitochondrial DNA would have correctly functioning mitochondria, but "in every other respect would get all their genetic information from their mother and father."[7]

However miraculous this may seem, more scientific developments were in store. When the Newcastle University researchers published their findings in the May 6, 2010 edition of *Nature*, they revealed that they had actually

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* Associate Professor of Law, Maurer School of Law, Indiana University-Bloomington; J.D., University of Pennsylvania, 2003; Ph.D., Annenberg School for Communication, University of Pennsylvania, 2007. The author would like to thank June Carbone and Dawn Johnson for their invaluable comments on earlier drafts of this piece.

[1] Ben Hirschler, *DNA Egg Swap Prevents Rare Diseases in Babies*, REUTERS, Apr. 14, 2010, http://www.reuters.com/article/idUSTRE63D3OB20100414.

[2] *Id.*

[3] Lyndsey Craven et al., *Pronuclear Transfer in Human Embryos to Prevent Transmission of Mitochondrial DNA Disease*, 465 NATURE 82, 82 (2010).

[4] Hirschler, *supra* note 1.

[5] *Id.*

[6] *Id.*

[7] *Id.*

succeeded not only in transferring nuclear DNA from an embryo into a donor egg with healthy mitochondrial DNA, but in transferring nuclear DNA between two fertilized embryos (transferring one or two nuclei from a donor embryo into a recipient embryo).[8] Scientists estimated that at most two percent of the mitochondrial DNA is carried over but found that many of the embryos contained no detectable mitochondrial DNA from the contributing embryo.[9] The researchers concluded that, while pronuclear transfer could potentially prevent mitochondrial disease in humans, the effects of genetic manipulation could hypothetically cause chromosomal or other genetic abnormalities and required further study.[10] The manipulated embryos appeared to be viable, living for six to eight days in the laboratory, continuing to divide until they reached the blastocyst stage consisting of approximately 100 cells.[11] Researchers were hopeful that therapeutic mitochondrial manipulation would be available within three years.[12] Using this technique, however, would require a change in British law banning the use of manipulated embryos for reproductive purposes.[13] As will be seen, however, such therapeutic techniques stand to significantly change the disposition options open to infertile couples with excess frozen embryos.

This nuclear transfer technique fits into a broader trajectory of research in which certain components of embryos, such as nuclei and cytoplasm, are interchanged with others from donor gametes or donor embryos. Such embryonic transfer techniques are not necessarily "new"; eradicating mitochondrial disease is just one of the latest possible uses of such technology. Older women with "aging" eggs and women with "poor quality" eggs may have their eggs "rejuvenated" with cytoplasm donations from younger women.[14] Cytoplasmic transfer was first pioneered in 1996 by Dr. Jacques Cohen, an embryologist at the Institute for Reproductive Medicine and Science at St. Barnabas Medical Center in New Jersey.[15] The results of his research were published in *Human Reproduction* in March, 2001, where Cohen and his colleagues reported that nearly thirty babies worldwide had been born through

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[8] Craven et al., *supra* note 3, at 82. The embryos used in the study had been "abnormally" fertilized, meaning that they had one or three pronuclei at the one-cell stage; such embryos are not normally used in fertility treatment. *Id.*

[9] *Id.*

[10] *Id.*

[11] Hirschler, *supra* note 1.

[12] *Id.*

[13] *Id.*

[14] *See* Holly Firfer, *How Far Will Some Couples Go to Conceive?: Some Travel Overseas for Fertility Treatment Banned in U.S.*, CNN, June 17, 2004, http://edition.cnn.com/2004/HEALTH/03/12/infertility.treatment/index.html (stating that cytoplasmic transfer can be used for patients whose eggs are aged).

[15] *See* Jacques Cohen et al., *Cytoplasmic Transfer in Assisted Reproduction*, 7 HUM. REPROD. UPDATE 428 (2001).

the use of such techniques.[16] Cohen and his research fellows asserted that such techniques are especially useful for patients who consistently experience "poor embryo development and implantation failure" during IVF and who would otherwise have to resort to donor eggs; instead, cytoplasmic transfer "may now restore normal growth and viability to their own developmentally compromised embryos."[17] The researchers reported that two babies born through cytoplasmic transfer carried mitochondrial DNA from both the recipient and the donor, a condition known as "heteroplasmy," but that none of the donor's chromosomal DNA was inherited.[18] However, two out of eighteen fetuses developed Turner's Syndrome, a chromosomal abnormality in which one of the two female X chromosomes is missing that usually causes early miscarriage.[19] This incidence rate of eleven percent is much higher than the one to six percent rate incidence of major congenital abnormalities observed in the general population; researchers cautioned that it could have resulted from "the increase in sex chromosome aneuploidy observed following [intracytoplasmic sperm injection] . . . as well as maternal age."[20]

Alarmed by these results, the Food and Drug Administration ("FDA") took action shortly after the *Human Reproduction Update* article was published. In a letter to clinicians dated July 6, 2001, the FDA asserted regulatory authority over "human cells used in therapy involving the transfer of genetic material by means other than the union of gamete nuclei," and defined genetic material to include cell nuclei, egg nuclei, and cytoplasm.[21] Concerned over the long-term effects of genetic manipulation, the FDA promulgated new regulations requiring clinicians to complete an Investigational New Drug application, and follow the same procedures as developers of new prescription medications, including obtaining informed consent from patients participating in testing and conducting regimented clinical trials.[22] According to the FDA, genetically manipulated embryos are "cellular and tissue-based products" and subject to regulation under the same logic as medical apparatus and drugs.[23] As a result of the FDA's actions, gene transfer procedures in the United States have been effectively banned since 2001 and will remain banned until rigorous testing proves them to be safe—something that is unlikely to ever occur due to bans on federal funding

