Ecole Doctorale COMPLEXITE DU VIVANT – Fiche Projet CONCOURS

Nom et prénom du directeur de thèse : Houliston Evelyn
Coordonnées Tel : +33 (0) 4 93 76 39 83 e-mail : houliston@vlfr.

Nom et prénom du co-encadrant (non HDR) : Leclère Lucas
Coordonnées Tel : +33 (0) 4 93 76 37 94 e-mail : leclere@obs-vlfr.fr

Y-a-t-il un candidat déjà identifié pour le projet : OUI
Nom et prénom du responsable de l’équipe : Houliston Evelyn
Intitulé de l’équipe : Cnidarian developmental mechanisms
Nombre de chercheurs et enseignants-chercheurs statutaires de l’équipe titulaires d’une HDR (ou équivalent) : 1

Nom et prénom du responsable d’unité ou de département : Houliston Evelyn
Intitulé et N° d’unité ou de département :
UMR7009 CNRS/UPMC – Laboratoire de Biologie du Développement de Villefranche sur mer.
Signature du directeur d’unité ou de département (vaut avis favorable pour le dépôt du projet) :

Titre du projet de thèse : Embryonic developmental mechanisms in the direct developing jellyfish Pelagia.

Spécialité : Biologie du développement, Evolution

Résumé du projet de thèse (1 page maximum, en anglais)

Cnidarians (including coral, sea anemone, jellyfish) are sister group to Bilateria (which includes most experimental animal model species) but employ a largely overlapping set of developmental regulator genes, and thus can provide extremely informative comparative systems for understanding developmental mechanisms and their evolution (Houliston et al 2010). Current knowledge on developmental regulator genes from the vast cnidarian clade is restricted to very few species and is thus largely inadequate to address the evolution of embryonic developmental mechanisms within it, or to make comparisons with Bilateria. Concretely, the few cnidarian developmental model species developed so far represent only two of the main cnidarian sub-groups: the anthozoans (sea anemone Nematostella and coral Acropora) and the hydrozoans (Clytia, Hydra and Hydractinia), while the molecular regulation of embryonic development in the scyphozoan group, the "true jellyfish", remains completely unexplored. In this context, we have started to develop tools to exploit the direct-developing scyphozoan Pelagia noctiluca as an experimental model.

This PhD project will analyze the involvement of conserved developmental regulator genes during embryonic development, leading to formation of the juvenile jellyfish (ephyra) of Pelagia. Embryonic development in Pelagia is direct, the planula larvae transforming four days after fertilization into the ephyra, which already exhibits the radial adult body plan. Pelagia medusae are very abundant in the bay of Villefranche-sur-mer throughout the year, a large numbers of eggs and synchronized embryonic stages can be obtained daily, and the simplified life cycle can be controlled in the lab. Some genetic resources, tools and methods are already established for Pelagia, and will be further developed in the framework of this project. Studies currently underway have uncovered a wide set of developmental regulators, similar to those in Nematostella and Clytia.

The goal of this project is to analyze the sets of genes expressed during successive stages of development from blastula to ephyra in Pelagia, and to characterize in detail the roles of key selected genes. Specific comparisons will be made with the embryonic developmental mechanisms previously characterized in Nematostella and Clytia (e.g. Leclère et al. 2014, 2016; Lapebie et al. 2014). Preliminary data have identified promising candidate developmental regulators including Wnt signaling ligands, as well as transcription factors of the Six and Fox families, expressed at the ephyra stage. This molecular study will be complemented by a precise morphological description of the developmental stages from egg to ephyra. The PhD student will employ a variety of techniques including molecular biology, imaging, transcriptomic analyses and gene function analyses.
Ecole Doctorale COMPLEXITE DU VIVANT – Fiche Projet CONCOURS

and will also participate in developing new tools for studying cell and developmental biology of Pelagia.

Experimental strategy:
1) Establish the gene repertoire of Pelagia noctiluca using both existing and newly generated transcriptomic data and phylogenetic methods, focusing on well conserved signaling pathway components (e.g. Wnt, BMP, FGF) and transcription factors (e.g. Fox, Sox, Homeobox).
2) Undertake expression profiling by in situ hybridization for a selection of genes identified in (1). Particular attention will be paid to genes whose orthologs in Nematostella and Clytia have well-described expression patterns and known functions.
3) Characterize at the cellular level the main developmental stages from egg to ephyra in relation to the gene expression patterns established in (2). Cell proliferation, cell movement and tissue organization will be detailed at gastrula, planula, metamorphosing planula and ephyra stages using a variety of approaches including imaging (live and fixed specimens) and different types of nuclear, cytoplasmic and membrane staining.
4) Perform knockdown assays on key genes identified from (1 & 2) and showing particularly interesting expression patterns. Knockdown will be performed by injecting morpholino and/or RNAi in unfertilized eggs. Likely candidates include Wnt β-catenin signaling pathway components, since a wealth of functional data demonstrate a major role of this pathway in embryo patterning in all other cnidarian (e.g. Leclère et al. 2016; Lapebie et al. 2014) as well as bilaterian developmental models.

Thèses actuellement en cours dans l’équipe.

<table>
<thead>
<tr>
<th>Nom et Prénom du doctorant</th>
<th>Directeur(s) de thèse</th>
<th>Année de 1ère inscription</th>
<th>ED</th>
<th>Financement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peron Sophie</td>
<td>Houliston Evelyn</td>
<td>2015</td>
<td>CdV</td>
<td>MRT</td>
</tr>
</tbody>
</table>

Trois publications récentes du directeur de thèse et du co-encadrant.

Directeur de thèse :


Co-encadrant :


Docteurs encadrés par le directeur de thèse ayant soutenu après septembre 2011 et publications relatives à leur sujet de thèse.


