Grenoble Alliance for Integrated Structural & Cell Biology

INTERNSHIP PROPOSAL

Institute and Group: BIG, Plant and Cell Physiology laboratory (LPCV)

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Research project title: Editing Epigenetic Modifications in Plants to Rewire Development

5 Keywords to describe the project: Chromatin Biology, Polycomb, trithorax, Histone marks, stem cell fate

Description of the project (aims, experimental techniques, recommended background):

How do higher plants deploy flexible and adjustable developmental programs?
Considerable advances have been made in identifying genetic and epigenetic regulators, but so far, studies of plant epigenomes have mainly derived correlations between chromatin contexts and development. To convert correlation-based findings into mechanistic principles, a challenge in functional epigenomics is to develop tools for precise modification of epigenetic marks. The ***aim*** of the project is to **establish and use** such **tools for addressing functionality of histone marks on plant architecture.** The tools will allow inducing lysine methyl transferase or demethylase activities (nanobody or dCas9-driven) in a controlled manner. Using molecular approaches, morphogenesis analyses and *in situ* imaging, the student will follow the effects of induced chromatin dynamics on gene expression, cell fate and body patterning.

This internship project should bring a stepping-stone to discoveries of epigenetic determinants for plant plasticity.

We are seeking candidates with a ***background*** in DNA technologies and molecular genetics, and showing a strong interest in chromatin biology and development; knowledge on *Arabidopsis thaliana* plant model isn't a pre-requisite.

Justification that the internship's subject fits with the general theme of GRAL:

The internship project combines multi-scale analyses, from atomic (histone modifications) to cell assembly into an organism, via molecular engineering of the epigenome. This integrated molecular and developmental biology study thus fits within the framework of the labex Gral.

Relevant publications of the team:

J. Engelhorn, R. Blanvillain, C. Kröner, H. Parrinello, M. Rohmer, D. Pose, F. Ott, M. Schmid, **C.C. Carles*** (2017). Dynamics of H3K4me3 chromatin marks prevails over H3K27me3 for gene regulation during flower morphogenesis in *Arabidopsis thaliana*. ***Epigenomes***, 1(2), 8; doi:10.3390/epigenomes1020008.

F. Moreau, E. Thevenon, R. Blanvillain, I. Lopez-Vidriero, J.M. Franco-Zorrilla, R. Dumas, F. Parcy, P. Morel, C. Trehin and **C.C. Carles*** (2016). The Myb-domain protein ULTRAPETALA1 INTERACTING FACTOR 1 controls floral meristem activities in Arabidopsis. ***Development***, 143(7):1108-19.

C.C. Carles and J.C. Fletcher (2009). The SAND domain protein ULTRAPETALA1 acts as a trithorax group factor to regulate cell fate in plants. ***Genes & Development.*** 23: 2723-2728.