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ISSN: 2155-9546
Journal of Aquaculture Research & Development

Commentary

# Impact of Cryopreservation, Cryoprotectants for Ovarian Tissue Freezing and Advances in Cryobiology

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## DESCRIPTION

Cryobiology is the "study of effects of freezing and low temperature on organisms". Although the focus of cryobiology is on living organisms, cryobiology techniques have been extended to include non-living treatments as well. Biological time freezing occurs when cells are cooled in a controlled manner to temperatures below those required to continue normal physiological activity. Damaged or dying cells undergo structural differentiation under destructive processes and exhibit characteristic changes that can lead to death. In our case, there are two scenarios in which cells are damaged or killed.

The cell membrane has two layers, an inner layer and an outer layer, which are formed by chains of different types of phospholipids. Positively charged phospholipids such as phosphatidyl choline and sphingomyelin tend to reside in the outer sheet of the cell membrane, while anionic phospholipids such as phosphatidylethanol amine, phosphatidyl serine and phosphatidylinositol tend to reside in the inner sheet. The interaction between these two phospholipid layers forms trans membrane channels through cholesterol and proteins. Providing a fluid and variable membrane structure, phospholipids, which are predominant in docosahexaenoic acid chains, account for 65%-70% of the total membrane in lipids.

The cryobiology of germ cells, especially sperm, oocytes, and embryos, has received much attention. Great empirical progress has been made over the years to develop successful protocols for cryopreservation. Also, sophisticated methods of mathematics predictions of optimal conditions for freezing these cells were made. In this section discusses the frozen biological properties of sperm and egg cells. Whereas species specific differences in the molecular structure of plasma membranes have been shown to have different permeation thresholds, hydraulic conductivities, cryoprotectant permeability differences, and the effects of different extenders on these biophysical properties, the sources of inter individual differences may explain the heterogeneity within noticeable differences in sperm size and shape as a fraction of the osmotically inactive cell volume among ten species of mammals.

Cryobiology as an applied science is primarily concerned with cryopreservation. Cryopreservation is usually above 0°C but below mammalian body temperature (32°C to 37°C). Cryopreservation, on the other hand, is performed at temperatures ranging from -80°C to -196°C. Single cells are the most common cryopreservation target, although organs and tissues are more common targets for cryopreservation. Cryopreservation is the successful preservation of the normal functioning of cells or tissues by lowering the temperature below that at which normal chemical reactions occur. It is not the long term storage of cells at these temperatures that is detrimental, but the progression to these temperatures and return to normothermia leading to cryoinjury. Cryopreservation almost always requires one use. A compound that protects cells during freezing called as Cryoprotectants (CPAs) are usually very simple low molecular weight molecules, highly water soluble and of low toxicity. A common feature of these compounds is their ability to interact with water via hydrogen bonding. CPA is applied by simply incubating cells in a solution containing these compounds.

Human cryopreservation for infertility involves preservation of embryos, sperm or eggs by freezing. IVF is attempted when the sperm is thawed and inserted into a "fresh" egg, the frozen egg is thawed and the sperm is reinserted into the uterus with the egg, or the frozen embryo is inserted into the uterus. Vitrification has drawbacks and is not as reliable or proven as the traditional slow freezing method of freezing fertilized sperm, eggs, or embryos. Many researchers also freeze egg associated ovarian tissue in hopes of implanting the ovarian tissue into the uterus to stimulate normal ovulatory cycles.

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**Received:** 08-Aug-2022, Manuscript No. JARD-22-17714; **Editor assigned:** 10-Aug-2022, PreQC No. JARD-22-17714 (PQ); **Reviewed:** 22-Aug-2022, QC No. JARD-22-17714; **Revised:** 09-Jan-2023, Manuscript No. JARD-22-17714 (R); **Published:** 16-Jan-2023, DOI: 10.35248/2155-9546.23.14.719.

**Citation:** Eugeny J (2023) Impact of Cryopreservation, Cryoprotectants for Ovarian Tissue Freezing and Advances in Cryobiology. J Aquac Res Dev. 14:719.