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Orientation: Sustainable use of Marine Resources
Specialization Area: Aquaculture
Research Area: 2.11 Biotechnology applied to aquaculture

PhD project: **Vitrification and ultra-fast laser warming of oocytes and embryos of model marine organisms**

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Summary: Cryobiology is a well-developed and worldwide-recognized technique for achieving long-term storage of biological material at low temperatures. Cryopreservation consists of freezing, banking and thawing living organisms, cells or tissues in the presence of cryoprotecting agents. When cryopreserving cells, one way to avoid lethal Internal Ice Formation (IIF) is to cool cells slowly enough so that the freezable water in the cell flows out of the cell and freezes externally. Another alternative approach is to avoid intracellular ice formation by vitrifying cellular water which involves converting water into a non-crystalline or amorphous glass. Several species of marine invertebrates can be cryopreserved, most of the developed protocols are either for sperm or for larvae. This is due to the impossibility of cryopreserving oocytes of marine invertebrates with a good post-thaw survival. The oocytes of aquatic organisms have proven to be recalcitrant to cryopreservation and there are several factors that have been quoted as responsible for this: large volumes, low surface/area ratio, low permeability to water and cryoprotecting agents, high sensitivity to toxicity of cryoprotecting agents and chilling sensitivity are some examples.
The aim of this work is to use this experimental methodology to try to cryopreserve marine invertebrate´s oocytes which have remained as a challenge up until now. This work aims to answer some important questions regarding damage during traditional slow cooling, about the technical challenges of the application of vitrification to marine invertebrates and the implementation of technologies like vitrification coupled to ultra-rapid laser warming as a solution to slow freezing damage.