



Master Biologie Moléculaire et Cellulaire 'BMC',  
Université de Paris - UFR Sciences du Vivant

Parcours : **Biologie et Développement Cellulaires 'BDC'**

<http://www.master2bdc.fr/>

Fiche de Projet de Stage M2, Année 2021-2022

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**Titre du projet :** Role of epigenetic regulation and cell identity changes during regeneration in the annelid *Platynereis dumerilii*

**Résumé du Projet de Stage** (en 300 mots maximum, mots clés en gras)

Every single animal is an extraordinary well-organized network of various cell populations showing highly diverse molecular and functional identities. However, all these adult cell populations arise from a single-celled zygote and thus share the same DNA sequence, raising the issue of the mechanisms underlying the variety of cell fate trajectories. These molecular events that allow gene expression modulations without any alteration in the nucleotide sequence, or **epigenetic mechanisms, include post-traditional modifications of Histones such as methylation and acetylation**. A growing interest for Histone modifications has revealed the conservation of key **Histone marks of active and inactive genes during embryogenesis and organogenesis** in a variety of organisms across animals and beyond. Nevertheless, other developmental processes such as **regeneration remains poorly investigated**, especially in non-vertebrates, despite clear evidences that such processes require massive changes in gene expression and the *de novo* establishment of differentiated cells.

Regeneration, the ability to restore lost body parts, is a widespread phenomenon in animals. Whilst this ability is somehow limited in classical developmental model organisms, a variety of animals belonging to every main branch of metazoans are able to **regenerate complex structures upon injury**, such as limbs or even their whole body from a small piece of tissue in some cases. In the lab, we use **the annelid *Platynereis dumerilii***, an emerging developmental biology model to study regeneration. After amputation of the posterior part of their body, *Platynereis* worms are able to regenerate both the pygidium (the posteriormost differentiated part of the body, which bears the anus) and a subterminal growth zone through the formation of a regeneration blastema (mass of undifferentiated proliferating cells that accumulate at the damaged surface underneath the wound epithelium).

This M2 project aims to **investigate how modulations in Histone marks contributes to changes in gene expression and changes in cell identity and trajectories** (i.e. differentiation and dedifferentiation processes) during *Platynereis* posterior regeneration. More specifically, the student will develop complementary approaches such as pharmacological treatments and **cutting-edge sequencing technologies** (i.e. CUT&RUN-seq and scRNA-seq) to unravel the role of Histone marks in cell population diversity and its dynamic during regeneration.

**Publications de l'équipe relatives au projet de stage (max 5)**

- Bideau L, Kerner P, Hui J, Vervoort M@\*, Gazave E@\*. Animal regeneration in the era of transcriptomics. Cell Mol Life Sci. 2021 doi: 10.1007/s00018-021-03760-7.
- Planques, A., Kerner, P., Ferry, L., Grunau, C., Gazave, E.@\*, & Vervoort, M@\*. (2020). DNA methylation during development and regeneration of the annelid *Platynereis dumerilii*. BioRxiv, 2020.11.13.381673. <https://doi.org/10.1101/2020.11.13.381673>
- Planques, A., Malem, J., Parapar, J. Vervoort, M.@\*, Gazave, E.@\*. (2019) Morphological, cellular and molecular characterization of posterior regeneration in the marine annelid *Platynereis dumerilii*. Developmental Biology. <https://doi.org/10.1016/j.ydbio.2018.11.004>
- Gazave E., Lemaître Q., and Balavoine G. (2017). The Notch pathway in the annelid *Platynereis*: Insights into chaetogenesis and neurogenesis processes. Open Biology 7, 160242.
- Gazave E., Béhague J., Laplane L., Guillou A., Préau L., Demilly A., Balavoine G., and Vervoort M. (2013). Posterior elongation in the annelid *Platynereis dumerilii* involves stem cells molecularly related to primordial germ cells. Dev. Biol. 382, 246-267