

Recent Progress in Egg Freezing

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Although sperm and embryos (fertilized eggs) have been successfully frozen and subsequently thawed to create healthy children for decades, it is only recently that successful human egg freezing has become a reality. There are two primary groups of women who are likely to benefit from advances in egg freezing technology: 1) Preservation of eggs for medical indications in women who are at risk of becoming sterile due to chemotherapy for cancer and 2) women who are delaying reproduction until later in life but who hope to retain the reproductive potential of when they were younger.

It has been nearly 20 years since the first successful pregnancy was reported from frozen and then thawed eggs (Chen, 1986), however only a handful of births was reported over the next decade. Today, experts estimate that approximately 200 babies have now been born from previously frozen eggs, and the number of patients with eggs frozen is most likely in the thousands. A survey of recently published literature yields pregnancy success rates ranging from 30-40% per embryo transfer.

The basic theory behind freezing any biological cell is to first dehydrate the cell in order to avoid ice crystal formation (typically accomplished by exposing a cell to a simple isotonic salt solution containing a permeable cryoprotectant (exp: 1, 2- Propanediol (PrOH), Glycerol, Ethylene Glycol (EG) or Dimethyl Sulfoxide (DMSO)) and a low concentration of a non-permeable cryoprotectant (sucrose)). The cell is given a brief equilibration period in order to uptake the cryoprotectant. It is then rapidly cooled to a temperature slightly below the melting point of the solution (usually around -7 °C) at which point the solution is 'seeded' to avoid supercooling (Trounson, 1984). As ice crystals form in the extracellular solution while the temperature slowly drops, the extracellular osmolarity increases. This in turn causes the cell to dehydrate during slow cooling until the temperature is lowered below -30°C. At this stage the intracellular cryoprotectant concentration is high enough that the remaining intracellular water will vitrify, preventing intracellular ice formation when the cell is plunged into liquid nitrogen. Thawing is done rapidly in order to avoid devitrification below the melting point when the water molecules can rearrange from the disorderly amorphous vitrified position to the orderly crystalline position (Mazur et al., 1968; Luyet, 1970). The dehydrated cell is also exposed to hypotonic conditions to facilitate rehydration and cryoprotectant removal (Mazur, 1977), while preventing osmotic shock (Leibo, 1986).

Slow freezing is the most commonly used method to cryopreserve oocytes, and is the method that has resulting in the vast majority of babies born from frozen oocytes worldwide. Slow freezing methods, with only slight modifications, are based on the procedure first described nearly 30 years ago. Oocytes are suspended in a solution containing cryoprotectants, cooled and seeded to induce ice formation, dehydrated, and then plunged into liquid nitrogen for storage. Ultra-rapid freezing, or Vitrification literally, achieving a glass-like state, represents a potential, though still less proven, alternative to slow freezing.

In the fall of 2004, The American Society for Reproductive Medicine (ASRM) issued an opinion on oocyte cryopreservation concluding that the science was "promising" due to the fact that recent laboratory modifications have resulted in improved oocyte survival, fertilization, and pregnancy rates from frozen-thawed oocytes in IVF. The ASRM noted that from the limited research performed to date, there does not appear to be an increase in chromosomal abnormalities, birth defects, or developmental deficits in the children born from cryopreserved oocytes. The ASRM recommends that, pending further research, oocyte cryopreservation should be introduced into clinical practice only on an investigational basis and under the guidance of an Institutional Review Board (IRB). As with any new technology, safety and efficacy must be evaluated and demonstrated through future research.

Extend Fertility™ is a company committed to furthering the advancement of oocyte cryopreservation research and providing services to women in need of preserving their fertility due to cancer, age, or other medical conditions. To further research of oocyte cryopreservation through multi-center clinical trials, Extend Fertility has partnered with six premier medical centers across the U.S., including Reproductive Medicine Associates of New York (NY), Stanford University's Reproductive Endocrinology and Infertility program (Northern CA), Huntington Reproductive Center (Southern CA), IVF New Jersey (NJ), Reproductive Science Center (MA) and Texas Fertility Center (TX).

Most recently, in a study sponsored by Extend Fertility and supported by Serono Pharmaceuticals and MediCult, RMA of New York achieved three pregnancies in four attempts using a frozen donor egg model, representing a 75 percent pregnancy success rate per embryo transfer. This outcome represents a 26 percent implantation rate, compared to other published results in the high teens. The group also reported a 90 percent thaw survival rate and a 90 percent fertilization rate – also well-above the averages published in the literature. These promising results are preliminary and are part of an ongoing study being conducted at six Extend Fertility-affiliated centers throughout the U.S., under standard IRB oversight.

Effective cryopreservation of human oocytes provides exciting new opportunities to many patients. Based on the recent advances and encouraging results, new applications for egg freezing may continue to emerge, and its wide-spread acceptance as a mainstream technology may be around the corner.