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Saving embryos in stem cell science and embryo adoption

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The million frozen human embryos accumulated in IVF clinic freezers across the United States have become premier targets for saving by groups committed to repurposing reproductive remainders. Based on twenty-seven months (2008–2013) of ethnographic research within a Christian embryo adoption program and an embryo biobank for stem cell research, this article examines the motivations and practices involved in transforming leftover IVF embryos from a remaindered to a repurposed state. A focus on saving illuminates how moral discourses, economic logics, and biomedical issues conspire in shaping futures as well as modes of care in the present. Embryo repurposing programs use similar saving practices for different reasons, assume responsibility for repurposing IVF embryos, and strive to transform them into revalued forms for new futures. Fluctuating factors beyond the cryopreservation tank multiply rather than stabilize embryo potential. As a dynamic, open-ended process, saving requires programs to adjust strategies over time and wait.

Keywords: embryo disposition; in vitro fertilization; human embryonic stem cell research; embryo adoption; United States

Over a million human embryos left over from in vitro fertilization (IVF) procedures have accumulated in fertility clinic freezers across the United States (Lomax and Trounson 2013). At the turn of the twenty-first century, the fates of these reproductive remainders became the subject of bioethical controversy. In 1998, biologists in a University of Wisconsin lab established the first human embryonic stem cell line from a donated leftover embryo (Thomson et al. 1998). That same year, the first child was born through the world's first embryo adoption program – a “pro-life” Christian effort to rescue embryos from “frozen orphanages” by facilitating their chances to be born (Nightlight Christian Adoptions 2017). These coinciding events became embroiled in ongoing ethical debate in the U.S. about using

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human embryos and fetuses to advance scientific research (Scott 2006; George and Tollefsen 2008; Maienschein 2014; Thompson 2014; Hurlbut 2017). The events precipitated the establishing of biobanks to procure donated embryos for research on curing human diseases as well as advocacy by embryo adoption proponents for recognizing embryos as persons. Fueling debate about the fates of frozen embryos, a 2003 report estimating 400,000 embryos in cryostorage across the United States rendered more urgent discussions about what should happen with these widely valued and rapidly accumulating remainders (Hoffman et al. 2003).

During the past two decades, popular and scholarly literatures about embryo donation for research and adoption have examined their ethical, legal, and political differences, of which there are many (cf. Mundy 2006; Spar 2006; George and Tollefsen 2008; Thompson 2014). Serving as each other's opponent on the national stage has encouraged such analyses. President George W. Bush's first presidential address in 2001 announced an executive policy that limited federal funding for human embryonic stem cell research (hESCR) by expressing concern "about a culture that devalues life" (Bush 2001). Bipartisan majorities in both chambers of the U.S. Congress disagreed with Bush's policy, and prepared funding legislation for hESCR that might bring forth treatments for people debilitated by diseases. The day the U.S. House of Representatives prepared to pass the Stem Cell Research Enhancement Act of 2005, which Bush later vetoed, Bush dramatized his opposition by staging a press conference with twenty-one children born through the Snowflakes Embryo Adoption program. Bush commended the Snowflakes program for demonstrating "there is no such thing as a spare embryo" and for their effort "to ensure that our society's most vulnerable members are protected and defended at every stage of life" (Office of the Press Secretary 2005). Within months of President Obama revoking the Bush-era funding restrictions in order to finance research on a wider range of hESC lines (Obama 2009), staff and clients of the Snowflakes program signed onto a high-profile lawsuit against the Obama administration, which resulted in a temporary suspension of federal granting for hESCR (Wadman 2013). In many respects, the so-called "embryo wars" (Crockin 2006) continue to rage.

Yet, to explain broader social forces operating within embryo politics, some feminist social scientists have taken interest in what such opposing groups have in common. Anthropologist Sarah Franklin analyzed public debates in the United Kingdom on the use of embryos in research, and specifically the testimony of "pro-life" Christians and stem cell scientists. Based on their shared "language of hope, faith, miracles, and the salvation of humanity," Franklin concluded that IVF embryos function for all sides as a "salvation object" believed to be capable of redeeming the nation, economy, species, and future (Franklin 1999, 64). As Franklin noted, regarding embryos as salvation objects reflects the sacralization of life itself (cf. Duden 1993) and the reach of Christian discourses within contemporary biopolitics (Haraway 1997; Sunder Rajan 2006; Radin and Kowal 2017).

Anthropologist Elizabeth F.S. Roberts (2007), who conducted ethnographic research on IVF cryopreservation practices in Ecuador, drew a comparison with

the United States where she discerned a shared orientation to “life ethics” among embryo adoption promoters and stem cell research advocates. Within life ethics, embryos are alienated from their social contexts to allow them to be circulated and revalued: “It is precisely contemporary discourses of life that contribute to the transformation of entities like embryos into valuable, and anonymous, raw materials” (Roberts 2007, 181–2). For Roberts, life ethics reveal free-market logics that render frozen embryos “bioavailable” not only for stem cell research, as scholars of bioeconomies have noted (Franklin 2006b; Waldby and Mitchell 2006; Cooper and Waldby 2014), but also for adoption by “pro-life” Christians. Life ethics highlight the role of capital in fetishizing embryos among opposing groups concerned for their futures.

A third example from sociologist Charis Thompson’s (2014) study on hESCR ethics in California identified biomedical concerns as a common focus for stem cell proponents and embryo adoption advocates. Thompson argued that both groups, while coming from distinct ethical perspectives, embrace a shared ethical mandate to “save lives” – to save people from debilitating diseases and to save frozen “orphans” from physical harm (Thompson 2014, 45). For Thompson, saving life bridges medical and moral concerns for preserving the health of vulnerable beings.

Together, these comparative studies highlight the roles that moral discourses, economic logics, and biomedical issues play in aligning the efforts of groups committed to different fates for frozen embryos. Building on this scholarship, I introduce *saving* as a framework for examining how all three – moralities, markets, and medicine – conspire to realize the perceived potential of leftover embryos. Based on twenty-seven months (2008–2013) of ethnographic research within a Christian embryo adoption program and a human embryo biobank, this article examines the practices involved in transforming leftover IVF embryos from a remaindered to a repurposed state. I maintain that embryo donation programs use similar saving practices for different reasons and goals. In what follows, I analyze why embryo-saving programs assume responsibility for repurposing IVF embryos and how they strive to convert embryos into revalued forms. Then, I show how fluctuating forces beyond the cryopreservation tank multiply rather than stabilize embryo potentialities. Saving emerges as a dynamic, and sometimes incomplete, process that requires programs to adjust their strategies and reconsider their commitments over time.

