Fertility patients considering donation of their excess frozen embryos to stem cell research are motivated by the desire not to waste their embryos, and often express a keen interest in stem cell research and a sincere hope that their embryos will contribute to improving human health.

In vitro fertilization (IVF) treatment typically results in the creation of more embryos than are needed for implantation. With parental consent, excess embryos are cryopreserved for future use, including for reproductive purposes. Typically, 6 months after the first IVF cycle, when the first frozen embryo storage payment is due, parents are asked what they would like to do with their excess embryos: continue storing for future pregnancy attempts, thaw and dispose, donate to another couple, donate to research, or donate to the clinic for technology development. For those couples opting for storage of the frozen embryos, bills continue to arrive every 3 or 6 months; some couples pay for continued storage because they cannot decide what to do with the embryos. Lyerly et al. [1,2] have demonstrated that patients’ preferences for disposition of frozen embryos often change over time, and can be fraught with a great deal of ‘decisional conflict’ [2]. Generally, a minority choose the research option.

The University of Washington Institute for Stem Cell and Regenerative Medicine has a research program for the derivation of new human embryonic stem cell lines (hESC lines) from excess frozen embryos that are no longer needed for reproductive purposes. Fertility clinics unaffiliated with the University connect patients with the Institute if the patients are interested in donating their excess embryos to research.

Donation of specimens from living human beings requires compliance with human subject protection regulations (http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.html). Accordingly, the Institute has an approved Institutional Review Board application (University of Washington Human Subjects Application No. 32659), and informed parental consent is obtained, either in person or by telephone. To date, over 120 consent conversations have taken place. Because couples/individuals contacting the Institute have preliminarily decided that they are interested in the research option for their embryos, the majority give their consent for the donation.

It is not the purpose of the Institute’s hESC research program to study the motivations of parents who donate embryos to research, and no survey or opinion data are collected in a systematic fashion. However, as part of the consent process, some common questions and concerns arise.

Embryos are different: the emotional component
While embryos remaining after the completion of reproductive purposes are ‘leftover’ human tissue, they are not ‘waste’ materials in the same sense as other clinical specimens, such as blood remaining after a clinical draw. IVF embryos are deliberately and painstakingly created, and IVF is expensive; in the USA the average cost for the first cycle of IVF is $12 000 [3]. In addition, the physical demands and risks posed to the mother are significant, including risk of ovarian hyperstimulation syndrome. In terms of the moral status of their embryo, only rare would-be donors have referred to their embryo as a ‘baby’. It is presumed that parents who equate embryos with babies do not usually consider donating their embryos to research. However, the average donor does demonstrate an attachment to their embryos, exemplified by a keen interest in stem cell research and the potential fate of their embryos.

Having a stake: familial diseases
Donors commonly ask what diseases are being studied with hESCs. Many are particularly interested in diseases that run in their families, such as diabetes, amyotrophic lateral sclerosis, Parkinson’s, cancer, Alzheimer’s, and multiple sclerosis, and often ask if their embryos can be directed toward particular research areas. Donors who have an IVF-conceived child affected by a particular condition have asked if their embryos could be used to study that disease or condition.

Few hESC line derivation programs give embryo donors the option to restrict the use of their embryos, primarily for scientific reasons. First, it is unknown whether a line will be derived successfully from any given embryo. Moreover, if a line is derived, it is impossible to know whether it will be uniquely suited to studying a specific disease. Even with a family history of a particular disease, it cannot be assumed that the embryo and subsequent hESC line will also have the genetic predisposition for that condition. Moreover, some hESC lines more readily differentiate to one lineage or another (i.e., endodermal, mesodermal, or ectodermal). To limit a particular hESC line to a chosen type of research could preclude valuable research.

