**Master 2 internship project**

**Year 2023-2024**

**Laboratory/Institute:** IAB **Director:** Pierre Hainaut

**Team:** DYSAD **Head of the team:** Corinne Albiges-Rizo

**Name and status of the scientist in charge of the project:** Dr Olivier DESTAING (DR-CNRS) and Odile Filhol-Cochet (CR, Inserm) **HDR: yes X no ☐**

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**Program of the Master’s degree in Biology:**

**X** Immunology, Microbiology, Infectious Diseases **☐** Structural Biology of Pathogens

**X** Physiology, Epigenetics, Differentiation, Cancer **X** Neurosciences and Neurobiology

**Title of the project: Development of an optogenetically activable Casein Kinase 2 Beta to investigate its biological functions and applications.**

Objectives (up to 3 lines):

This project aims to build and characterize an optogenetic version of the functionally pleiotropic casein kinase 2, understand the cellular responses in response to its activation and ability to be challenge by own inhibitors.

Abstract (up to 10 lines):

Protein kinase CK2 targets a vast array of substrates located in a number of cellular compartments, making the challenge of discriminating among these substrates a daunting task. However, as a signaling protein, CK2 could be targeted to different cellular compartments in response to various stress stimuli such as heat shock, UV irradiation, hypoxia, DNA damage and viral infections. This review will be focused on the evidence that the dynamic association of CK2 subunits and the substrate-dependent subcellular targeting of the enzyme are a likely point of regulation in response to a variety of signaling events. We propose that in addition to enzymatic substrate recognition, regulated CK2 localization to specific compartments should help to provide the exquisite specificity required for robust signal transduction.

To test these hypothesis, we aim to develop an optogenetic version of CK2 in order to have a spatial and temporal control of its activation.

 Methods (up to 3 lines):

Molecular biology, cell engineering (infection and Cell sorting), live imaging, zymography, optogenetics activation

Up to 3 relevant publications of the team:

1- [CK2β Is a Gatekeeper of Focal Adhesions Regulating Cell Spreading.](https://pubmed.ncbi.nlm.nih.gov/35847979/) **Filhol O\***, Hesse AM, Bouin AP, Albigès-Rizo C, Jeanneret F, Battail C, Pflieger D, Cochet C. **Front Mol Biosci.** 2022 Jun 29;9:900947.

2- Cross-talk between the calcium channel TRPV4 and reactive oxygen species interlocks adhesive and degradative functions of invadosomes. Vellino S, Oddou C, Rivier P, Boyault C, Hiriart-Bryant E, Kraut A, Martin R, Coute Y, Knölker HJ, Valverde AM, Albiges-Rizo C, **Destaing O**\*. **J Cell Biol.** 2021 Feb 1;220(2):e201910079.

3-Control of SRC molecular dynamics encodes distinct cytoskeletal responses by specifying its signaling pathway usage. Kerjouan A, Boyault C, Oddou C, Hiriart-Bryant E, Pezet M, Balland M, Faurobert E, Bonnet I, Coute Y, Fourcade B, Albiges-Rizo C, **Destaing O**\*. **J Cell Sci.** 2021 Jan 25;134(2):jcs254599.

4-DNA mechanotechnology reveals that integrin receptors apply pN forces in podosomes on fluid substrates. Glazier R, Brockman JM, Bartle E, Mattheyses AL, **Destaing O\*, Salaita K\***. **Nat Commun.** 2019 Oct 18;10(1):4507.

5-[Polarity Reversal by Centrosome Repositioning Primes Cell Scattering during Epithelial-to-Mesenchymal Transition.](https://pubmed.ncbi.nlm.nih.gov/28041907/)

Burute M, Prioux M, Blin G, Truchet S, Letort G, Tseng Q, Bessy T, Lowell S, Young J, **Filhol O**, Théry M. **Dev Cell.** 2017 Jan 23;40(2):168-184.

Requested domains of expertise (up to 5 keywords):

Cell culture, molecular biology, biochemistry, microscopy, image analysis, cell biology, synthetic biology