Saving: A framework

I frequently encountered the word *saving* in conversations with interlocutors across my field sites to explain why and how they repurpose IVF embryos. While generally understood to mean the preservation of something considered valuable, saving has a rich etymological history containing multiple definitions (“save, v.” 2018). The earliest meaning of saving comes from fourth century A.D. notions of

heroic healing efforts that delayed death and rescued bodies from disease. In the tenth century, saving evoked Christian themes of rescuing the soul and delivering persons from evil into God's salvation. By the sixteenth century, saving took on an economic tone concerning the storing of financial resources for future use. Like saving, frozen embryos are irreducible to a "singular entity" (Franklin and Roberts 2006) or definition. The non-finite form of the verb *to save*, saving also signifies grammatical ongoingness that cannot be fixed in time. Thus, I favor using the multiple and continuous valences of saving to analyze how frozen embryo fates are managed because, as anthropologist Marilyn Strathern reminds, "it matters what ideas one uses to think other ideas (with)" (1992, 10).

Saving illuminates two main commonalities between embryo donation programs. First, it reveals a shared obligation to value the perceived potential of frozen embryos. Potentiality is one of those "future tense" (Selin 2011) concepts that raises questions about temporality. I show how discourses of saving in stem cell labs and Christian adoption agencies justify the repurposing of embryos by articulating relationships between pasts, presents, and futures. Specifically, saving cultivates attitudes of responsibility in the present to redress accumulated problems from the past and foster conditions for ethical action on behalf of the future. Moreover, I suggest that saving reproduces technoscientific, capitalist, and Christian notions of time in which linear notions of progress toward a realizable future are fundamental (Sunder Rajan 2006; Cooper 2008; Adams, Murphy, and Clarke 2009; Puig de la Bellacasa 2015). Yet I argue that saving embryos also entails practices of care (Puig de la Bellacasa 2011, 2012) that cannot be reduced to or subsumed by teleologies of progress. This raises for consideration what kind of time, and relationship to time, saving practices produce.

Saving also illuminates how frozen embryo potentialities multiply rather than stabilize over time; their futures, I suggest, are difficult to fix. Anthropologist Anne-marie Mol describes practices, or enactments, as techniques for "mak[ing] things audible, visible, tangible, knowable" (2002, 33). Building on Mol's theoretical interest in multiple coexisting realities, I focus my attention on how fluctuating social factors beyond the cryopreservation tank enact multiple *potentialities* for embryos. Bridging this approach with recent scholarship on cryopreservation technologies (Radin 2013; Radin and Kowal 2017), this article challenges the myth that frozen biological materials remain unchanged or singular over time. According to historian Joanna Radin, "While preservation has been idealized as the temporary suspension of life, in actuality, it mutates life" (2013, 269). The multiplicity and non-fixedness of saving as a conceptual framework helps explain these qualities in the practice of saving embryos.

Research methods

This ethnographic study utilized three research methods – participant observation, interviews, and textual analysis – to examine the repurposing of leftover embryos

within two embryo donation programs in California: the REDEEM Biobank and the Blossom Embryo Adoption program.¹ I conducted field research for twenty-seven non-consecutive months between 2008–2013.²

Based in Dr. Christine Moto's well-resourced research lab at West University, I traced how the lab's REDEEM Biobank converts embryos from excess clinical wastes into precious resources for research. My desk was located next to the Biobank in the lab manager's office – a choice spot for observing the management of donated embryos. I shadowed faculty, student and postdoc researchers, and tissue bank staff during their everyday activities in two large lab spaces in the Stem Cell Institute. The team of researchers working most often with donated human embryos became my closest interlocutors. I spent a week in a laboratory crash course in deriving stem cells, which provide me as a non-scientist hands-on experience caring for precious research materials. I also assisted the Biobank staff with addressing storage and database problems with their embryo inventory.

Activity in the Blossom program was intermixed with team meetings, calls with clients and clinics, and embryo matching sessions, all of which revealed how they strive to transform IVF embryos into adoptable orphans and clients into parents. Beyond the program office, I joined outreach events, annual picnics, and fundraising galas hosted by the program to learn how they promoted embryo adoption to broader publics.

During the period of research, I interviewed two main groups: relevant professionals (e.g. doctors, nurses, social workers, counselors, embryologists, lawyers, theologians, bioethicists) and embryo program clients (e.g. donors, adopters). I recruited interviewees in person as well as through an email posting to the embryo adoption program's client listserv. Interviews with people recruited in person were conducted in person; most of the people recruited by email, who often lived around the country, were conducted over the phone. I completed 200 formal, semi-structured interviews with: 38 embryo adoption professionals; 65 embryo adopters; 30 embryo donors; 30 fertility clinic professionals; 10 tissue bank staff; 20 pre- and postdoc stem cell scientists; and 7 active fertility patients.

I audio recorded and transcribed all interviews. For analysis, I coded interview transcripts and field notes using modified grounded theory, which was a systematic and iterative approach to defining and categorizing significant themes emerging from the data. Themes analyzed in this paper draw primarily from codes on responsibility, care, value, transforming, and time.

Study settings

At the end of IVF, fertility patients typically have four disposition options for any unused frozen embryos: discard, move to long-term storage, donate to scientific research, or donate to a person or couple for procreation. For many fertility patients, deciding what to do with their leftover embryos is emotionally challenging (McMahon et al. 2003; de Lacey 2005; Provoost et al. 2009). While some

studies indicate moderate levels of interest in donating for research or procreation (Nachtigall et al. 2005; Lysterly et al. 2006; McMahon and Saunders 2009; Lysterly et al. 2010), actual rates of donation are estimated at less than ten percent (Nachtigall et al. 2010). Organizations like the REDEEM Biobank and Blossom Embryo Adoption program rely upon embryo donations to advance their respective saving missions.

Embryo donation for research

Although Bush's 2001 executive order stalled the burgeoning field of hESC research in parts of the United States (Korobkin and Munzer 2007), California experienced it as a boon. In 2004, California voters passed Proposition 71, entitled the Stem Cell Research and Cures Initiative, which catapulted California onto the international scene as a world leader committed to the promise of research with human embryos. Voters agreed to invest \$3 billion dollars of taxpayer funds into the promise of hESCR over a decade's time. This unprecedented budget quickly surpassed in dollars the entire National Institute of Health's annual funding for human embryonic stem cell research in the United States, which in 2003 totaled \$24.8 million (Benjamin 2013, 13); it also surpassed all public investments made by other countries committed to this research.

