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Ph.D in Biology XXXV Cycle

Innovative methods for marine research and automated culture of aquatic model organisms

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Traditional protocols can have limitations that can lead to missed opportunities for important discoveries and potential biases in the research. To overcome these limitations, new approaches are intended to involve collaboration between researchers from different fields and the integration of different perspectives, methods, and techniques. According to this, the main objective of this thesis was to investigate the potential of incorporating new methods and a multi-disciplinary approach in several fields of biological research, as well as to develop innovative automatic culture techniques for aquatic model organisms.

In this project, we tested an encapsulation technique, proposed as an innovative method, to preserve the active compounds from algal extracts and administer them to aquatic model organisms. Moreover, we highlighted the potential of the integration of the molecular approach in studies of various fields. Indeed, we found that molecular analysis of the gene expression could be used as an early indicator of stressful conditions for sea urchins, in our studies, and other marine invertebrates more in general.

Moreover, we explored the potential of incorporating molecular analysis as an alternative to traditional bioassays. For this reason, we aimed to investigate the potential of using a molecular approach to better understand the mechanisms involved in the correlation between the peculiar early sexual shift in the shrimp *Hippolyte inermis* and the ingestion of *Cocconeis* spp. diatom, with the ultimate goal of optimizing the protocol for earlier identification of the molecular structure of the active compound.

Ultimately, two smart, flexible and modular culture systems were developed to facilitate the automatic production of demanding species, both for scientific and aquaculture purposes.