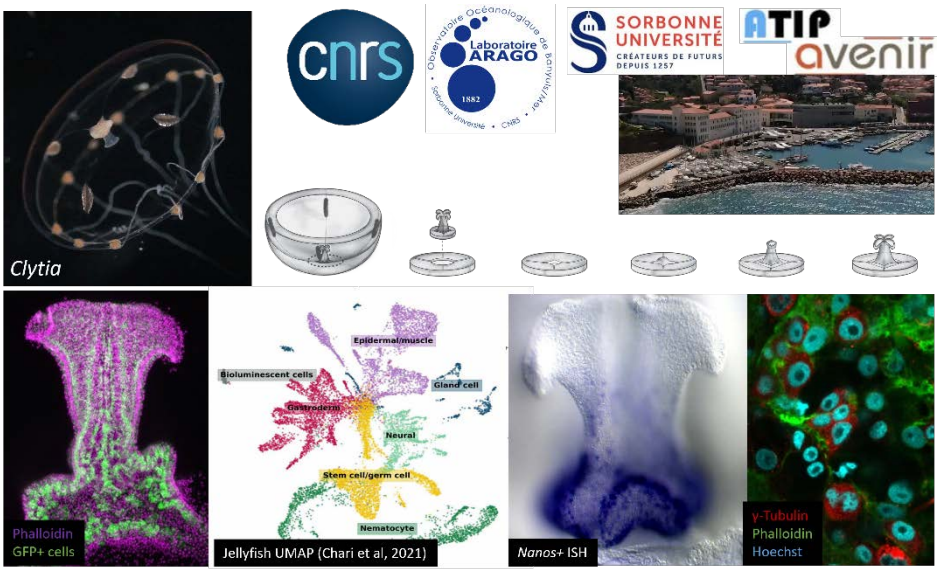
Master 2 project

2023-204

Progenitor cell differentiation trajectories in jellyfish organ regeneration



Some organisms can regenerate damaged body parts and organs. This non-embryonic morphogenetic process usually depends on the coordinated behaviour of a reservoir of progenitor cells that accumulate, proliferate and start differentiating into appropriate cell types. What is the potential of these progenitor cells? And what are the differentiation trajectories of the regenerated cell types? These are key questions of regenerative biology, which we are addressing with our jellyfish laboratory model *Clytia hemisphaerica*.

We recently showed that *Clytia* is capable of regenerating missing organs in less than a week, re-building in particular a smaller but functional feeding organ in only four days (Sinigaglia et al., eLife, 2020; unpublished). This process starts from a heterogeneous cell mass, comprising *Nanos+* stem cells, germ stem cells and differentiated digestive cells. A fraction of regenerative stem cells derives from migrating germ stem cells coming from the gonads (Sinigaglia et al., eLife, 2020) and -likely- from local de-differentiated cells. We still know little about the stem cell system of the adult jellyfish, about the actual potential of the progenitors, and about the fate of the germ stem cells in the regenerated mouth. Our current working hypothesis is that mouth regeneration requires the contribution of multiple lineages of progenitor cells, with restricted potential, deriving from different sources.

We are seeking a motivated master student to join our dynamic team "Cnidarian Regeneration, Development and Evolution" (www.cnidevolab.com) and contribute to this ongoing project. This internship project will apply a combination of established molecular biology, bioinformatic, imaging (e.g. confocal microscopy) and microsurgery approaches, in order to disentangle the progenitor dynamics during mouth regeneration in the jellyfish *Clytia*. The student will gain expertise in jellyfish culture, and will:

- Perform microsurgeries (dissections, grafts) in order to manipulate the cellular contribution of different jellyfish structures, notably of the nearby organs (that are stem cell niches).

- Analyse single cell transcriptomic data using well-established bioinformatic tools, in order to identify the stem cell pools and define the differentiation trajectories of the diverse cell types constituting the mouth (muscle cells, nerve cells, digestive cells, stem cells…).

- Characterize the nature and the spatial distribution of progenitor during regeneration, through in situ hybridization (chromogenic, fluorescent and HCR) and antibody staining, in diverse regeneration assays (notably in presence/absence of nearby organs).

- Determine the proliferation patterns of stem cells and cell type progenitors, through a combination of in situ hybridization and pulse and chase EdU-based proliferation assays.

This master internship – which could lead to a PhD project – will be done at the Oceanographic Observatory of Banyuls-sur-Mer (Sorbonne University/CNRS).