Dr. Moto established the REDEEM Biobank through a grant from these tax dollars as a resource to provide regional scientists access to human embryos.³ Her research laboratory was comprised of thirty graduate and postgraduate scientists from numerous countries. She received over \$28 million dollars in grants and an endowed professorship at West University to support her investigations in human fertility and degenerative diseases.

The Biobank developed a novel informed consent process that allowed researchers more streamlined access to embryos for experiments through a universal consent. Before the Biobank, West University researchers created informed consent protocols for each experiment and connected with IVF clinics directly to recruit embryo donors. With the advent of REDEEM's standardized consent process, researchers whose projects met qualifying criteria liaised with the Biobank – rather than donors – to request embryos.⁴ The experience for Biobank donors differed from typical consenting processes. Instead of giving their embryos to a specific study, donors agreed to a range of possible uses, including IVF, infertility, human development, and stem cells, as well as specified preferences for two classes of research: early human development (Class 1) and genetic reprogramming (Class 2). This procurement approach required a multi-year approval process that involved the scrutiny of numerous ethics committees to ensure compliance with federal, state, and CIRM guidelines concerning the protection of embryo donors. Following these “ethical accounting procedures” (Thompson 2014), embryo donations began in June 2008.

To donate embryos to REDEEM Biobank, fertility patients followed these steps: Potential donors contacted the Biobank coordinator who followed up inquiries by mailing an introductory letter, six-page informed consent form, and voluntary health questionnaire. Patients were instructed to review the materials at home; if they decided to donate, they marked their preferences for how researchers may use their embryos, signed the donation forms in the presence of a witness, and returned the paperwork to REDEEM for review and final consenting over the phone. REDEEM considered embryo donations complete for patients when they submitted their consent forms free of error to the Biobank office. The coordinator then contacted the patients' fertility clinics to coordinate shipping arrangements to the lab.

Embryo adoption

Seven programs in the United States offer embryo adoption services. The two largest programs, the Snowflakes Embryo Adoption program and the National Embryo Donation Center, have each facilitated the birth of over 500 children to recipient families in the U.S. and abroad. Since 2002, the Office of Population Affairs has provided federal grant monies to organizations promoting "awareness" of "embryo donations and/or adoption" (US Department of Health and Human Services 2017). For many of the programs, the financial means to forward their missions is supported through program fees paid for by receiving clients.

The Blossom Embryo Adoption program served a clientele from an adoption agency in suburban California. During my period of research, the Blossom team was comprised of a program manager, social worker, and program assistants. Staff decorated the program office with Anne Geddes images of newborns, angel figurines, and Christian imagery. A placard stating, "Life is fragile, handle with prayer," rested on a bookshelf beneath the Dr. Seuss *Horton Hears a Who* movie poster with the tagline: "A person's a person no matter how small." A faux cryo-preservation tank – used as a prop for Blossom outreach events – was stored in the conference room with an accompanying sign that reads: "Frozen Embryo Nursery: Where Children Wait For Their Dreams To Come True."

Five of the seven embryo adoption programs in the U.S., including Blossom, use adoption as a model for matching embryo donors with recipients.⁵ Donors entered the Blossom program by completing an application and family profile, and submitting FDA-required health records. Once completed, donors spoke with the program's social worker about their matching preferences for qualities they want in recipients. Prospective recipients also filled out an application and profile, completed a home study with an adoption agency, and sent a \$500 check to start their file. Blossom recipients ranked matching preferences for the embryos (e.g. race/ethnicity of gamete donors, openness to embryos created with donor egg or sperm). To proceed with matching, they paid another \$500.

Clients with completed applications entered the matching pool where Blossom staff searched for possible fits between families based on program rules, client preferences, and “a little bit of God.” When staff identified a potential match, they sent donors the prospective recipient’s profile for review. If the donors approved, their profile was shared for review by the recipients; if the donors declined, both parties reentered the matching pool. Recipients paid \$3500 when a mutual match was made and another \$3500 when contracts were signed, at which time Blossom coordinated the shipping of embryos to the new fertility clinic. Depending on the level of contact desired between clients, the agency facilitated communications by forwarding information, such as birth updates and holiday cards.

Responsible repurposing

The REDEEM Biobank and the Blossom Embryo Adoption program shared an ethical commitment to valuing the potential of frozen embryos. Guided by different missions, REDEEM and Blossom resolved to save embryos because they saw them as containing high levels of potential – as pluripotent cells, scarce research materials, pre-born children, etcetera. They rejected the idea that excess IVF embryos are without potential use, and thus assumed responsibility for repurposing reproductive remainders.

“Every embryo counts”

According to an early Biobank brochure, REDEEM’s mission is “to optimize the use of precious resources for an increased knowledge of basic science and the future treatment of human diseases.” Researchers needed human embryos in order to continue the work of deriving stem cell lines, studying disease development, and testing therapies on human tissues that may lead to cures. “The situation was that we needed blastocysts,” the Biobank director, Dr. Pat Dunn explained, “but we decided that we’ll take any unwanted embryos.” REDEEM’s other mission, according to Dr. Dunn, was to support ethical decision-making:

The Biobank provides an ethical disposition option for patients who have a difficult decision to make ... [and] a way for people to dispose of their embryos in an honorable way. It is truly a tremendous savior option for people who spent money and effort to get to what they achieved.

In her view, donating embryos to REDEEM was a respectable contribution to scientific progress that relieves patients from the emotional stressors involved in embryo disposition decisions.

Dr. Moto’s research made headlines around the globe, in response to which she had become accustomed to answering questions about the ethical nature of experiments with human embryos. From her vantage point, it was not the destruction of embryos as human life that is unethical – as opponents of human embryonic stem cell research have argued (cf. George and Tollefsen 2008) – but the waste of their

potential. “I believe that it is not good to throw human embryos away,” she stated in a newspaper interview, “– *without studying them.*”

Scientists in Moto’s lab believed that the REDEEM Biobank contributed to scientific progress by recycling valuable resources destined for the trash. Nearly all of the lab members I met believed that IVF embryos were unusable for pregnancy prior to donation to the Biobank. One researcher’s reasoning captured a common refrain I heard: “Leftover embryos would just be discarded or incinerated anyways, so why not use them for good?” Simone, a senior postdoctoral fellow, explained what using embryos for good meant to her by invoking notions of saving:

Instead of throwing them away or discarding them, they are being used for these critical, insightful scientific studies ... They are very precious things because we can address really critical things about human development that we couldn’t otherwise address if we didn’t have access to these discarded samples.