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[16] Jason A. Barritt, et al., *Epigenetic and Experimental Modifications in Early Mammalian Development: Part II, Cytoplasmic Transfer in Assisted Reproduction*, 7 HUM. REPROD. UPDATE 428, 428 (2001).
[17] *Id.*
[18] *Id.* at 433.
[19] *Id.* at 429-30.
[20] *Id.*
[21] Letter from Kathryn C. Zoon, Dir. of the Ctr. for Biologics Evaluation & Research of the Food & Drug Admin, to Sponsors/Researchers (July 6, 2001), *available at* http://www.fda.gov/BiologicsBloodVaccines/SafetyAvailability/ucm105852.htm.
[22] *Id.*
[23] *Id.*

for such research and the scarcity of private funds.[24] Most cytoplasmic transfer research has taken place abroad.

These findings open up numerous cans of worms, some more obvious than others. Gene therapy usually raises concerns over the ethics of cloning technology and debates over the moral status of embryos.[25] But such research also offers promising solutions to the existing controversial problem of excess embryos, opening up new disposition options for infertile couples who have undergone IVF and have excess embryos in frozen storage. An estimated 500,000 cryopreserved embryos in the United States await either disposition or destruction for lack of disposition, and approximately 20,000 more embryos are frozen each year.[26]

Research on infertile couples' disposition decision-making has found that infertile couples feel emotionally bonded to their embryos and are concerned for their welfare, and that couples' choice of disposition is strongly influenced by these affective ties.[27] Allowing couples to donate their frozen embryos for cytoplasmic transfer would not only increase the number of available disposition options but it would also have positive implications for couples' perceived emotional connections to their embryos. Currently, many infertile couples report dissatisfaction with the range of choices; as Lyerly and others observe, "the options they face are either unacceptable to them, or other options that would be acceptable are not available."[28]

This essay addresses the impact of infertile couples' affective ties to their excess cryopreserved embryos impacts how they choose to dispose of those embryos, and how inter-embryonic transfer can change this calculus. It first documents how infertile couples come to form emotional connections to their frozen embryos and how these attachments are influenced by three factors: judgments about frozen embryos' moral status, feelings of responsibility towards

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[24] Dr. Jamie Grifo, the New York fertility specialist who has used nuclear-transfer techniques, was asked why he had not done safety testing first in monkeys. *See* Nigel Hawkes, *Baby Race That May Be Too Fast for Safety*, TIMES LONDON, Oct. 10, 1998, at 4. "Animal colonies cost a fortune to maintain," he said. *Id.* And because there is a ban on federal-research money being spent on embryo research, "we have no research dollars." *Id.*

[25] *See, e.g.*, John A. Robertson, *Oocyte Cytoplasm Transfers and the Ethics of Germ-Line Intervention*, 26 J.L. MED. & ETHICS 211, 214 (1998).

[26] David I. Hoffman et al., *Cryopreserved Embryos in the United States and Their Availability for Research*, 79 FERTILITY AND STERILITY 1063, 1063-69 (2003).

[27] *See, e.g.*, Anne Drapkin Lyerly et al., *Factors That Affect Infertility Patients' Decisions About Disposition of Frozen Embryos*, 85 FERTILITY & STERILITY 1623 (2006) [hereinafter Lyerly et al. 2006]; Anne Drapkin Lyerly et al., *Fertility Patients' Views About Frozen Embryo Disposition: Results of a Multi-Institutional U.S. Survey*, 93 FERTILITY & STERILITY 499 (2010) [hereinafter Lyerly et al. 2010]; Robert D. Nachtigall et al., *How Couples Who Have Undergone In Vitro Fertilization Decide What To Do With Surplus Frozen Embryos*, 92 FERTILITY & STERILITY 2094 (2009) [hereinafter Nachtigall et al. 2009]; Robert D. Nachtigall et al., *Parents Conceptualization of Their Frozen Embryos Complicates the Disposition Decision*, 84 FERTILITY & STERILITY 431 (2005) [hereinafter Nachtigall et al. 2005].

[28] Lyerly et al. 2010, *supra* note 27, at 508.

particular embryos, and altruistic motivations. The essay then considers how inter-embryonic transfer would fit into this framework and assesses how couples who espouse a variety of ideological stances would regard it as a disposition option. This discussion is deepened through a comparison between frozen embryo disposition and organ donation. This essay concludes with the assertion that inter-embryonic transfer offers unique opportunities to infertile couples with cryopreserved surplus embryos and might prove a more comfortable option than existing choices. Simply put, options such as nuclear or cytoplasmic transfer—collectively referred to as "inter-embryonic transfers"—acknowledge, support, and effectuate couples' emotional connections and preferred outcomes for their embryos as no other disposition option can.

II. HOW EMBRYOS INSPIRE EMOTIONAL CONNECTIONS

At the heart of this essay is not an embryo's moral status *per se*, but a related issue: the emotional reactions that embryos—and their actual or potential uses—engender. Embryos trigger emotions,[29] as any woman who has undergone in vitro fertilization can attest. On the morning of transfer, the intended mother is usually offered a picture of the embryos that are transferred back into her uterus. That image seems to capture so much—the emotional energy required to ride the IVF rollercoaster, which jolts around in extremes of hope and despair; the hours spent in the fertility clinic for doctor's appointments, tests, blood draws, and ultrasounds; the expense of required medications and treatment; the discomfort, even pain, of massive ovaries and drug injection sites; the retrieval surgery. All that—for these. For the intended mother, this picture confirms that she has accomplished all she can in order to ensure that the cycle results in a successful pregnancy, and also that she is "pregnant until proven otherwise"—a phrase that female infertility patients use to denote the expectant state in which one awaits the "beta" pregnancy test. Until that "otherwise" arrives, one is free to regard this image as a first baby picture.

