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Opinion Article

Approaches of Cryobiology and Science of Cryopreservation in Reproductive Medicine

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DESCRIPTION

The study of the effects of freezing and low temperatures on organisms is defined as cryobiology. Although cryobiology is primarily concerned with living organisms, cryobiology techniques have been extended to include non-living organisms. treatment freezing of biological time happens when cells are cooled in a controlled way to temperatures lower than those required to maintain normal operations physiological exercise Cells that are damaged or dying go through structural changes. Differentiations in destructive processes and manifestation observable changes that can result in death are two possible outcomes in which cells are damaged or killed. Low temperatures have been used to keep dormant but potentially alive living cells and tissues for cryopreservation and bio banking, with significant implications for scientific and biomedical applications. However, there is a critical discrepancy between the cryopreservation goal and experimental findings. The cryopreservation process can be fatal to cryopreserved cells and tissues. The challenge to the life of living cells and tissues during cryopreservation is not their ability to withstand storage at cryogenic temperatures (below 190° C) rather, it is the lethality associated with mass and energy transport within an intermediate zone of low temperature (15°C to 130°C) that a cell must pass over twice, once during cooling and once during warming.

The discovery of glycerol as a powerful cryoprotectant in 1949 launched the era of reproductive cryobiology. Polge and colleagues were the first to report the successful use of glycerol for sperm cryopreservation that year. Much progress has been made in the cryopreservation of reproductive cells and tissues since this initial fundamental technological step. Slow freezing, freeze-drying, and Vitrification technologies have been developed, and now it is possible to freeze not only all types of reproductive germ cells, but also ovarian and testicular tissues. Significant advances have thus been made in biotechnology and the storage of important murine lines, in genome resource banking for endangered species, in agriculture through germplasm transfer of genetically superior animals, and in human reproductive medicine. Depending on the kinetics of exposure, cryoprotectants can have both positive and negative effects on cell function. The concept of tolerable osmotic excursion of cell volume, as well as evidence for a 'pseudo-glassy' state for cells during traditional cryopreservation, will be discussed. This will be contrasted with the recent interest in promoting glassy states in whole-sample vitrification protocols, with the benefits and drawbacks of each approach outlined. Priorities for human reproductive clinics include avoiding multiple pregnancy complications and complications caused by endometrial bleeding, increased progesterone levels, or other unplanned risks embryo transfer delays. One method for achieving this goal is to transfer a single embryo to the patient and cryopreserve the remaining ones for future cycles. Embryo cryopreservation also allows patients' reproductive potential to be preserved before surgical interventions on pelvic organs.

As their concentration increases, penetrating cryoprotectants become more toxic. The toxic effect on cells can be reduced by using a CPA mixture in which the proportion of each protective agent is reduced while the total concentration remains constant. To avoid ice formation, high concentrations of CPAs and cooling rates are used during freezing - vitrification to achieve the oocyte/embryo glassy state. To avoid osmotic stress in oocytes and embryos, such agents have high osmolality and various osmotic stress reduction procedures, such as strict adherence to the solution exposure time and an increase in washing steps after thawing, are used. There is currently no agreement on the best universal cryoprotectant. In cryopreservation, mature oocytes are in the second meiotic division, which is sensitive to physical and chemical influences. Oocyte survival is increased when oocytes are released from surrounding cumulus cells and granulosa (denudation).

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