Anna, a doctoral student in Moto’s lab, discussed her career with Catholic family members by conveying that stem cell scientists like her make responsible use of unusable embryos:

I have to tell them that the seven embryos I’m getting for research aren’t going to come to term as babies, that there’s no possibility of that ... They are proud of me because I’m using potential life that is not going to become actual life, and that I’m helping someone have higher a quality life and to save lives.

Responsibilities to save were also apparent in laboratory practices, in which I regularly observed how “every embryo counts,” as one postdoc put it. Researchers felt obligated to obtain maximal data by using minimal materials in their experiments; exercise careful lab techniques to ensure the best environment for the embryos; and adjust their personal lives to commit to rigid schedules that allow them to care for their *in vitro* cells during experiments. “As a scientist,” Simone explained, “you try to ask key questions, do good science, do good work, and not be wasteful.” She elaborated on how she and her lab-mates did good science by not wasting the potential of human embryos:

We all treat these things like gold. These are very precious samples. There’s no way we’d be throwing things away or wasting. We collaborate, we group up, and we try to maximize our resources. We take it very seriously.

Saving discourses articulate in many ways among scientists in Dr. Moto’s lab. They framed research with embryos in moral terms of not destroying valued entities but rather as repurposing resources destined for wastage. They deployed medical notions of saving when describing stem cell research as critical and life-saving, and economic connotations when championing efficiency and mindfulness about scarcity. For affiliates of the Biobank, REDEEM served a vital function by positioning itself as a responsible handler of societal refuse and by providing new purpose for leftover embryos no longer needed for their original intention.

“We want to give them all a chance”

The Blossom program began from the desire to rescue those left, literally and figuratively, in the cold. Tim Shoener, Blossom’s founder, felt that there was a “problem in society of valuing life less”:

I think one of the symptoms of that is 500,000 embryos frozen that we, as a society, have commodified because it’s more economical. There’s an attitude in IVF that as long as you are doing it, you might as well make it by the dozen. But life isn’t cheaper by the dozen. Embryo adoption is a movement to remind people that life begins at conception.

Like proponents of traditional adoption, the Blossom program considered itself “a child-focused organization.” As Tim explained, “There are innumerable children available, whether embryos or carried by a birth mother or orphanage, that need a family. Our focus is on recruiting families for these children.” On many occasions, Blossom staff expressed hope that they would “work ourselves out of a job” by finding adoptive homes for all “orphaned” embryos.

Even though each donated frozen embryo averages a 12% chance of successful thaw and implantation (Keenan et al. 2008), Blossom was dedicated to giving every embryo an equal opportunity to be born. “We consider that every embryo is a potential continued life,” said Kathy, the program’s social worker. “We want to give them all a chance.” For this reason, Blossom accepted all frozen embryos into its program for place with adoptive clients, regardless of how they were ranked clinically. “We’re not looking at the embryology report saying, ‘Oh this one’s not really worth saving.’ That’s just horrible to us,” Kathy explained.

The Blossom program strategically used language to challenge what they consider to be irresponsible and destructive discourses in American society. “What we call things matters,” according to Tim:

It means we’re trying to give the status of what is happening between these families and the baby that is involved some meaning and some dignity ... I think that by elevating the conversation and the terminology that applies to embryos may have some aftereffect. Just like the abortion language has had a tendency to devalue life, I hope the embryo adoption debate helps to revalue life.

Blossom enshrined its belief that embryos are valued persons in the program’s adoption contract by defining them as “pre-born children who are endowed by God with unique characteristics and are entitled to the rights and protection accorded to all children, legally and morally.” It also described donors as “genetic parents” who “become responsible for the lives of pre-born children in the embryonic stage” and the recipients as “adoptive parents” who “desire to accept the full moral and legal responsibility for parenting the embryos adopted hereunder and the child(ren) born therefrom.” Actively imbuing donors and recipients with parental responsibilities serves to “make parents” (Thompson 2005) of clients well before any potential children are born. By enshrining kinship language

within a contract that functions as a legal transfer of property – rather than an official adoption – Blossom strived to revalue embryos commonly described as spare, leftovers, excess, and property.

Embryo donors and recipients expressed commitments to saving by assuming responsibilities as parents and as stewards of God's gifts. Imagining embryos as children helped motivate many donors, like Belle, a mother of twins through IVF, to place their remaining embryos for "adoption."

I treated my embryos as if I was a pregnant woman who was going to give birth and I had to decide who was going to raise them. I thought of them as children, not embryos, when I was placing them. That's a very important distinction for me. I was picturing children, thinking that these are my children. I wanted to be true to them from the beginning.

Belle and her husband donated through the Blossom program because it allowed their embryos the opportunity to be born to another family, a "picture" they could tolerate better than donating for research or discarding. Many donors also described an obligation to be good stewards of gifts received from God. Dave, a father by IVF and domestic adoption, compared the duty he felt toward the seven frozen embryos "entrusted" to him by God to the task of caring for babies:

Responsibility is created knowing you have been entrusted with those people, those souls, and you need to think about it as being given seven babies so that it has the same burden and weight of a born baby. That's how I think of it. If you can't physically take care of seven babies, your job, your responsibility is to find them a home.

Blossom recipients expressed similar responsibilities for saving embryos as parents and obedient Christians. Soon after Tiffany's first child was born through embryo adoption, she began to think about the four embryos that remained in storage at her clinic. "I feel a big responsibility to go back to them, like a good parent," she explained. "I probably haven't prayed for them specifically but for God's wisdom. At the moment we are trying to figure out when the best time to do another transfer would be, when to give them the best chance." Yet as discussed below, the vast majority of recipients experienced infertility and were thus drawn to embryo adoption as a means for creating a family. In practice, this meant that their commitments to "giving embryos a chance" sometimes conflicted with their desires to "shop" for embryos to maximize the likelihood of pregnancy.

The Blossom program's commitment to saving foregrounds each connotation of the term: a moral imperative to regard embryos as persons, a challenge to economic discourses that cheapen embryos, and recognition that women's uteruses are necessary for "giving embryos a chance." Blossom staff and participants sought to revalue embryos that society had yet to fully recognize as precious. In doing so, they positioned themselves as responsible caretakers of what they perceive to be America's most vulnerable.

