



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, 2024-2025

Unité INSERM ou CNRS ou Université : CNRS/UPC (UMR 7592)	Responsable du Stage : Jérémy Sallé
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Titre du projet : Size scaling and cell fate determination during early embryogenesis

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

During early development, one of the most striking consequences of embryonic cleavage is the rapid reduction in cell size. As this process unfolds, the first developmental landmarks are established, with subsets of cells acquiring specific fates. Asymmetric divisions, which occur in a variety of cleavage patterns, perfectly illustrate this phenomenon by producing two daughter cells with different sizes and fates. Understanding the **relationship between cell volume modification and cellular identity** is a fundamental question in developmental biology. However, until recently, experiments aimed at modifying cell size within a developmental context were challenging due to the difficulty of avoiding interference with other key processes such as growth, cell cycle, or fate determination itself. Our team has recently developed a novel method to **mechanically manipulate cell division**, both in orientation and position, allowing us to precisely modify cell volume during early development in a minimally invasive manner. This approach provides a unique opportunity to directly test the consequences of cell size modification on cell determination. During this internship, the student will use sea urchin embryos as a model system to **study the impact of cell size modification on cell identity**. The project will involve microinjection and micromanipulation of live embryos to generate artificial asymmetric divisions, combined with video microscopy.

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

Sallé J., Minc N. Cell division geometries as central organizers of early embryo development. Seminars in Cell & Developmental Biology (2021). 10.1016/j.semcdb.2021.08.004

Mukherjee R. N., Sallé J., Dmitrieff S., Nelson K. M., Oakey J., Minc N., Levy, D. L. The Perinuclear ER Scales Nuclear Size Independently of Cell Size in Early Embryos. Developmental Cell 2020

Sallé J., Xie J., Ershov D., Lacassin M., Dmitrieff S., Minc N. Asymmetric Division through a Reduction of Microtubule Centering Forces. J Cell Biol 2018, jcb.201807102.

Lacroix B., Letort G., Pitay L., Sallé J., Stefanutti M., Maton G., Ladouceur A.M., Canman J. C., Maddox P.S., Maddox A.S., Minc N., Nédélec F., Dumont J. Microtubule Dynamics Scale with Cell Size to Set Spindle Length and Assembly Timing. Dev. Cell 2018, 45 (4), 496-511.e6.