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

Parcours : **Biologie et Développement Cellulaires 'BDC'**
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Fiche de Projet de Stage de M2, 2026-2027

Unité INSERM ou CNRS ou Université : Institut Pasteur – UMR3691 Biologie cellulaire physiologique et pathologique **Intitulé Équipe :** Biologie cellulaire évolutive et évolution de la morphogenèse **ED d'appartenance :** BioSorbonne Paris Cité (UPC) **Responsable de l'Equipe :** Dr. Thibaut Brunet	**Responsable du Stage :** Dr. Mathilde Dura **Contacts** Adresse : 25 rue du Dr Roux 75015 Pasteur Email : Mathilde.dura@pasteur.fr Thibaut.brunet@pasteur.fr

Titre du projet: From Microbes to Animals: Evolution of multicellularity in an emerging model organism.

Résumé du Projet de Stage:

BACKGROUND: Choanoflagellates are marine microorganisms composed of a cell body and a flagellum surrounded by a collar of microvilli. Depending on environmental conditions, they can adopt different forms: solitary cells or colonies containing up to several hundred cells. This ability to alternate between unicellular and multicellular states is referred to as **facultative multicellularity**. Choanoflagellates are particularly interesting because they constitute an excellent model for studying the origin of animal multicellularity, as: 1) they are the closest living relatives of animals; and 2) they display facultative multicellularity.

OBJECTIVE: The intern will work on an essential pathway involved in the regulation of organ size and conserved in both animals and choanoflagellates: the **Hippo signaling pathway**. In animals, Yorkie, the main transcription factor of this pathway, is regulated by mechanical stress through a process known as **mechanotransduction**. The precise function of the Hippo pathway, as well as its regulation by mechanotransduction, remains to be elucidated in choanoflagellates. This work will provide key insights into the **evolution of Hippo signaling** and shed light on the role of physical forces during the early evolution of animal multicellularity.

METHODS: The team has already generated multiple mutants and tagged strains of Hippo pathway genes, which suggest a role for the Hippo pathway in choanoflagellate[2]. A project will be selected by the student, depending on the specific needs of the team at that time and the student's preferences. The intern will be trained in **molecular biology** techniques (CRISPR mutagenesis, genotyping…), as well as **bioinformatics** and/or **microscopy**, **image analysis**.

LAB: The laboratory will provide **mentoring** for the student in writing and presenting their work. The student will probably not have the opportunity to pursue a PhD in our team the following year due to space limitations. However, if the student wishes to undertake a PhD in another laboratory, we are committed to **supporting** them and **preparing** them for selection interviews.

Domaine: Cell biology, molecular biology, marine biology, evolution, multicellularity.

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

1. Ros-Rocher, N. *et al.* Clonal-aggregative multicellularity tuned by salinity in a choanoflagellate. *Nature* **651**, 974–985 (2026).
2. Combredet, C., Ansel, M. & Brunet, T. A selection-based knockout approach for a choanoflagellate reveals regulation of multicellular development by Hippo signaling. *Cell Rep.* **44**, 116345 (2025).
3. Freire-Delgado, M. & Brunet, T. Flagellar gliding in choanoflagellates. *Curr. Biol.* **35**, R828–R829 (2025).
4. Brunet, T. Clues to the origin of embryonic development in animals. *Nature* **635**, 291–293 (2024).
5. Ros-Rocher, N. & Brunet, T. What is it like to be a choanoflagellate? Sensation, processing and behavior in the closest unicellular relatives of animals. *Anim. Cogn.* **26**, 1767–1782 (2023).