The REDEEM Biobank and Blossom program both sought to save IVF embryos from becoming purposeless. This commitment exemplifies what Joanna Radin and

anthropologist Emma Kowal (2017) call “cryopolitics,” which are practices in tissue preservation that strive to *make live* and *not let die*. Preventing embryos from “dying” in useless states involved revaluing their potential.

Transforming remainders

This section examines everyday practices within REDEEM and Blossom that tried to transform frozen embryos into new valued forms. In both settings, embryos underwent reclassification through paperwork and institutional protocols. Both programs also attempted to sever past relational ties forged through embryos, like claims of ownership and kinship, so that they may be repurposed for new futures. These efforts mutated and multiplied, rather than stabilized, what embryos could become.

Trash to treasure

REDEEM Biobank turned leftover embryos into research materials by preparing them for reclamation and use by researchers. To transform embryos into unclaimed resources, the Biobank’s informed consent (IC) process used the category “waste” as a temporary passage point for donated embryos. In so doing, REDEEM’s IC protocol reinforced the prevalent idea in Dr. Moto’s lab that excess embryos are a natural by-product of IVF destined for the waste bin (Hurlbut 2015). The IC document started by describing IVF as a process through which “materials” are made to assist with pregnancy. Some patients faced decisions about “discarding” what are described as “excess” and “unusable biological materials.” It characterized IVF as a technique that can produce “nonviable” cells “in excess of clinical need ... which may not be further required for your treatment.” If patients decided to donate their unused embryos, they were assured that these materials were already en route to the waste bin: “All cellular materials to be used in this research would normally be discarded because you, the patient, have chosen to discard the material.”

Describing IVF embryos as excess, discardable, nonviable, and unusable in the donor consent materials reclassified IVF leftovers as waste-embryos. Anthropologist Lynn Morgan’s (2009) study of early twentieth century embryo-collecting projects in the U.S. noted that waste has facilitated the donation of precious reproductive remains to science labs for over a century.⁶ Ethnographers of twenty-first century IVF have also identified enactments of the “spare embryo” to justify donation to scientific research (Thompson 2005; Franklin 2006a; Svendsen and Koch 2008). In Danish IVF clinics, anthropologist Mette Svendsen argued that “the bin facilitated a rearrangement of meaning” (2011, 422) for embryos slated for research. REDEEM’s consenting process supports the observation by scholars of tissue economies that IC protocol does not serve the single function of protecting research participants but rearranges the meaning of biological

tissues by converting them into unclaimed wastes (Waldby and Mitchell 2006; Hoeyer 2007; Ikemoto 2009; Cooper and Waldby 2014). IC achieves this by operating as a quasi-property contract that transfers ownership of biological materials from donors to biobanks (Cooper and Waldby 2014). REDEEM's IC form followed suit by including language about embryo donors having "no legal or financial interest in any commercial development resulting from the research," a clause that is now typical of tissue procurement in the United States. Once donors signed the form, embryos were allegedly severed from their "reproductive pasts" (Franklin 2006a) to become a microscopic *res nullius* awaiting productive reuse.

Newly designated waste-tissues are more easily objectified for scientific research and commercial profiteering (Landecker 1999; Waldby and Mitchell 2006). In this light, REDEEM Biobank operated as a "waste-exploiting club," to borrow sociologist Martin O'Brien's (1999) term about life within rubbish societies. Like other forms of waste within tissue economies, embryos donated to the Biobank become "simply another raw material" that can be turned into a profitable resource with the help of "modern day alchemists" (O'Brien 1999, 281) – or stem cell researchers – who are in a "search to renew, revitalize, refurbish and reaffirm the value of something that appears, superficially, to possess no value" (O'Brien 1999, 282).

The prevailing sentiment in Dr. Moto's lab, to use the words of one graduate student, is that REDEEM coordinates the ultimate "trash to treasure." While the ability to disentangle embryos from relational ties is essential to scientific research, it is hard won, if ever fully (Svendsen and Koch 2008). In narratives from frozen embryo and fetal tissue donors, scholars notice "trace effects" (Svendsen 2011) and "duties to care" (Pfeffer 2008) that complicate the clean story of converting reproductive leftovers into laboratory treasures.

Abandoned to adoptable

Like the classificatory role of waste in REDEEM Biobank, staff and supporters of the Blossom program strived to turn leftover embryos into "adoptable orphans" that may one day be born. The first step of transforming IVF leftovers into parentless children in need of homes involved making them objects of rescue. Blossom borrowed rescue rhetoric from traditional adoption practices in which promoters strategically use it, as historian Laura Briggs argues, to "mobilize pity ... to position some as legitimately within a circle of care and deserving of resources" (Briggs 2003, 181). The Executive Director of the adoption agency housing the Blossom program connected its mission to Proverbs 24:11–12, a Biblical passage about the perils of not rescuing those in need. "Embryos are orphans until they are born; they are not being cared for," he said. "God has a heart for orphans and therefore so should we."

Critical adoption scholars argue that transforming other people's children – many of whom have one or both living parents – into rescuable orphans involves "canceling" (Yngvesson 2010) their pre-adoptive histories by erasing ties with families

of origin and presenting them as autonomous agents ready for incorporation into a new family (Yngvesson 2002; Dorow 2006; Dubinsky 2010; Briggs 2012; Oh 2012).⁷ Blossom used similar “canceling” strategies to render frozen embryos parentless and in need of “homes,” or, more accurately, uteruses. A former program manager of the Blossom program described the state of frozen embryos around the country as an “orphan crisis”:

This program is not here to provide a new way for families to get children. It’s here to eliminate a problem that currently exists, in that there are children waiting to be born. It’s no different than an orphanage, an orphanage that has never been really looked at as a really neat opportunity for somebody to add children to their families. It’s been seen as a travesty that these children are not being parented.

She contrasted the image of an orphanage – a temporary place for housing allegedly parentless children – with the image of a warm uterus and argued that embryos, like children, do not belong in orphanages. Over the years, Blossom staff developed the imagery of “frozen orphanages” in promotional videos and materials. As mentioned earlier, they created a faux cryotank prop for use at tabling events to convince those who “have a heart for orphans” of where embryos do and do not belong.