Ehrich et al. [4] reported the results of a workshop convened in the UK which identified the issues raised by
allowing donors to restrict the future use of hESCs created from their embryos. While the workshop did not come to a clear conclusion, it was acknowledged that a ‘tiered system’ could be developed in which embryo donors could choose between ‘unrestricted use’ or specified ‘restricted use’. Embryos would be directed to the appropriate bank or laboratory in accordance with the wishes of the donors. However, because hESC lines are shared, it could be impossible to guarantee what types of research any given line would eventually be used for.

Checking us out: success rates
Stem cell laboratories do not publish their success rates. However, the typical rate of hESC line derivation can be far less than 10%. This is due to a variety of reasons, including the stage at which the originating embryo was frozen, the quality of the cryopreservation process, and the specific culture conditions. If they ask about success rates, embryo donors are informed of the generally low success rate among laboratories deriving lines, and that making a line is not trivial and depends on many factors, including the introduction of the cells into a highly artificial environment. Irrespective of whether or not a line is made, valuable data are acquired from every attempt to derive a line. Many donors ask if they will be informed if their embryo led to the derivation of a line. This raises several issues (Box 1).

Ethical concerns
Some couples want confirmation that their embryos will not be used to create a pregnancy. Other couples seek confirmation that human cloning will not be carried out (our institution prohibits reproductive cloning). Couples also ask how long the embryo will be allowed to develop before it is destroyed. As do most US laboratories, our institution prohibits in vitro culture of an intact human embryo for more than 12 days of development, or until formation of the primitive streak, whichever occurs first. In fact, growth is normally halted well before then, if the embryo is grown at all.

Several embryo donors have read The Immortal Life of Henrietta Lacks [5], the poignant story of the woman whose cervical cancer cells, unbeknownst to her or her family, became the HeLa cell line that continues to grow and contribute to scientific knowledge to this day. Embryo donors would like to know if their embryo could similarly end up as an immortal cell line, widely used in medical research. Although theoretically it could, it would be de-identified, unlike HeLa cells.

Donors have generally not questioned the statements in our consent form: ‘Research using your donated embryos may lead to the development of commercial products. There are no plans to provide compensation to you should this occur’. Occasionally, a would-be donor is turned-off by the prospect of a company making money from their embryo.

A desire not to waste
At the heart of many donors’ comments is Moller’s ‘discarded embryo argument’: ‘Many people maintain that if spare embryos will be discarded anyway, it is better to use them for research than to allow them to go to waste’ [6]. Although Moller finds this argument to be ‘unsound regardless of how one understands the claim that embryos have moral status’, for many donors their fundamental motivation to donate to research is a desire that the embryos do not ‘go to waste’. Many parents firmly reject the option of donating their excess embryos to other infertile couples because they do not want ‘someone else raising our child’ and do not want their current children to have one or more siblings ‘out there’. Therefore, destruction is the only remaining option, and destroying them for research purposes is preferable to throwing them away.

Many donors express hope that their embryos will do some good, and are relieved and even thankful there is a use for them. Some donors feel it is incumbent upon them to give back to research because research enabled them to have a family. Many donors ask scientific questions about stem cell research, including how tissues are made from pluripotent stem cells. Some want to know about the political climate for funding stem cell research. Occasionally, donors need assurance that their identities will not be made public. Although some donors seem to convey a sense of resignation, and comment on the finality of the decision to donate, others express their enthusiastic support for stem cell research and for science in general.

Concluding remarks
At the end of every consent conference, donors are told: ‘Thank you for considering this generous donation to research. We know this is a profound decision, and we appreciate it.’ Many couples appreciate this recognition. Indeed, without the extraordinary generosity and trust of these individuals and couples, this research would not be possible.