Consistent with their own commercial interests, the fertility industry acknowledges and even fosters the formation of emotional attitudes towards frozen embryos. A page on the website of the American Fertility Association addressing prospective embryo donors states, "[a]t either end of the [assisted reproductive technologies] outcome spectrum, there are former patients, like you, wrestling with the emotionally-laden decision of what to do with the cryogenically preserved embryos they gave so much to create but will never use."[30] Fertility clinics foster emotional connection to embryos by giving intended mothers pictures of transferred embryos and by encouraging them to

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[29] See *infra* Part II and accompanying footnotes.

[30] American Fertility Association, Embryo Donation—Prospective Donors, http://www.theafa.org/library/article/embryo_donation_prospective_donors/ (last visited Dec. 24, 2010).

watch the transplantation procedure on an ultrasound screen—and perhaps even giving them an ultrasound picture of the newly transferred embryos "at home" in the uterus.[31]

Even without these affective inducements, it is logical that infertile couples would feel some emotional attachment to their embryos—including ones that are "left over" after an IVF cycle.[32] One does not come by such embryos easily; they are the product of a great deal of labor—financial, emotional, physical, and psychological. They offer hope; infertile individuals may regard them as the "golden eggs" necessary to conceive that which is impossible to come by (or nearly so) outside the laboratory. They possess the potential for life; whether fresh or frozen, they embody the potential to develop into ardently desired children. They symbolize a journey accomplished and perhaps a shortcut to future pregnancy attempts, cutting out the retrieval process of a "fresh" IVF cycle. They are usually genetically related to one or both of the intended parents; the "overwhelming majority" of frozen embryos in the United States were formed from the gametes of both a husband and wife.[33] For these reasons and many more, leftover embryos—often affectionately termed "embies" or "frosties" by infertile couples—are sentimental objects for intended parents. As Naomi Cahn acknowledged in *Test Tube Families*, "my husband and I kept our extra embryos on ice for more than a decade. When it came time for us to dispose of them, I did feel an emotional connection to them and found it difficult simply to flush them down the drain."[34]

Emotional attachments to embryos develop and change over the course of IVF treatment, and are influenced by how an infertile couple experiences IVF as well as treatment outcomes. At the inception of IVF treatment, individuals are unlikely to have "settled moral views or reflective preferences" about their embryos, and the "process of infertility treatment, whether successful or not, profoundly influences what these preferences turn out to be."[35] The type and intensity of emotions that frozen embryos evoke likely differ according to the extent that an individual feels the embryo is unique, morally significant, or even child-like—an enormously complex judgment tied to an individual's ideological, political, and spiritual beliefs, as well as that individual's connections to the embryo, her life plans, and the outcome of the cycle in which the embryo was created.[36] These emotional connections have consequences, affecting what

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[31] Such images have also been used to generate emotional affect in the abortion context. *See* Carol Sanger, *Seeing and Believing: Mandatory Ultrasound and the Path to a Protected Choice*, 56 UCLA L. REV. 351 (2008).

[32] Excess embryos may remain for any number of reasons. An IVF cycle may generate more embryos than a couple, in consultation with their reproductive endocrinologist, wish to implant in that cycle, necessitating that these extras be frozen.

[33] Nachtigall et al. 2005, *supra* note 27, at 434.

[34] NAOMI CAHN, TEST TUBE FAMILIES 175 (2009).

[35] Lyerly et al. 2006, *supra* note 27, at 1629.

[36] *See id.*

happens to these frozen embryos when the intended parents are done with child bearing.

Individuals obviously differ as to when and for what purposes it is morally permissible to destroy an embryo: Should one destroy an embryo to eradicate a disease? For research? For any or no reason at all? Still others may feel that embryos do not merit "special" regard but deserve the same respect as any other item of private property. Here, it would be morally permissible for individuals to act in any way towards an embryo, so long as that individual had "ownership" of it.[37]

III. HOW EMOTIONAL TIES TO FROZEN EXCESS EMBYROS IMPACT DISPOSITION DETERMINATIONS

Research on embryo disposition decisions has outlined a decision-making process through which most couples undergoing IVF generally proceed.[38] In the midst of IVF treatment, extra embryos provide "reassurance" to couples that treatment will enable them to conceive; but after completing IVF treatment and considering themselves finished with efforts to conceive, most couples initially devote little thought to what to do with these surplus embryos.[39] Precisely how this postponement of disposition decisions intersects with couples' emotional attachments to their surplus embryos is unclear from the research literature. Presumably, this emotional connection is present throughout this time period and perhaps even motivates a delay in selecting a final method of disposition and following through with that decision. When reminded of the need to decide their frozen embryos' disposition, often by bills received years after the embryos were frozen, they experience "discomfort, and uncertainty" about choosing an option; after deciding on the embryos' disposition, however, couples most often experience "a profound sense of completeness and resolution."[40] Confronted with this decision, most couples begin by assessing whether or not they wanted to conceive additional children, a decision driven by considerations such as age, financial status, and the intended parents' health; couples who were willing to continue efforts to conceive were likely to attempt pregnancy by thawing and transferring the frozen embryos.[41]

The reasons why embryos are "left over" may affect intended parents' feelings towards them. Sentimental ties may be strongest when there were simply too many high-quality fertilized embryos to choose from; these embryos were just not selected even though they, too, were excellent candidates for

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[37] *See* June Carbone & Naomi Cahn, *Embryo Fundamentalism*, 18 WM. & MARY BILL OF RTS. J. 1015 (2010).