Framing the cryopreservation tank as a risky place challenged the common clinical view that embryos are safely protected in subzero temperatures for an indefinite duration. It also challenged a guiding premise in the Blossom program that embryo donors and recipients are *parents*, which means that their embryos could not also be parentless “orphans.” This incongruity was clear to Monica, the Blossom program manager who spent a lot of time talking with clients on the phone about their feelings and concerns. Through these conversations, she learned about the affective labor entailed for donors making embryo adoption plans. Most of them, she explained, actively care for their embryos:

Even if they’re not being implanted, the [donor] parents are really loving them. They fill out the application, they cry about who to choose. They mull it over in their heads about what kind of family [and ask], *are these the right ones?* And then they talk to their doctor: *what is this going to cost, how are we going to do this, and what are our steps?* They’re just very concerned with going about things the right way.

For the vast majority of Blossom clients, Monica felt that terms like orphan, rescue, and abandoned failed to acknowledge the care that she saw donors bringing to the donation process: “The embryos aren’t abandoned but are the opposite: they are loved and cared for.”

Treating frozen embryos as abandoned orphans encouraged their rescue by recipients at the same time it erased the role of Blossom donors, who were often actively involved in the placement process and beyond. Like waste, orphanhood served as a necessary, though not uncontroversial, category in the Blossom program for converting IVF embryos into adoptable “preborn children” to maximize their chances of being born.

Caring for potential

Despite REDEEM's and Blossom's efforts, some donated embryos ended up having no place to go – yet. Embryo potentialities were contingent upon forces beyond the cryopreservation tank, including the desires of would-be recipients. While embryo-saving programs did not always realize particular futures for remaining embryos, they practiced forms of care by adjusting their strategies over time and waiting patiently for the future to come.

90% Of the supply, 10% of the value

When portable cryotanks arrived with donated embryos to the Biobank, Wendy, Dr. Moto's lab manager, signed the FedEx forms and flipped through the accompanying clinic papers in search for the embryology reports. Every shipment was greeted by staff with some level of anticipation because they were unaware what types of embryos they were receiving. Since the Biobank accepted all embryos for donation, the range of possibility was wide: from Day 1 two pronuclear (2PN) stage embryos to Day 6 hatching blastocysts, in batches of any number, frozen using any variety of method, and made using the sperm and eggs of the intended parents or gamete donors.

Some days Wendy responded excitedly that they received materials needed by researchers. "Those have to go to the bottom of the tank," Wendy said one afternoon, describing the location where a couple dozen 2PN embryos would be immersed deep in liquid nitrogen. "I want to prioritize them." Researchers studying human development (Class 1) were the most common users of donated embryos during my period of research, for whom 2PNs were the most valuable. Yet blastocysts were most often received – a stage of embryo development consistent with fertility clinic practices of growing embryos *in vitro* to Day 5 or 6 before transferring. "Ninety percent of the embryos in the bank are blastocysts," Wendy said in response to an entire shipment of them. "And they probably represent ten percent of the value."

The need for blastocysts to derive human embryonic stem cell lines was the original impetus for establishing the Biobank. Since opening, research agendas within the Stem Cell Institute's labs shifted in response to technological innovations within stem cell biology. The emergence of induced pluripotent stem cell technology now allows researchers to derive pluripotent stem cells from easily obtained human skin cells rather than solely relying on the stem cells contained within human embryos. The Biobank originators did not know that blastocysts would be less useful for researchers than initially imagined, nor did they realize how receiving all types of embryos through a universal consent disconnected from specific research needs would create a surplus of unusable materials.

Wendy became concerned about the Biobank's near full capacity. The Biobank had room to store over 50,000 straws, each of which could contain up to three embryos. "We can't just keep getting blast[ocyst]s from people who want to

donate,” she said. She and Biobank users worried about what to do when the tank reached capacity: Invest in a new tank? Limit the kinds of donations received? Close the bank altogether, as many other tissue banks in universities around the country have done? For Caitlin, a senior postdoc researcher, blastocysts were not useful today but might be useful tomorrow. “You never know down the road what you’re going to need,” she said. “Blastocysts are not being used as quickly as they are coming in but I think things go full circle sometimes. I feel like science is like that.” Despite the burdens of caretaking embryos with no current purpose, REDEEM staff and users continued to manage the frozen remainders for a future day when research needs may be otherwise.

Some questions about the Biobank’s future were answered soon after I left West University in the spring of 2013. Later that year, the Biobank launched a soft close by limiting the kinds of embryos they accepted to 2PNs and diseased embryos from genetic testing. Since it was one of the only tissue banks in the United States that received donated embryos without restriction, word spread quickly among fertility clinic staff. In Wendy’s view, closure was necessary: “In reality, if we ever use these blastocysts up it will be astounding.” The Biobank coordinator sent notification to EmbryoMail, a public embryology listserv, explaining the new situation for Biobank donors as depending “on the need and usage of such embryos by the research teams.”

The news of REDEEM’s closure might have been a story already foretold; other tissue banks at U.S. universities opened, received embryos for research, and eventually shuttered, like banks at the University of Minnesota and University of Michigan. Coinciding with the whispered news of REDEEM’s closure was another announcement: Dr. Moto was leaving West University for another. The closure of the Biobank and dissolution of Moto’s lab brought urgency to questions of what would happen with the thousands of embryos in REDEEM’s storage.

I visited what was left of Moto’s lab in April 2014 to inquire about the Biobank’s future. I sat down to Wendy’s familiar desk where we discussed what happened with capital equipment purchased through grant money, and how factors like the value of the equipment and wishes of the home department, Dean’s office, and university determined what happens when labs dissolve. Our conversation turned to the challenge of applying these logics to the Biobank; while the tank itself could be claimed as West University property, to whom the contents of the tank belonged remained murky. Wendy proffered an uncertain guess: “It’s a West University consent, so I imagine the embryos belong to West? I don’t know ...”

The Biobank was not in its usual spot because Wendy had moved it to a hallway storage closet in anticipation of relocating it. Dr. Moto did not plan to take the Biobank with her, which left the precious materials soon without a funding source or a physical location to be stored. “We’re trying to get the Biobank adopted,” Wendy said. “The bank is in need of a home.” She clarified: “By adopted I mean paying to support it.” Wendy seemed confident that the Biobank would find a home:

I can say that it will be taken care of but I don't know for sure and the decision is above my pay grade. I think they are too valuable of a research asset to dispose of in that way, but I don't know how exactly how it's going to be done.

In the meantime, she cared for the less-than-precious embryos by helping process the already consented donations awaiting shipment, monitoring the bank's liquid nitrogen levels every week, and holding out hope for its "adoption."

