

Master Biologie Moléculaire et Cellulaire 'BMC',
Université de Paris - UFR Sciences du Vivant

Parcours : **Biologie et Développement Cellulaires 'BDC'**

<http://www.master2bdc.fr/>

Fiche de Projet de Stage M2, Année 2021-2022

Unité INSERM ou CNRS ou Université : CNRS UMR3691 - Institut Pasteur Intitulé Equipe : ED d'appartenance : CdV (2021) mais très probablement UP à partir de 2022 Responsable de l'Equipe : Arnaud Echard	Responsable du Stage : Arnaud ECHARD Contacts Adresse : Institut Pasteur 25-28 rue du Dr Roux 75015 Paris Email : arnaud.echard@pasteur.fr Tel : 01 44 38 94 09
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Titre du projet : Developing optogenetic tools to locally and acutely depolymerize actin in cells, in particular in cancer cell division

Résumé du Projet de Stage

Our lab is interested in cytoskeleton and membrane remodeling in **human cell division**, focusing on **cytokinesis**. This topic is highly relevant in **cancer biology**, since recent evidence actually shows that 40% of human tumors might result from cytokinetic defects. Intriguingly, cytokinesis presents many interesting **parallels with viral budding** from infected cells.

Our lab is internationally recognized as a leading lab in cell division. In particular, we study the role of the oncogenic Rab GTPase Rab35 and partners in cytokinesis, endocytic recycling, phagocytosis and cell polarity. We also revealed the **first connection between oxidoreduction and cell division, through local oxidation of F-actin**.

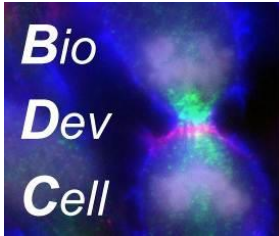
Using **proteomic approaches**, we recently identified a number of promising proteins highly concentrated in the midbody, the central part of the cytokinetic bridge which is a platform for abscission. Unexpectedly, we identified many proteins involved in actin dynamics.

One bottleneck in the field of cell division and of cell biology in general, is to be able to manipulate the actin cytoskeleton locally (micrometer scale) and at a given time (second scale).

We have started to **develop innovative optogenetic tools to locally and acutely depolymerize actin** (unpublished results). The aim of this internship is to improve this approach and to apply it to study the effect of locally depolymerizing F-actin in the cytokinetic bridge during cell division and, later, during viral budding. This tool aims to be useful for many cell biologists, including people interested in cell migration, phagocytosis, bacterial infection etc.

You will be trained in **state-of-the-art live cell microscopy** (the lab has its own spinning disk confocal microscope with photoactivation/photoconversion lasers), **genome editing by CRIPR-Cas9** and **super-resolution microscopy**.

This work should reveal the exact role of actin in the terminal step of cell division and to develop unprecedented tools to manipulate actin in key cellular functions.



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

Relevant and recent publications of the Lab (*= PhD students)

1- Presle A*, Frémont S, Salles A, Commere PH, Sassoon N, Berlioz-Torrent C, Gupta-Rossi N, Echard A.
The viral restriction factor tetherin/BST2 tethers cytokinetic midbody remnants to the cell surface.
Current Biology 31: 2203-2213 (2021)

2- Addi C*, Presle A*, Frémont S, Cuvelier F, Rocancourt M, Milin F, Schmutz S, Chamot-Rooke J, Douché T, Duchateau M, Gai Gianetto Q, Ménager H, Matondo M, Zimmermann P, Neetu Gupta-Rossi N and Echard A.
The Flemmingsome Reveals an ESCRT-to-membrane Coupling via ALIX/syntenin/syndecan-4 Required for Completion of Cytokinesis.
Nature Communications, 11: 1941 (2020)

3 Bai J*, Wioland H, Cuvelier F, Romet-Lemonne G and Echard A.
Actin reduction by MsrB2 is a key component of the cytokinetic abscission checkpoint and prevents tetraploidy.
PNAS 117, 4169-4179 (2020)

4- Ribet D, Boscaini S, Cauvin C, Siguier M, Mostowy S, Echard A[^], Cossart P[^]
[^]co-corresponding authors
SUMOylation of human septins is critical for septin filament bundling and cytokinesis.
Journal of Cell Biology 216: 4041-4052 (2017)

5- Fremont S, Hammich H, Bai J*, Wioland H, Klinkert K*, Rocancourt M, Kikuti C, Stroebel D, Romet-Lemonne G, Pylypenko O, Houdusse A, Echard A
Oxidation of F-actin controls the terminal steps of cytokinesis.
Nature Communications 8: 14528. (2017)