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

Parcours : **Biologie et Développement Cellulaires 'BDC'**
https://master2bdc.ijm.fr/
Fiche de Projet de Stage de M2, 2025-2026

Unité INSERM ou CNRS ou Université : Institut Jacques Monod (UMR 7592) **Intitulé Equipe :** Cellules souches, développement et évolution **Responsable de l'Equipe :** Eve GAZAVE	**Responsable du Stage : Eve GAZAVE** **Contacts** Adresse : IJM 15 rue Helene Brion 75013 Paris Email : eve.gazave@ijm.fr Tel : 0157278101

Titre du projet : Unravelling animal regeneration success, insights from the annelid Platynereis

Résumé du Projet de Stage

Regeneration, the ability to restore lost parts of the body, is a widespread phenomenon in animals. We use the **annelid *Platynereis dumerilii***, an emerging developmental biology model (Ozpolat et al., 2021) to study regeneration in a comparative and evolutionary perspective. After amputation of the posterior part of their body, *Platynereis* worms are able to regenerate this complex body structures (Planques et al., 2019). However, after **head or anterior amputation**, while regeneration appears to be initiated, the process stops and there is no production of any differentiated head structures. The main research project of the team is to understand **why some regeneration processes are successful while other are not** in *Platynereis*. The M2 student will participate to this major project of the team and will test the specific hypothesis that differences in regeneration success could rely on different or altered **initiation regeneration program(s).** Indeed, we have previously shown that ROS and apoptosis trigger the initiation of posterior regeneration in *Platynereis* and that they are mandatory for regeneration to proceed normally (Vullien et al. 2025, Krasovec et al., in prep). In the absence of those signals, cell proliferation is reduced and regeneration is stopped. While the signaling pathways allowing interactions between those cellular processes remain largely unknown, preliminary data of the lab suggest the importance of the MAPK signaling pathway.
The student will study the importance, roles and interactions **of ROS, apoptosis and MAPK** during the initiation of the abortive anterior regeneration and compare the situation with successful posterior regeneration. S/He will perform:
i) a characterization of the *in vivo* distribution of cells producing ROS (with dye), showing apoptosis (TUNEL) and MAPK signaling (immunohistochemistry) during anterior abortive regeneration using confocal imaging.
(ii) a characterization of the expression of genes linked to all three processes, using *in situ* hybridization and Hybridization Chain reaction (HCR) to define and combine their spatio-temporal expression patterns during anterior abortive regeneration.
(iii) Functional analyses using efficient pharmacological inhibitors that block ROS (Apo), apoptosis (Z-VAD) and MAPK signaling (UO126). In addition, the M2 student will participate in the production of mutants for key members of those pathways (such as caspases) thanks to **CRISPR-Cas9**, a technic recently established in the lab. Phenotypic analysis (using a series of known markers and (sc)RNA- seq) will be done for both functional methods.

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

-Vullien A, Amiel A, Baduel L, Diken D, Renaud C, Krasovec G, Vervoort M, Röttinger E@*, Gazave E@*. (2025). The rich evolutionary history of the Reactive Oxygen Species metabolic arsenal shapes its mechanistic plasticity at the onset of metazoan regeneration. Molecular Biology and Evolution, msae254, https://doi.org/10.1093/molbev/msae254
- Bideau L, Velasquillo-Ramirez Z, Baduel L, Basso M, Gilardi-Hebenstreit P, Ribes V, Vervoort M, Gazave, E.@. (2024). Variations in cell plasticity and proliferation underlie distinct modes of regeneration along the antero-posterior axis in the annelid *Platynereis*. Development. doi: 10.1242/dev.202452.
-Paré, L., Bideau, L., Baduel, L., Dalle, C., Benchouaia, M., Schneider, S.Q., Laplane, L., Clément Y., Vervoort, M., Gazave, E.@. (2023) Transcriptomic landscape of posterior regeneration in the annelid *Platynereis dumerilii*. BMC Genomics 24, 583.
- Bideau L, Kerner P, Hui J, Vervoort M@*, Gazave E@*. (2021) Animal regeneration in the era of transcriptomics. Cell Mol Life Sci. doi: 10.1007/s00018-021-03760-7.
- 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.