Before leaving Dr. Moto's once vibrant lab, I asked Wendy if she thought all of the efforts made to collect frozen embryos from around the country was worth the hassle. She explained that human embryos are vital for "good, valid research" and "how things will progress" for treating human disease. "You have to *make* it worth it," she said. For REDEEM affiliates, saving the least valued embryos was justified despite the burdens and uncertainties doing so entailed. The contentious environment around embryonic stem cell research in the U.S. made all donated embryos more precious to researchers as seemingly scarce resources. They also gave embryo potentials value by maintaining faith in the progressive direction of stem cell research that, as Caitlin maintained, will circle back around. This faith required staff and researchers to care for embryos with "ten percent of the value" and wait for circumstances to change.

Special circumstances embryos

The Blossom program similarly faced difficulty finding homes for some frozen "orphans." Blossom started having more recipients than donors since 2008, which allowed receivers a greater number of match opportunities and a greater level of "pickiness" in the matching process. "When you wait four months for the first match, you're not going to be too picky," said Monica, Blossom's program manager. "If when you come in and wait 12 h to get a match in your [email] inbox, it's a lot easier to say 'No.' Adoptive clients are much better 'shoppers' now."

While recipients endorsed the program's mission to rescue embryos, they also wanted to create a family of their own. The vast majority of clients came to the program after struggling with years of infertility, pregnancy failures, and losses. Thus, they often wanted to be matched with embryos that would help them achieve birth. Blossom staff were critical of prospective recipients who went "embryo shopping," which staff described as selecting matches based on criteria that they felt cheapened the "adoption" process. "It feels like people think it's a risk of not achieving pregnancy if they don't have more than 4 embryos, or a certain stage," Monica explained, referencing some of the criteria by which recipients "shop" for embryos. "Because we're a Christian agency," said Kathy, the program's social worker, "we want to believe people adopt to save the embryos." Monica wished receiving clients would "think about it just a bit more" before turning down matches with adoptable embryos. Following a disheartening rejection from a potential recipient, she vented to the Blossom team about the conflict

between the program's mission to save embryos and the client-driven matching process that enables "embryo shopping." "Does she want to be a mom?" Monica asked. "Because the embryos still need to be born to some family. It's not going to be easy for those embryos anywhere."

In 2011, the Blossom program developed an idea to remedy the problem of picked over embryos. It first debuted a "Special Needs" webpage featuring six biographies of "waiting embryos" that were deemed hard to match with recipients due to medical considerations (e.g. health issues with the genetic parents or siblings, or a positive infectious disease test result from a gamete donor). Months later, Blossom retitled the webpage to "Special Circumstances" to include donors with a small number of embryos and poor clinical rankings by embryologists. Staff explained that the goal of the webpage is to "get embryos adopted." Drawing details from the donor applications, they created biographies about how donors came to have remaining embryos and the qualities they want in a recipient family. The online features, according to Kathy, "paint an entire picture about the family and existing children and not just the embryo with a particular disease or issue." Monica further explained: "We are trying to pull a bit at people's heart-strings. We want people to be captured by the biography and think, 'Yes of course I want to give this embryo a story.'"

In the fall of 2012, I received an e-mail soliciting interest in one of the special circumstance embryos: "Dear Risa, Are you ready to take a leap of faith? There is a single embryo waiting for its chance at life. Here is its story ..." After several years of infertility, Dennis and Jolene Bower turned to IVF in 1998. By year's end, they had given birth to one son and were paying storage for seventeen frozen embryos. Nine years later, the Bowers decided they were done having children but wanted to help another couple become parents. In 2007, within months of completing their Blossom donor application, the Bowers chose the Daniels to receive their entire batch of seventeen embryos. Mirroring common practices in traditional adoption, Blossom prioritized placing embryos with recipients in complete "sibling batches." Unlike other embryo adoption programs that divide embryos among numerous families at once, Blossom preferred to find "forever families" who commit to using all of the embryos they receive in order to limit the number of families parenting genetic siblings.

Yet some recipients cannot fulfill this commitment. The Daniels transferred five of the Bowers' embryos, resulting in the birth of son, and felt their family complete. The Daniels relinquished their use rights to the remaining twelve embryos by returning them to the Bowers for re-matching with another family, which Blossom called a "disruption." In early 2008, the Bowers selected the Millers as the next family to receive their remaining twelve embryos. Over a year's time, the Millers thawed and transferred eleven embryos without becoming pregnant, then decided to discontinue trying. After disrupted placements with two families, the Bowers' original group of seventeen embryos had become a batch of one.

“Since the embryo was already in the program,” said Sarah, the Blossom program assistant, “we assumed responsibility. There were seventeen embryos to begin with. We don’t want to give up on one.” Finding a recipient for the single Bower embryo proved challenging for the Blossom team. The original batch matched within months, but as it reduced in number and the freeze date grew more distant, the single Bower embryo’s special circumstances became more pronounced. The Bower embryo was rejected numerous times by potential recipients uninterested in the low-graded Day 1 embryo frozen in 1998 using a slow-freeze method.

A year after starting the “Special Circumstances” webpage to help embryos like the Bowers’ be placed, nearly half (25) of Blossom’s sixty donors were featured on it. Kathy disliked the length of the list, suggesting that “most [donor embryos] aren’t special needs; people [recipients] are just being picky.” But client pickiness cannot fully account for the growing list of waiting embryos. Program decisions to welcome all embryos into the program and place embryos in complete sets with recipients have consequences that made it difficult for the program to fulfill its mission to give every embryo a chance to be born. For instance, more than half (14) of the special circumstances cases featured donors with one to three embryos, many of which resulted from disruptions. At the end of 2013, the Bowers’ embryo continued to wait along with the embryos of 22 other families. A shortlist of the least viable embryos for donation were prayed for each week during Blossom’s team meeting to help facilitate whatever they believed God had in store for the waiting embryos.

Blossom’s mission involved working persistently to find “homes” for all embryos, even for those hardest to place. It believed in the inherent worth of each embryo and had faith that “pro-life” Christians would be more motivated to “adopt to save the embryos” than to “shop” for would-be children. Yet the program found that factors beyond the cryopreservation tank and client desires shaped how embryos were valued as prospective “adoptees.” Thus, they tried to resolve the problem of “hard to match” embryos through maintenance strategies that they hoped would give “orphaned” embryos a story. They also wait, like stem cell researchers, for circumstances to be otherwise.