[38] This decision-making process is regarded as the "the norm"; however, as discussed earlier, infertile couples may evince a range of reactions.

[39] Nachtigall et al. 2005, *supra* note 27, at 433.

[40] *Id.*

[41] Lyerly et al. 2006, *supra* note 27, at 1625.

transfer into the intended mother's uterus. To some women, such embryos may seem like "sisters" or "brothers" to already-born children conceived through the same cycle. An article in the *Boston Globe* profiled "Linda," a mother of twins conceived through IVF who had agreed with her husband to discard their frozen embryos but could not bring herself to do it.[42] Linda confessed that when it came time to discard the embryos, "I couldn't [throw them away]. Our children were in the same batch. I'd look at them and think, 'Wow, if someone had grabbed a different straw, our children would still be sitting there.'"[43] The embryos may have lagged behind developmentally so that they were smaller on the morning of transfer, when the embryologist made her selection, yet healthy enough to develop to the point of being worthwhile to freeze. Perhaps all fertilized embryos from an IVF cycle were frozen for a particular reason, such as the woman's inability to complete the cycle for health reasons. Perhaps the embryos represent an intended parent's last chance to conceive, as they incorporated that individual's last viable eggs or sperm.

What happens after the IVF cycle in which "left over" embryos are created also affects the intended parents' emotional attitudes towards them. Perhaps the IVF cycle was a success, producing one child, and the intended parents hope to have additional children. Or perhaps the intended parents got pregnant with twins or higher order multiples and reached their desired number of children. If the IVF cycle was not successful, the intended parents may wish to try again, but using fresh—not frozen—embryos; over eighty percent of IVF cycles use fresh embryos.[44] Alternately, an unsuccessful cycle may have been followed by another tragic blow, such as the death of one of the intended parents, or their divorce.

Determining how to dispose of excess frozen embryos is a highly complex and emotionally difficult, even excruciating process, fraught with delay and indecision. Though portrayed as a public issue through public discussion of related issues such as the ethics of stem cell research and its funding, infertile couples experience the embryo disposition decision as a private burden, in which they often feel alone, uninformed, and without necessary guidance.[45] Perhaps for that reason, a significant majority of couples put off the decision for several years after completing IVF treatment, whether from a lack of guidance or from a conscious decision to ignore the issue, or a combination of these and other factors.[46] Observing that seventy-two percent of couples in his study had not decided upon a disposition for their frozen embryos, Nachtigall concluded that this decision was "a significant and frequently unresolved issue in couples' lives in many countries, with many couples changing their minds about their initial

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[42] Alison Lobron, *The Maybe-Baby Dilemma*, BOSTON GLOBE, Nov. 22, 2009, *available at* http://www.boston.com/news/health/articles/2009/11/22/the__maybe_baby_dilemma/?page=1.
[43] *Id.*
[44] Lyerly et al. 2010, *supra* note 27, at 499.
[45] *Id.* at 500.
[46] *Id.*

disposition determination made prior to undergoing IVF."[47] In fact, it is estimated that seventy percent of couples with embryos delay their decisions for five years or more, or even indefinitely.[48] But emotional conceptions of embryos are highly likely to change over time, giving rise to changes in disposition preferences. Even when couples do make disposition decisions, either before an IVF cycle or at some later point, statistics show that approximately three-quarters of them will change their minds.[49] Thus, as numerous researchers have observed, the disposition of frozen embryos is "a significant and frequently unresolved issue in couples' lives in many countries."[50]

Deciding not to use frozen embryos for future pregnancy attempts does not, however, end couples' emotional attachment to their embryos; couples still very much care about their welfare.[51] Even couples who are sure that they do not want additional children may be reluctant to decide upon a disposition because of the important symbolic functions that excess embryos can fulfill. For instance, couples may regard frozen embryos as a "genetic or psychological insurance policy," believing that they may one day provide important medical services to existing children—or become a means of conceiving new children if living children should perish through illness or accident.[52] Similarly, frozen embryos may also be a reproductive "security blanket"[53] that preserves and extends a couple's fertility. Finally, frozen embryos may also serve as "symbols of the infertility that had dominated their lives for so many years," or as "unfinished business" that prompted women to attempt to conceive additional children to "use them up," even when that desire was impractical.[54]

It is useful to narrow our focus to infertile couples who have decided they do not wish to have any additional children, thereby eliminating the possibility of using the remaining embryos to attempt pregnancy. These couples must consider numerous factors, such as personal beliefs, values, attitudes about the embryos' moral status, emotional ties to the embryos, individual circumstances, embryo quality, and institutional information about various disposition choices and support in effecting them.[55]

Infertile couples who do not wish to use their frozen embryos for additional pregnancy attempts may choose among several disposition options. In most states, couples may elect to thaw and discard their cryopreserved embryos, with or without a "disposal ceremony"; some states, however, have made this

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[47] Nachtigall et al. 2005, *supra* note 27, at 433.
[48] Lyerly et al. 2010, *supra* note 27, at 500.
[49] Nachtigall et al. 2005, *supra* note 27, at 433.
[50] *Id.*
[51] Lyerly et al. 2006, *supra* note 27, at 1627.
[52] Nachtigall et al. 2005, *supra* note 27, at 433.
[53] Lyerly et al. 2006, *supra* note 27, at 1625.
[54] Nachtigall et al. 2005, *supra* note 27, at 433.
[55] Nachtigall et al. 2009, *supra* note 27, at 2094.