Box 1. An open question: whether to give the results
When embryo donors ask if they will be informed if one of their embryos has led to the derivation of a line, they are informed that they will not. Our Institute does not re-contact donors, and this policy is typical for donation of human tissue. For example, in a survey of over 400 biobanks (representing a wide variety of human specimens), only ~15% of biobanks returned individual research results to donors [7]. Indeed, a more ‘participant-centered’ interactive model for biobanks has recently been proposed: research participants engage in the research process with ongoing consent and regular communication with investigators [8], but this framework has not yet been widely adopted. More typically, research studies report results in a de-identified fashion, in aggregate, and do so in the scientific literature. This may be perceived as problematic in the unique case in which the donated specimens are embryos – in which the donors may feel emotionally invested. From an ethical standpoint, re-contacting embryo donors with the results of the research utilizing their embryos may be regarded as a kindness – ‘super-obligatory’ or ‘supererogation’ (i.e., morally good although not strictly required).

It could be argued that providing results to donors, and partnering with them, would be particularly advantageous when a new hESC line is made. As Saha has pointed out [9], maintaining relationships with stem cell donors, including continued access to their medical records, could enhance scientific discovery, and enable scientists to ‘connect information about cellular and tissue dysfunction in the lab with the manifestation of the pathologies in individuals.’ This presupposes that donors would like an ongoing relationship. Many embryo donors indicate that they want closure, although many say it would be nice to know if their embryo led to derivation of an hESC line.
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References

Special Issue: Nurturing the Next Generation

Breast is best, but not in my back-yard

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Breastfeeding may be the biological norm, but in Western culture it is not the social norm. Although intention to breastfeeding is high, new mothers emerge into a formula-feeding culture where formula milk appears as the solution to the public harassment, negative attitudes, and lack of support that breastfeeding women face.

Breastfeeding has consistently been shown to protect both infant and maternal health. The World Health Organization therefore recommends that all infants are breastfed exclusively for the first 6 months of life, with continued breastfeeding up to 2 years and beyond. This is echoed in localized health policy across the globe; promoting and supporting breastfeeding are key government health priorities [1].

Although contraindications to breastfeeding exist, over 98% of new mothers are physiologically able to breastfeed, and in developing countries initiation is typically over 99%, with many infants being breastfed through their second year. However, the picture in many developed countries is of notable contrast. In the UK, although 81% of mothers breastfeed at birth, by 6 weeks only 55% breastfeed at all. Similar figures emerge in the USA, Australia, and much of Europe (http://www.who.int/nutrition/databases/infantfeeding/en/).

Thus, although breastfeeding is the biological norm, in many Western nations it is no longer the social norm. This is despite data repeatedly showing that new mothers know the health benefits of breastfeeding and typically plan to breastfeed for longer than they do. If mothers are biologically able to breastfeed, plan to breastfeed, and are encouraged to breastfeeding by health policy, why then are levels so low?

This disparity can be attributed to the culture of formula feeding that has developed in many Western nations. Historically, breastfeeding was the common choice. Women who could not breastfeed had to give their infants substitute milks or, for the wealthy, find a wet-nurse. However, with the advent of formula milk and an industry that promoted the misleading concept that formula milk was better for infant health (and allowed independence for the mother), formula feeding gradually became the normal choice. In the UK, by the 1970s less than 25% of infants were breastfed by the end of the first week [2]. Even when health policy, and the research behind it, began to support breastfeeding again, experience and understanding of breastfeeding was low. Bottle-feeding and formula had become ingrained into Western culture: a ubiquitous synonymy of infancy that has lasted throughout attempts to promote breastfeeding. New mothers emerge into a culture where wrapping paper, clothing, and cards for new babies depict a bottle of formula. Baby facilities in shops and restaurants are signposted by a bottle image. Where there is an absence of women breastfeeding, pictures of bare-chested women adorn shelves of newsagents [3].

The impact of this upon new mothers is both direct and generalized. More overtly, the reactions a new mother faces from strangers and even family members when she breastfeeding her infant can be demoralizing and threatening. Although breastfeeding might be supported by health policy, and a woman breastfeeding in public is protected by law, reactions to public breastfeeding are a major barrier. Stories regarding negative remarks, threats, and being asked to leave premises are common. Women are called

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