Saving embryos

In recent science and technology studies scholarship, Maria Puig de la Bellacasa (2015) identifies three aligned interpretations of the future in technoscientific practices within late capitalist societies. Some scholars describe an epoch-defining paradigm that “associates the future with progress, with an ethico-political imperative to ‘advance’ that remains solidly the orientation of linear, ‘progressivist’, timelines” (Puig de la Bellacasa 2015, 693). Others examine how the future configures, orients, and paces everyday practices. A third vein traces the affective and embodied impacts of anticipation given the precarity of acting on uncertain futures.

Together, these interpretations create a dominant narrative about an “industrious speeded-up time” (700) that “suspends and compresses the present” (707) and “subordinate[s] it to the linear achievement of future output” (706). Puig de la Bellacasa raises critical questions about this narrative: “If we accept the possibility of a diversity of practices and ontologies, the progressive, productionist and restless temporal regime, although dominant, cannot be the only one” (694).

In response, she and other STS scholars offer alternative approaches to this dominant interpretation of time. Puig de la Bellacasa examines *care* in soil science, a temporal practice that is not reducible to teleologies of progress or value production. Rather, care “suspends the future and distends the present, thickening it with a myriad of demanding attachments” (Puig de la Bellacasa 2015, 707) that are messy and non-innocent. Steven Jackson’s call for greater attention to *repair* and *maintenance* offers a similar challenge to a “productivist bias” in STS toward innovation and the new (2014, 234). Described as “an inescapably timely phenomenon” that “bridg[es] past and future in distinctive and sometimes surprising ways” (223), repair facilitates what Jackson calls “broken world thinking” by refocusing our gaze on other “timely or rhythmic phenomen[a]” (235).

These approaches to the future in STS literature help to frame a key question raised in this article: What kind of kind of time does saving produce? Inspired by what embryo adoption and stem cell research advocates have in common, this article examined saving practices within embryo donation programs in the United States. The multiple valences of saving provided a lens for analyzing the intersections of medicine, capitalism, and Christianity. Also, as a non-finite verb, saving emphasized the unfinished aspects of repurposing embryos, which cannot be fixed in time or reduced to a singular form. I have shown that embryo savers share ethical obligations to advance toward a particular future while caring for purposeless embryos, including ones they have failed to revalue – yet.

In a certain light, saving reproduces what Puig de la Bellacasa describes as the dominant technoscientific, capitalist, and – I would add – Christian temporalities in which linear notions of progress toward a realizable future remain fundamental.⁸ REDEEM Biobank and the Blossom Embryo Adoption program were established in response to what they perceived to be an urgent problem concerning the future: the need for valuable research materials to advance stem cell science and the need to rescue precious “pre-born children” from frozen orphanages, respectively. Both adhered to linear logics of value production by trying to transform IVF leftovers into more valuable forms. By striving to make frozen embryos “live” and not letting them “die,” saving aligns with other cryopolitical practices that cohere around a future-oriented “instinct” to resist devaluation, decay, and death (Radin and Kowal 2017). When presented with obstacles to realizing embryos’ potentials, both programs adjusted their strategies but not their goals; they remained steadfast in their desire to realize certain futures.

Yet saving practices also reveal thick forms of care that require attentive maintenance and patient waiting. Circumstances beyond the cryo-tanks “suspended the

future” by multiplying embryo potentials: as discarded waste, unclaimed waste, invaluable resource, devalued resource, abandoned orphan, preborn child, special circumstance embryo, waiting embryo, etcetera. These possibilities “thickened” the present with messy relationships and forms of value that disrupted “productivist” trajectories from trash to treasure, and abandoned to adoptable. Affiliates of both programs actively cared: Wendy maintained nitrogen levels for embryos in the REDEEM Biobank with “ten percent of the value” while Monica curated online biographies to promote the placement of “special circumstance” embryos. Both organizations also practiced waiting – a passive, rather than progressive, orientation to time that “bridges” unpredictable fluctuations of pace rather than subordinating them to one’s future goals.

Examining the inconspicuous practices and ontologies that structure the everyday, as critical STS scholars encourage one to do (Mol, Moser, and Pols 2010; Jackson 2014; Denis and Pontille 2015), reveals how fundamental care, repair, and maintenance are to future-oriented paradigms like saving. As Puig de la Bellacasa argues, “no output, no growth in the future and, one could say, no innovation or emergence of newness are possible” (2015, 708) without care and maintenance. While saving practices reproduce dominant imperatives to manage the future today, they also require care and maintenance upon which embryo repurposing programs – and their respective outputs, growth, and innovations – depend.

Notes

1. Considerable efforts have been made to protect the confidentiality of individuals and organizations participating in this study. All names of research subjects and locations in this article are pseudonyms.
2. All participants completed an oral informed consent process and all study procedures were approved by the author’s university Institutional Review Board.
3. Proposition 71 established CIRM as the granting agency that oversees the allocation of funds for human embryonic stem cell research within California and the Independent Citizens’ Oversight Committee as CIRM’s governing body.
4. During my field research, researchers in Dr. Moto’s lab requested the majority of embryos. The Biobank Director took initial steps to implement a software system for managing broader requests.
5. Most embryo adoption programs coordinate embryo adoptions without managing a physical inventory of embryos. By contrast, the National Embryo Donation Center is based in a fertility clinic where they receive and store frozen embryos awaiting placement with an adoptive couple.
6. Before prominent embryologists spearheaded a national embryo-collection network in the U.S., women typically discarded miscarried and aborted fetuses in unceremonious ways through burial in the backyard or by tossing down a privy. In order to secure the flow of precious reproductive remains to his Baltimore lab, Franklin P. Mall and other embryologists collaborated with state officials to ensure the classification of embryo and fetal remains as “medical waste” rather than corpses based on their assurance that the remains would be “put to good use” by researchers (Morgan 2002).

7. Yet, as critical adoption scholars also note, real and imagined ties to adoptees' pasts are rarely severed fully.
8. Modern Christian teleologies of progress most evident in discourses of salvation, end times, and resurrection are rife within U.S. biomedical and biotechnological discourses, which entwine scientific knowledge with forms of Christian witnessing (Haraway 1997), salvation (Sunder Rajan 2006), quests for the Holy Grail (Kay 2000), and actualizations of the "gift of life" (Sharp 2006). Recent anthropological scholarship began "untucking" religiosity to show how "secular" medicine has long depended on the non-secular (Whitmarsh and Roberts 2016). Christian teleologies have long structured capitalism, including recent iterations of speculative finance and security in advanced capitalist settings (Cooper 2008).

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