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 : UMR7592, Institut Jacques Monod (CNRS/UPC) **Intitulé Equipe : Comparative Developmental Neurobiology** **ED d'appartenance : BioSPC** **Responsable de l'Equipe : Nikos KONSTANTINIDES**	**Responsable du Stage : Nikos KONSTANTINIDES** **Contacts** Adresse : 15 rue Helene Brion Email : nikos.konstantinides@ijm.fr Tel : +33-781186327

Titre du projet : Evolution of circuitry and behaviors from a cell-type-specific perspective

Résumé du Projet de Stage (en 300 mots maximum, mots clés en gras)
Neurons are the most diverse cell type in the animal body in terms of morphology, physiology, molecular identity, activity, function, etc. They assemble into diverse circuits, which drive specific behaviours. These behaviours in turn are under selective pressure to help animals adapt to their environment, avoid predators, forage, find mates, and produce offspring. Pairwise comparisons between closely related species have demonstrated that small differences in neuronal identity, activity, and circuitry can affect behavioural output. However, it is unclear how generalizable these findings are. Therefore, a comprehensive study of the mechanisms that drive changes in behaviour remains elusive. The insect visual system has arisen as an ideal system to address the role of neuronal identity, neuronal features, and circuitry in the evolution of behaviours, using single-cell sequencing and advanced genetic tools as means to achieve this.
Objective: The M2 student will address the differences in the circuitry that could underlie specific behaviors in different insects.
To study neuronal circuits in non-model insects, the student will adapt genetic tools that have been developed in *Drosophila*. One will be trans-Tango which labels the postsynaptic targets of a neuron of interest; the other is Gal4 which will be used to generate neuronal type-specific drivers. For this goal, s/he will focus on two species: a) *Musca domestica*, which is a fly whose behaviours and circuits should be comparable, albeit different, to *Drosophila* and b) the flour beetle *Tribolium castaneum*, which has been developed as a genetic model organism and for which many genetic tools are already available. The student will then combine the two tools to target specific neurons and visualize their circuitry, which will then be compared to that of *Drosophila*.
In parallel, the student will also familiarize him/herself with single-cell sequencing data analysis that will allow them to choose the right candidate neurons to target.

Publications de l'équipe relatives au projet de stage (max 5)
Konstantinides N.*, Degabriel S., Desplan C. (2018) Neuro-evo-devo in the single cell sequencing era. Curr Opin Syst Biol 11:32-40.
Özel M.N., Simon F., …, Konstantinides N.*, Desplan C.* (2021) Neuronal diversity and convergence in a visual system developmental atlas. Nature 589(7840):88-95
Simon F., Konstantinides N. (2021) Single-cell transcriptomics in the Drosophila visual system: advances and perspectives on cell identity regulation, connectivity, and neuronal diversity evolution. Developmental Biology 479:107-122
Konstantinides N.*, Holguera I., Rossi A.M., et al. (2021) A complete temporal transcription factor series in the fly visual system. Nature 604 (7905): 315-322
Filippopoulou K., Konstantinides N. (2023) Evolution of patterning. FEBS J. doi: 10.1111/febs.16995