Sciences de la Vie et de la Santé
Master BMC, Universités de Paris

Parcours : **Biologie et Développement Cellulaires**
http://www.master2bdc.fr/
Fiche de Projet de Stage M2, Année 2021-2022

Unité INSERM ou CNRS ou Université : Paris Brain Institute (Institut du Cerveau, ICM) - Inserm U1127, UMR7225 **Intitulé Equipe :** Spinal Sensory Signaling, https://wyartlab.org/ **ED d'appartenance :** ED3C – ED158 **Responsable de l'Equipe :** Claire Wyart	**Responsable du Stage :** Yasmine Cantaut-Belarif, CR CNRS **Contacts** Adresse : 47 Boulevard de l'Hôpital, 75013, Paris Email : yasmine.belarif@icm-institute.org Tel : 01 57 27 41 10

Titre du projet :
Understanding the interplay between noradrenergic signaling and the Reissner fiber bathing in the cerebrospinal fluid during embryonic morphogenesis

Résumé du Projet de Stage (en 300 mots maximum, mots clés en gras)
The cerebrospinal fluid (CSF), a dynamic solution filling the cavities of the brain and the spinal cord, is an important signaling pathway during development. In many vertebrate species, the CSF contains a conserved extracellular thread formed by the aggregation of the SCO-spondin protein named the Reissner fiber. This acellular polymer running from the brain ventricles to the central canal of the spinal cord was described more than a century ago but its function remained elusive until recently. By generating the first *scospondin* mutants in zebrafish, (Cantaut-Belarif *et al*. 2018, *Current Biology*) we revealed that the **formation of the Reissner fiber in the CSF is a crucial event controlling the geometry of the of the body axis in the embryo**.

Further observations of juvenile *scospondin* mutants showed that they develop three-dimensional torsions of the spine (Rose *et al.* 2020 *Current Biology*, Troutwine *et al.* 2020 *Current Biology*), reminiscent of adolescent idiopathic scoliosis observed in human patients. Thus, **mechanisms shaping the body axis might share fundamental principles from embryos to juveniles and may rely on a Reissner fiber-dependent pathway**.

Using a combination of genetics and *in vivo* imaging, we recently identified the **molecular signature underlying the Reissner fiber-dependent straightening of the body axis in the embryo**. We showed that the Reissner fiber controls the expression of a peptide expressed in spinal neurons contacting the CSF involved in axis straightening (Cantaut-Belarif *et al*. 2020, *eLife*). In addition, we found that the Reissner fiber binds noradrenaline, which is able to rescue for body axis and peptide expression defects in *scospondin* mutants.

Yet, the **mechanisms by which noradrenaline contributes to the Reissner fiber-dependent straightening of the body axis are not understood.**

This project will further characterize the pathways controlled by the Reissner fiber and modulated by noradrenaline to ensure a correct morphogenesis of the body axis in the embryo, using zebrafish as an animal model. During his/her internship, the student will: 1/.characterize the role of noradrenaline on their cellular targets, newly identified; 2/.identify how the Reissner fiber contributes to the detection of noradrenaline *in vivo* at the interface with the central canal of the spinal cord.

Highly motivated students interested in molecular and cellular developmental neuroscience are encouraged to apply. In this project, the student will **combine the power of genetics and *in vivo* imaging in the zebrafish embryo**. He/she will learn state-of-the-art live imaging techniques and analysis methods. If the student performs well, her/his project is open to compete for a PhD project

Publications de l'équipe, relatives au stage proposé
[1] Cantaut-Belarif et al. 2018, **Current Biology**, *The Reissner fiber in the cerebrospinal fluid controls morphogenesis of the body axis* https://www.cell.com/current-biology/fulltext/S0960-9822(18)30747-4

[2] Cantaut-Belarif et al. 2020, **eLife**, *Adrenergic activation modulates the Reissner fiber signal to cerebrospinal fluid-contacting neurons during development* https://elifesciences.org/articles/59469