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Popular Article

Cryopreservation of fish gametes

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Abstract

The biological field of cryopreservation examines the theories and procedures for maintaining live things at extremely low temperatures of -196°C. The metabolic processes of the cells are halted but they are still alive at this temperature. After a good thaw, their usual functioning can be restored. Genes can be preserved through cryopreservation for a long time. The preservation of biodiversity also includes the cryopreservation of sperm. By creating a gene bank, it permits maintaining a larger and more productive breeding population and aids in the conservation of endangered species by preserving genetic variety.

Keywords: Cryopreservation, Conservation, Fishes

Introduction

Cryopreservation is the process of freezing biological materials at a temperature of liquid nitrogen at -196°C. The sole factor impacting biological viability at this temperature, which can be preserved in a genetically stable form, is background radiation. This indicates that it is possible to store biological materials unmodified for hundreds of years while still having the ability to restore cell activity after thawing. This situation has increased the importance of the subject of study known as cryobiology, which examines how ultra-low temperatures influence cells, tissues, organs, and organisms as well as their capacity to retain vitality (Tsai and Lin, 2012). The development of cryobiology has also been sped up by a better understanding of the functional properties of thawed

cells after the freezing process. Basically, the cryopreservation process entails lowering the temperature, cellular dehydration, freezing, and thawing. Basic mechanisms for the long-term preservation of biological material in genetically stable form are provided by these occurrences at extremely low temperatures. Since no major biologically important change happens in practice below 150°C, the substance can be conveniently kept in liquid nitrogen at -196°C (Anjali and Kumar, 2020).

Cryopreservation of fish eggs

The process of egg cryopreservation is more difficult than that of sperm. In 1950, the first effective cryopreservation of fish sperm was documented. Since the initial attempts to freeze fish sperm, researchers have speculated about the potential use of this technique on a variety of freshwater and marine species, including zebra fish, salmonids, common carp and cyprinids, beluga sturgeon, Atlantic salmon, Siberian sturgeon, eel, perch and shrimp. due to their significant commercial importance, either as food or for leisure activities like fishing (Noble, 2003; Chew and Zulkafli, 2012). The fresh water prawn, *Macrobrachium rosenbergii* spermatophores successfully preserved for the first time. Storage of milt can be helpful in the fish farming and seed producing industries-

1) Selective breeding
2) Hybridization
3) Commercial seed production

It is reasonable to say that the primary challenges in removing intracellular water from fish eggs are their size and the presence of three distinct membrane layers with various water permeabilities. Fish eggs and embryo cryopreservation attempts have had little to no success.

The fundamental problems are-

1. Inadequate dehydration during chilling or freezing because fish eggs are quite large (1-6 mm).
2. Membranes with varying water permeabilities are present. Cryoprotectant penetration is also minimal, especially into smaller eggs and embryos.

The opening of the channel in the shell-like chorion allows the eggs to be removed and makes them accessible to cryoprotectants that reduce ice. In inactivated ova, the uptake of cryoprotectants such glycerol, Dimethylsulphoxide (DMSO), and methanol is quite sluggish. Yet, the tube closes and the chorion hardens once fertilization or activation takes place. Studies on fish egg cryopreservation to date have mainly focused on model species like zebrafish (*Danio rerio*), although

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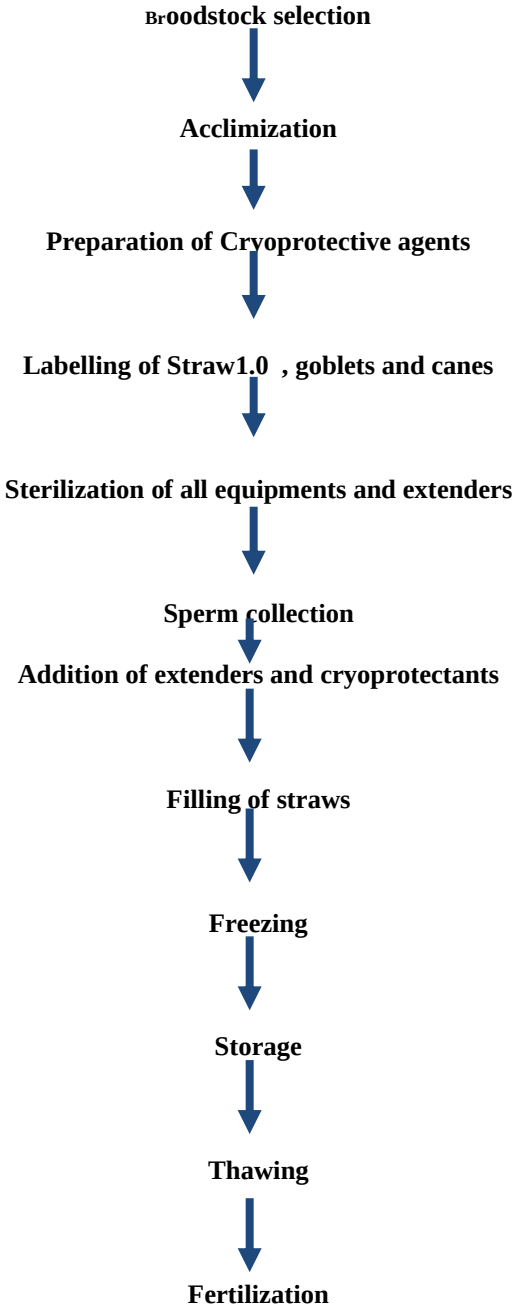
other marine and freshwater species have also been studied, such as gilthead sea bream (*Sparus aurata*) and some South American freshwater species (Motta et al., 2021). At this point, the eggs are impermeable to cryoprotectants and will significantly increase in size due to a brief inflow of water. Fish eggs' multicompartmental biological systems, low membrane permeability, high chilling sensitivity and bigger size are some of the characteristics that limit their ability to be frozen.

Methods of cryopreservation



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Application of cryo preservation in fisheries and aquaculture

Sperm freezing is crucial for a number of fish species involved in genetic improvement programs in order to disperse or conserve genetic potential or to assess genetic advancement

- Gametes can be gathered and held under suitable storage settings during asynchronous conditions for use in the future. It is possible to raise the effective population size while maintaining a small male broodstock.
- Sperm cryobanks can be used to control the genetic integrity of farmed stocks, as well as the genetic conservation and management of wild resources and threatened wild or cultured stocks.
- Genes from valuable stocks that possess desirable traits can be stored in frozen sperm banks for use in the future.
- In selection programs, original stock milt can be cryopreserved and used subsequently to compare half-siblings.
- Through androgenesis, it is possible to recover the entire genome of endangered or extinct stock from cryopreserved milk.

Conclusion

We can be established for Endangered or Endangered species, wild strains, cryobanks, or species of economic significance (Continued effort). Fish eggs and embryos cannot yet be cryopreserved due to their large size and high yolk content. Materials for cryopreservation include spermatogonia and oogonia, undifferentiated germ cells such as primordial germ cells.

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