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 : U1163 **Intitulé Equipe : Heart Morphogenesis** **ED d'appartenance : BioSPC** **Responsable de l'Equipe : Sigolène Meilhac**	**Responsable du Stage : Audrey Desgrange** **Contacts** Adresse : 24 boulevard du Montparnasse Email : audrey.desgrange@institutimagine.org Tel : 01 42 75 44 83

Titre du projet : Role of extracellular matrix during mouse heart morphogenesis

Résumé du Projet de Stage (en 300 mots maximum, mots clés en gras)
Organ acquisition of shape is key to achieve their specific function. Understanding the mechanisms controlling organ morphogenesis is a major challenge in developmental biology. In the context of cardiac morphogenesis, this also represents a major public health issue, since congenital heart disease affects 1% of newborns and is a major cause of perinatal mortality. During embryogenesis, the heart is initially a straight tube that loops into a helix. This looping process is the first asymmetric morphogenesis event in the embryo and positions the future cardiac chambers to establish double blood flow. How cardiac precursor cells receive and interpret the molecular and mechanical asymmetries to form the heart remains largely unknown. By performing a transcriptomic screen with a unique spatiotemporal resolution during mouse heart looping, we have uncovered asymmetric expression of extracellular matrix (ECM) components. Recent studies suggest an important role of the mechanical properties of the ECM as active factors shaping organs. However, it remains unknown how such mechanical properties influence cardiac progenitors patterning and behaviour during heart morphogenesis.
The Master research project aims to characterise the impact of ECM disruption on asymmetric heart morphogenesis. The project will be carried-out in the mouse model, relying on cutting-edge techniques in quantitative 3D imaging of gene expression and organ shape, which are already developed in the laboratory.
This work is expected to provide novel insight into the role of biomechanics during asymmetric organogenesis and is relevant to the pathological mechanisms of congenital heart disease

Publications de l'équipe relatives au projet de stage (max 5)
Bønnelykke T.H, et al. *Notch3* is an asymmetric gene and a modifier of heart looping defects in *Nodal* mouse mutants. ***PLOS Biology*****,** 2025.
Bernheim S., et al. Identification of Greb1l as a genetic determinant of crisscross heart in mice showing torsion of the heart tube by shortage of progenitor cells. ***Dev Cell***, *2023.*
Desgrange A., et al. *Transient Nodal signalling in left precursors coordinates opposed asymmetries shaping the heart loop*. ***Dev Cell****, 2020.*
Desgrange A.,_et al *Standardised imaging pipeline for phenotyping mouse laterality defects and associated heart malformations, at multiple scales and multiple stages*. ***Dis Models & Mech****, 2019.*
Le Garrec J.F., et al. *A predictive model of asymmetric morphogenesis from 3D reconstructions of mouse heart looping dynamics.* ***eLife****, 2017.*