illegal.[56] In most states, couples also may choose to donate them to research, where the embryos will enable advances in fertility medicine, stem cell research, or disease eradication before ultimately being destroyed.[57] Frozen embryos may be donated to another infertile couple, who will use them in attempts to become pregnant. Finally, couples may elect to freeze their embryos indefinitely—an expensive option that entails the payment of annual cryopreservation fees.[58]

In recognition of the moral difficulties, a small minority of clinics offer the option of a disposal ceremony to allow the couple time and space to mourn the loss, and, more striking, an entirely separate option known as "compassionate transfer." In "compassionate transfer" surplus embryos are transferred into the intended mother's uterus in a manner rendering pregnancy unlikely; the transfer may be scheduled for a time when the woman is likely to be least fertile, the woman may not take the hormones necessary to prepare her body for the transfer, or she may elect to have the embryo transferred into her vagina instead of her uterus.[59] Infertile couples may choose compassionate transfer because it may speak to a sense of physical connectedness to the embryos, and may seem more "humane" or "natural" than other forms of destruction because the body absorbs these transferred embryos just as it would any embryos that fail to implant in an IVF cycle.[60] These options, however, are rarely available; only five percent of American clinics offer disposal ceremonies or compassionate transfers.[61]

According to the most recent research study assessing infertile couples' disposition preferences (which is also the largest and only multisite study to directly analyze this issue), roughly twenty-eight percent of participants either believed that embryos had human moral status or felt that they did not; the convictions of most lay somewhere in between these two extremes.[62] In addition, forty-one percent of infertile couples who did not want additional children considered research donation very likely, as compared with sixteen percent who favored reproductive donation and twelve percent who leaned toward thawing and discarding their frozen embryos.[63] Seventy percent of such couples were very unlikely to choose compassionate transfer, sixty-four percent stated that they were very unlikely to keep their embryos frozen indefinitely, sixty percent were very unlikely to select a disposal ceremony, fifty-three percent were very unlikely to donate their frozen embryos to another couple, and forty-three percent

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[56] Discarding embryos is illegal in several states such as Louisiana, although these statutes' constitutionality has not yet been tested. *See, e.g.*, LA. REV. STAT. ANN. § 9:129 (2004) (stating that an embryo created through IVF is a "juridical person" that cannot be intentionally destroyed); *see also* Carbone & Cahn, *supra* note 38, at 1037-46 (summarizing state laws).

[57] *See, e.g.*, CAL. HEALTH & SAFETY CODE § 125300, et seq. (2008) (specifically authorizing stem cell research and establishing procedures for embryo donation).

[58] *See* Nachtigall et al. 2009, *supra* note 27, at 209.

[59] *See* Lyerly et al. 2008, *supra* note 27, at 500.

[60] Lyerly et al. 2006, *supra* note 27, at 1628.

[61] Lyerly et al. 2010, *supra* note 27, at 507.

[62] *Id.* at 503.

[63] *Id.* at 502.

were very unlikely to thaw and discard them, as compared to only eighteen percent who were very unlikely to donate their embryos to research.[64] Significantly, approximately seventy-five percent of respondents rated the same four factors as important in their disposition decisions: "wanting to help find cures for diseases like Alzheimer disease," "not wanting someone else to whom I could donate my embryos raising my genetic child," "my feeling that thawing and discarding is wasteful," and "my partner's/spouse's opinion about what to do with the embryos."[65]

In choosing among these various disposition options, many infertile couples must struggle through a complex panoply of emotions and moral evaluations. Researchers have identified three main factors influencing infertile couples' affective stances towards cryopreserved embryos: their conceptions of the embryos' moral status, their perceived "parental" responsibility or obligation to the embryos, and altruistic desires.[66]

Research suggests that the embryo's moral status—whether the embryo is seen as a "human"[67] entity with a right to life in and of itself—is recognized by "virtually all couples."[68] Couples may imagine their embryos as sentient beings who could potentially experience pain, or conceptualize them as "virtual" children that had interests that must be safeguarded—a viewpoint that is particularly meaningful when infertile couples consider donating their embryos to another couple and cannot accept the possibility that others may raise their genetic child.[69] Couples may even go so far as to integrate the embryos into their existing family—specifically as brothers or sisters of children already born that they could one day meet, befriend, and in some nightmarish scenarios, with whom they could fall in love.[70]

But the embryos' moral status alone determines the proper disposition for only a few infertile couples, primarily those for whom religion also has a significant impact on the selection of a proper disposition. Lyerly and others conclude rather starkly that these individuals are most likely to be Catholic, Evangelical Christian, or Baptist.[71] Most couples in qualitative studies do not accord embryos the same moral status or moral obligations as a human already born, and some considered their embryos to be mere "cluster[s] of cells without uniquely human moral rights or interests."[72] Couples assigning high moral status to their embryos were more likely to use them in future attempts to conceive, donate the embryos to another couple for the same purpose, or to elect a disposal

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[64] *Id.*
[65] *Id.* at 502-03.
[66] *See* Lyerly et al. 2006, *supra* note 27, 1625-27.
[67] *Id.* at 1626.
[68] Nachtigall et al. 2005, *supra* note 27, at 433.
[69] *Id.*
[70] *Id.*
[71] Lyerly et al. 2006, *supra* note 27, at 1626.
[72] *Id.*

ceremony or compassionate transfer, illustrating that the ascription of high moral status did not always entail refusing to destroy the embryos.[73] Couples assigning low moral status to their embryos were more likely to thaw and discard them or donate them for research.[74]

