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 Pasteur & Inserm U1347 **Intitulé Equipe : Trypanosome Cell Biology Unit** **ED d'appartenance : CDV (ED515)** **Responsable de l'Equipe : BASTIN Philippe**	**Responsable du Stage : BASTIN Philippe & BONNEFOY Serge** **Contacts** Adresse : 25 rue du docteur Roux Email : pbastin@pasteur.fr serge.bonnefoy@pasteur.fr Tel : 0140613805

Titre du projet : In search of mechanisms driving diversity of cilia and flagella

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

Cilia and **flagella** are sophisticated organelles made of 9 doublet microtubules and composed of up to 1,000 proteins. They perform multiple functions in motility, sensing or morphogenesis. Despite their conservation in most eukaryotes, they display amazing variations between species or between cell types of the same organism.

The goal of the project is to look for mechanisms that could explain this diversification by performing structural and functional comparisons of cilia and flagella, with a specific focus on **intraflagellar transport** (IFT), the machinery responsible for their construction. IFT is the movement of protein complexes (termed trains) dragged by molecular motors on ciliary microtubules (tracks), allowing the delivery of precursors for incorporation at the distal tip, which is the building site. Our team has shown that IFT trains circulate at high frequency but are restricted to some doublet microtubules in the protist *Trypanosoma brucei* (Bertiaux et al., 2018a). This restriction is put in place after the entry of trains in the flagellum (Alves et al., 2025). We proposed that this restriction would allow faster evolution of flagella (Mallet & Bastin, 2022).

The host team has collected several parasitic and free protists with flagella of different architecture. The student will use several electron and light microscopy approaches including **expansion microscopy** to reveal the organisation of their flagella thanks to a collection of antibodies already available. Functional impact of the morphological differences will be evaluated with a combination of fluorescent protein tagging to monitor **protein trafficking** and **Crispr-Cas9** approaches

Publications de l'équipe relatives au projet de stage (max 5) Former PhD students highlighted in bold

1. **Bertiaux, E.**, **Mallet, A., Fort, C.**, Blisnick, T., Bonnefoy, S., Jung, J., Lemos, M., Marco, S., Vaughan, S., Trepout, S., Tinevez, J.Y., and Bastin, P. (2018a). Bidirectional intraflagellar transport is restricted to two sets of microtubule doublets in the trypanosome flagellum. **J Cell Biol** *217*, 4284-4297. Top 5% Altmetrics.
2. **Bertiaux, E.**, Morga, B., Blisnick, T., Rotureau, B., and Bastin, P. (2018b). A Grow-and-Lock Model for the Control of Flagellum Length in Trypanosomes. **Curr Biol** *28*, 3802-3814 e3803.
3. **Mallet, A.**, and Bastin, P. (2022). Restriction of intraflagellar transport to some microtubule doublets: An opportunity for cilia diversification? **Bioessays** *44*, e2200031. Front cover.
4. **Abbuhl, D.**, Pruzincova, M., Stepanek, L., Bouscasse, E., Azevedo, R., Matondo, M., Varga, V., Bonnefoy, S., and Bastin, P. (2025). A novel approach to tagging tubulin reveals MT assembly dynamics of the axoneme in Trypanosoma brucei. **J Cell Sci**. *in press*
5. Alves, A.A., Jung, J., Moneron, G., Vaucelle, H., **Fort, C., Buisson, J.**, Schietroma, C., and Bastin, P. (2025). Intraflagellar Transport Selectivity Occurs with the Proximal Portion of the Trypanosome Flagellum. **J Cell Biol** *in press*.