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 Cochin (U1016) **Intitulé Equipe :** Destin, plasticité et reprogrammation cellulaire **ED d'appartenance :** BioSPC **Responsable de l'Equipe :** Antoine Zalc	**Responsable du Stage :** Antoine Zalc **Contacts** Adresse : 24 Rue du Faubourg St Jacques, 75014, Paris Email : antoine.zalc@inserm.fr Tel :

Titre du projet : Understanding how OCT4 reactivation enhances cranial neural crest cells differentiation potential

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

Control of cell differentiation potential is essential to embryo development. Pluripotent embryonic cells can generate all somatic cell types. However, development permanently restricts this capacity, in particular during gastrulation and the formation of the three germ layers – the endoderm, the mesoderm and the ectoderm – each giving rise to distinct lineages. Uniquely among vertebrates, an ectoderm-derived cell population arising in the embryo rostral part – called **cranial neural crest cells (CNCC)** – challenges this paradigm. CNCC possess a broader differentiation potential than their germ layer of origin as they not only give rise to ectoderm derivatives such as neurons and glia, but also to cell types canonically associated with the mesoderm such as bone and cartilage of the face – also called **ectomesenchyme**. CNCC exceptional differentiation potential is due to the transient re-expression of pluripotency transcription factors NANOG, KLF4, SOX2 and OCT4 specifically in CNCC. **OCT4** plays a central role in this process since preventing its reactivation impairs ectomesenchyme specification, yet **how this impacts cell fate decision during craniofacial development is unclear**.

In this project, the student will study how OCT4 molecularly orchestrates CNCC differentiation potential expansion. To this end, the student will profile chromatin accessibility changes and identify OCT4 downstream transcriptional networks regulating CNCC plasticity expansion. This will **clarify OCT4 function during CNCC *in vivo* reprograming** and indicate molecular programs controlling cell fate decision and plasticity expansion during CNCC development.

Techniques to be used: Cell culture, FACS, qRT- PCR, Western Blot, ChIP-seq, ATAC-seq

Publications de l'équipe relatives au projet de stage

- Fortunato S., Deschemin J.C., Zalc A.

Cranial Neural Crest Cells Three-Dimensional In Vitro Differentiation Protocol for Multiplexed Assay.
J. Vis. Exp. JoVE (2025) doi:10.3791/67695

- Smeriglio P, Zalc A.

Cranial Neural Crest Cells Contribution to Craniofacial Bone Development and Regeneration.
Curr Osteoporos Rep. (2023) doi:10.1007/s11914-023-00804-8

- Zalc A., Sinha R., Gulati G.S., Wesche D.J., Daszczuk P., Swigut T., Weissman I.L., Wysocka J.

Reactivation of the pluripotency program precedes formation of the cranial neural crest.
Science (2021) doi:10.1126/science.abb4776