However visible an embryo's moral status has been as a social, political or legal issue, for most infertile couples it was not the central focus in their disposition decision-making. Moral responsibility for embryos' fate—the duty to safeguard excess embryos' future welfare—was a more important factor. Instead of focusing upon the embryo's abstract moral status, couples preferred to emphasize perceived concrete, quasi-parental obligations towards their surplus embryos, or more specifically, towards their latent potential to develop into children. Safeguarding the well-being of the children into which the embryos might develop meant preventing the embryo from becoming a fetus and ultimately an infant who would be gestated in another's body and raised in another's home.[75] Thus, feelings of moral responsibility towards embryos did not oblige parents to ensure that embryos received a "chance at life"; this duty entailed ensuring that the embryos would never have the opportunity to develop further.[76] From this perspective, the embryos' potential to become a child is just as important to couples who make disposition decisions according to quasi-parental obligations as it is to couples who decide solely on the basis of an embryo's human moral status. In both contexts, this human potential shines through; it is as if one is looking at an embryo as a hologram; if you turn it to the left, you see a collection of cells, tilted to the right, it morphs into a child.

Donating frozen embryos to other infertile couples was therefore an unpopular option because it entailed two difficult emotional processes: surrendering embryos to which couples were emotionally attached and accepting that they may develop into someone else's children, in effect, adopting out one's own offspring.[77] In addition to predictable fears that "adopting" families might abuse, neglect, or otherwise harm potential children, couples expressed concern over "the possibilities for unintentional incest between full siblings or inadvertent disclosure of IVF or donated gametes."[78] Thus, couples who prioritized a quasi-parental obligation to safeguard the embryos' future well-being were more likely to thaw and discard them, donate them to research, or select a disposal ceremony or compassionate transfer. Interestingly, research shows that infertile couples tend to either support or oppose embryo research; the type of research for which embryos are donated does not much matter.[79]

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[73] Lyerly et al. 2010, *supra* note 27, at 503-04.
[74] *Id.*
[75] *Id.*
[76] Lyerly et al. 2006, *supra* note 27, at 1628.
[77] Nachtigall et al. 2009, *supra* note 27, at 2095.
[78] *Id.*
[79] Lyerly et al. 2006, *supra* note 27, at 1627.

Altruism also exerts significant influence upon infertile couples' disposition decisions. Defined as "helping others" or "giving back,"[80] altruism captures infertile couples' perceptions that embryos are more than just human tissue—unique, even precious resources that should be used for private or public benefits such as conceiving life or conceiving knowledge. Couples with altruistic motivations were likely to view thawing and discarding frozen embryos as wasteful; the fact that the overwhelming majority of couples were very unlikely to select this option testifies to altruism's strong influence.[81] Perhaps the subjective hardship of undergoing infertility or the fortunate experience of successful treatment also predisposes couples to "pay it forward," creating opportunities for individual and social benefit.[82] Current disposition options allow infertile couples to effect two forms of altruistic change: helping to generate life, and helping to generate knowledge. Donating frozen embryos to another infertile couple not only confers important altruistic benefits upon other individuals but also allows donating couples to preserve the embryos' integrity and the life-giving objectives with which the embryos were first created.[83] Donating frozen embryos to research expands the donation's altruistic impact from individuals to larger segments of society, rendering it more abstract; this option also allows couples to evade "entangling kinship ambiguities and responsibilities."[84] Significantly, couples with "few or low-grade" embryos might be more inclined to donate them to research instead of to another infertile couple because of their diminished chances for successful implantation and gestation.[85] Effectuating altruistic desires therefore allowed infertile couples to find a satisfying resolution to their disposition dilemmas, allowing couples to pass through and then close the door on their infertility experience and their embryonic emotional connections without inadvertently trapping any limbs in the process.[86] Unfortunately, however, a lack of institutional support for certain altruistic disposition options that are theoretically possible but practically difficult may thwart both couples' sense of closure and that option's potential benefits. According to Nachtigall, most couples who wished to donate their frozen embryos to another infertile couple "felt that the potentially daunting financial, legal, and medical burdens of facilitating donation fell entirely on them."[87]

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[80] Nachtigall et al. 2009, *supra* note 27, at 2095.
[81] *Id.* at 2096.
[82] Lyerly et al. 2006, *supra* note 27, at 1627.
[83] Nachtigall et al. 2009, *supra* note 27, at 2095.
[84] *Id.* at 2096.
[85] *Id.* at 2095.
[86] *Id.* at 2096.
[87] *Id.* at 2095.

IV. HOW INTER-EMBRYONIC TRANSFER COULD REVOLUTIONIZE DISPOSITION DECISIONS

As a disposition option, inter-embryonic transfer accords with three of infertile couples' top priorities in disposition decision-making: curing disease, preventing others from raising any children developing from their embryos, and avoiding the waste of thawing and discarding. Because inter-embryonic transfer uses embryos in different ways than the existing disposition options, it has distinctly different emotional ramifications for infertile couples and so significantly alters the disposition decision calculus. This impact is best seen by considering how inter-embryonic transfer would likely fit into the parameters along which infertile couples make disposition decisions: assessments of embryos' moral status, perceived parental obligations to particular frozen embryos, and altruistic desires. This in turn prompts us to reconsider what it means to "destroy" an embryo and, conversely, what it means to give an embryo a "chance at life." For infertile couples who accord high moral status to frozen embryos, believing that they have a "right to life" and should be given a "chance at life," donation to research is not likely to be a viable option because it results in the embryos' destruction.[88] In this context, however, terms such as "destruction" and "life" seem rather murky.

Until now, an embryo's "destruction" under existing disposition options has referred to total, not partial, destruction, after which no part of the embryo would remain. Giving an embryo a "chance at life" has referred to using it, or allowing others to use it, in attempts to conceive. But in inter-embryonic transfer, the entire embryo is not destroyed. The embryo as we know it ceases to exist, but some of its key cellular matter is preserved. This key cellular matter—health mitochondrial DNA—fuels the formation of new life when it is substituted for diseased mitochondrial DNA. Thus, not only does this healthy mitochondrial DNA continue to "live," it also enables the formation of another life.

It is fairly predictable how infertile couples with the most extreme views on frozen embryos' moral status will regard inter-embryonic transfer. Most couples believing that embryos are "lives in being" with full moral status will likely oppose inter-embryonic transfer because it destroys the embryo's original genetic integrity;[89] many infertile couples who differently conceptualize the moral status they accord to frozen embryos, however, will likely see it as a viable option. Some couples ascribing a somewhat higher moral status to their embryos, however, do elect to have a disposal ceremony or compassionate transfer, suggesting that inter-embryonic transfer will be at least a viable disposition option, and perhaps even a more attractive one because of its unique

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[88] For a summary of the different viewpoints on the status of the embryo, see Katheryn D. Katz, *The Legal Status of the Ex Utero Embryo: Implications for Adoption Law*, 35 CAP. U. L. REV. 303, 306 (2006).

[89] *See, e.g.*, Hilary White, *Britain's "3 Parent" Cloning Experiments Condemned*, LIFESITE NEWS, Apr. 19, 2010, *available at* http://www.lifesitenews.com/ldn/2010/apr/10041909.html.

abilities for preservation and creation. Some couples ascribing high moral status to their embryos may view the genetic manipulation involved in inter-embryonic transfer as "going too far," although the prerequisite that one undergo IVF to obtain genetically related frozen embryos in the first place likely filters out those to whom such practices are most unacceptable. It is uncertain how couples with intermediate views would feel about inter-embryonic transfer, particularly those couples who would prefer that the embryos have a "chance at life" without running afoul of other concerns, such as felt obligations to safeguard the welfare of any future children into which these embryos might develop.

Inter-embryonic transfer arguably has the most interesting impact upon the decision-making options of infertile couples who feel that they have quasi-parental obligations towards their frozen embryos—the duty to safeguard the welfare of any future children that these embryos might produce. Donating to research would ensure both that the embryos are not "wasted" and that they cannot be gestated and develop into children raised in other families. This option might not be ideal for donating couples who were troubled by the embryos' ultimate destruction or for couples who still wanted to honor the life-giving purpose for which the embryo was created but were frustrated by the abstract way in which donating embryos to research effectuated this goal. There is simply no option that would both preserve the embryo and prevent it from further developing. Inter-embryonic transfer, however, would simultaneously allow an infertile couple to mirror the intention for which the embryo was originally fertilized—to create life—and the need to safeguard the embryos' welfare by ensuring that the embryo will never become a child that is genetically the child of the donating couple. Injected into another embryo with the nuclear DNA of different intended parents, the donor embryo's mitochondrial DNA will fuel and therefore help to create a life with another couple's genetic characteristics.[90]

Finally, with respect to altruism as a decision making factor, the statistical unpopularity of the "thaw and discard" disposition option illustrates that the overwhelming majority of infertile couples favor an altruistic disposition where the embryo is not "wasted." But not all disposition options are equally altruistic. Options that allow infertile couples to know precisely how their donation will help others—where the donation has concrete, identifiable benefits for specific individuals and specific results—may make these options seem more altruistic than others in which the embryos' benefit is more abstract. Like donation to research, inter-embryonic transfer is clearly an altruistic option: the donor embryo's healthy mitochondrial DNA is used to power a cell whose own mitochondrial DNA is diseased, thereby enabling that cell to survive and fulfill

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[90] In this sense, the procedure is somewhat like organ donation. *See* James R. Rodrigue, Danielle L. Cornell, & Richard J. Howard, *Pediatric Organ Donation: What Factors Most Influence Parents' Donation Decisions?* 9 PEDIATRIC CRITICAL CARE MED. 180 (2008).

its biological function: fetal development.[91] Unlike donation to research, in which the infertile couple must measure the donation's benefit in abstract terms—helping society, helping others to conceive or overcome or avoid illness—cytoplasmic transfer allows couples to help a particular couple to overcome obstacles to conception, only without the risk of producing a child that is the child of the donating parents. Thus, the emotional ramifications of inter-embryonic transfer are somewhat of a hybrid between the affective implications of donating to research and donating to another infertile couple for gestation—the donating couple knows that the embryos will be used to effect the socially useful goals of curing disease and creating life without the perils of creating a life related to the donating couple. Thus, knowing exactly how one's embryos will help others might lead infertile couples to perceive that inter-embryonic transfer is more altruistic than donating frozen embryos to research.

Currently, the FDA's stance on genetic manipulation is an obstacle to adding inter-embryonic transfer to the list of disposition options. Should this change, the mechanics of adding inter-embryonic transfer as a disposition option would not be difficult, and would likely mirror donation for research purposes, at least as an initial matter. Donating couples would be able to elect that particular option but would not be able to select particular forms of inter-embryonic transfer (i.e., donation for mitochondrial disease versus donation to rehabilitate aging eggs) just as they are not presently able to donate their embryos for specific kinds of research.[92] A future legal and policy issue likely will be donating couples' ability to specify in more detail how donated embryos are to be used.

V. THE COMPARISON BETWEEN INTER-EMBRYONIC TRANSFER AND ORGAN DONATION

Like infertile couples attempting to select a disposition for their frozen embryos, relatives of organ donors are involved in an "ongoing quest to attribute meaning."[93] Infertile couples seek to find a disposition option that gives meaning to their infertility experience and their emotional connections to their frozen embryos, and relatives of organ donors similarly rely upon the act of donation to give meaning to the donor's life and death.[94] The idea that one's embryo donated to cure mitochondrial disease can "live on" in a way parallels the affective benefits experienced by family members of organ donors. Research suggests that

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[91] For discussion of the role of altruism in organ donation, see generally Jan A. Walker et al., *Parental Attitudes Toward Pediatric Organ Donation: A Survey*, 142 CANADIAN MED. ASS'N J. 1383 (1990).

[92] *See* NAT'L INSTS. OF HEALTH, GUIDELINES ON HUMAN STEM CELL RESEARCH (2009), *available at* http://stemcells.nih.gov/policy/2009guidelines.htm.

[93] Thalia Bellali & Danai Papadatou, *Parental Grief Following the Brain Death of a Child: Does Consent or Refusal to Organ Donation Affect Their Grief?* 30 DEATH STUD. 883 (2006).

[94] *Id.*

donating a relative's organs can positively affect family members' bereavement because the donors' family members feel comforted by the donation process and experience fewer depressive symptoms.[95] Organ donation allows something positive to come out of tragedy. Donating organs also helps family members find some meaning in a death. Parents who donated their children's organs felt that donation eased grief in that it helped another human to life, facilitating relief, tranquility, and a sense of purpose.[96] Parents also believed that organ donation also symbolically allowed their child to remain "alive" through the organ recipient, facilitating an ongoing bond with the deceased child.[97] This was especially true if the child's heart was donated.[98] The organ recipient becomes a (hopefully temporary) link between the relative and the deceased.[99] Organ donation changes the tenor of the donor's death, from "meaningless, bad, and private to . . . socially meaningful, good, and potentially heroic."[100] One study found that relatives' primary reason for donation was "the desire to keep the deceased relative alive through identification with the recipients," which was often fulfilled by seeking out information about them.[101] Donors' relatives also report that organ donation strengthens their bonds with society.[102] These positive affective connections linking an organ donor's relative with the deceased donor through the living organ in the recipient mirror the bonds between the donor couple and the donated embryo through the mitochondrial DNA in the recipient couple's embryo, and later, child. Helping to create or save another's life through embryo or organ donation allows something positive to emerge from the harrowing experiences of infertility and bereavement. Finally, in both contexts, the act of donation keeps cherished emotional ties and memories alive, while granting peace and perhaps even closure to those who decided to donate.

Just as options for disposing of excess frozen embryo that have more concrete, localized, and "immediately" realizable benefits may be seen as more altruistic than other options whose benefits seem more abstract, diffuse, and delayed, certain forms of corporeal donation—grants of organ or tissue—are also seen as conferring greater or lesser social benefit. The affective and altruistic differences between donating frozen embryos to research and inter-embryonic

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[95] Shaila J. Merchant et al., *Exploring the Psychological Effects of Deceased Organ Donation on the Families of the Organ Donors*, 22 CLINICAL TRANSPLANTATION 341 (2008).
[96] Bellali & Papadatou, *supra* note 94, at 898.
[97] *Id.* at 893.
[98] *Id.* at 896; *see also* Maryse Pelletier, *Emotions Experienced and Coping Strategies Used by Family Members of Organ Donors*, 25 CANADIAN J. NURSING RES. 64 (1992) (stating "knowing that someone was living a normal life, and that part of their loved one lived on lessened the pain of having lost their loved one").
[99] *See* Bellali & Papadatou, *supra* note 94, at 909; *see also* Magi Sque & Sheila A. Payne, *Dissonant Loss: The Experiences of Donor Relatives*, 43 SOC. SCI. & MED. 1359 (1996).
[100] Orit Brawer Ben-David, *Ranking Deaths in Israeli Society: Premature Deaths and Organ Donation*, 11 MORTALITY 79 (2006).
[101] Sque & Payne, *supra* note 100, at 1366.
[102] Ben-David, *supra* note 101, at 97.

transfer can be compared to the distinctions between donating a relative's body to science and donating a relative's organs to a living recipient. While donating a relative's body to science for anatomical dissection is a laudable goal that no doubt facilitates the accumulation of useful knowledge over time, knowledge is considered less valuable in the short term than the preservation of life.[103] Organ donation is therefore seen as more altruistic because it "has a direct life-saving and immediate consequence."[104] Similarly, an infertile couple who donates their embryos to research does not know what particular advances their embryos have helped to bring about, but a couple who donates their embryos to cure mitochondrial disease knows exactly what outcome their embryos facilitate: powering the formation of new life.

VI. CONCLUSION: VIABLE EMBRYOS, VIABLE OPTIONS

Currently, many infertile couples report dissatisfaction with the range of available disposition choices. There seems to be no "perfect fit"—an option that simultaneously allows excess embryos to directly aid in the formation of new life, precludes their further development, avoids their complete destruction, and effectuates couples' altruistic desires. Yet, qualitative research has shown that these considerations are among donating couples' top priorities: eradicating disease, ensuring that others do not raise their genetic children, and "wasting" the embryo by simply destroying it. Inter-embryo transfer as a disposition option would align with these disposition goals, yielding results that are more tangible, temporal, and particularized. Inter-embryo transfer also acknowledges and effectuates the emotional connections that infertile couples may feel towards their excess embryos—ties that prompt infertile couples to see them as points of departure for some destiny grander than wholesale destruction. We may look forward to the day when this novel, nascent potential may be fully realized.

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[103] Margaret A. Sanner, *People's Attitudes and Reactions to Organ Donation*, 11 MORTALITY 143 (2006).
[104] *Id.*