MASTERBIOSCIENCES
ECOLE NORMALE SUPERIEURE DE LYON

Offre de stage de Master / Master Internship offer

Tuteur du stage et Laboratoire d'accueil / Internship supervisor and Host laboratory:

Host team and laboratory: Hormonal signalling and development team (Teva Vernoux), Laboratoire de Reproduction et Développement des Plantes, ENS Lyon (http://www.ens-lyon.fr/RDP/).

Name of the supervisor: Teva Vernoux (teva.vernoux@ens-lyon.fr)

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Titre du projet de recherche / Research project title:

Molecular links between flower morphogenesis and auxin signalling

Description du projet / Project description:

Deciphering how the formation of organs (organogenesis) with a defined structure (morphogenesis) is controlled is a key question in developmental biology. In plants, the production of aerial organs (leaves and flowers) takes place in the Shoot Apical Meristem (SAM) and this process is primarily controlled by the key morphogenetic regulator auxin (Figure). As the SAM produces organs with different morphologies at different moment of the life of the plant, this suggests the existence of a generic organogenesis molecular program acting in conjunction with specific morphogenetic programs that can shape the organ for example in a leaf or a flower.

In the model plant species Arabidopsis thaliana used in the team, the production of flowers occurs after the floral transition. The acquisition of floral identity requires the early induction of the master regulators LEAFY and APETALA 1 that are required for floral morphogenesis. Despite our good understanding of the auxin-signalling pathway that triggers organogenesis, our understanding of the molecular network acting downstream of auxin is far from being exhaustive and its links with the floral morphogenetic program, remains largely unkown.

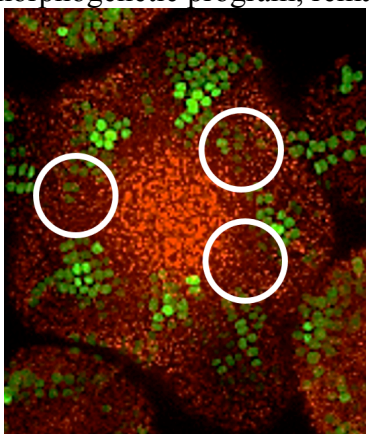

Figure : *The synthetic auxin response reporter pDR5::3xVENUS-N7 marks floral primordia initiation sites, indicated by white circles. The acquisition of floral fate occurs very early and triggers the floral morphogenetic program.*

To extend our understanding of the molecular events taking place in the few cells of the SAM that will produce the flower, the team has recently obtained a list of target genes, using a meta-analysis of several RNA-Seq datasets. The specific design of these approaches allows identifying target genes that act likely in the coupling of the auxin-regulated network and of the network involved in the acquisition of the complex shape of the flower.

The aim of the project to characterize some of these target genes to understand how the organogenetic and the morphogenetic program are coupled.

To do so, we will:

1- Determine their expression pattern using whole mount in situ hybridization
2- Study their function using T-DNA insertion lines
3- Analyze their position in the floral identity program using qRT PCR in the shoot apical meristem of wild type plants and of various mutants.
4- Those observations will be complemented with the analysis of transgenic lines expressing transcriptional and/or translational reporters, miRNA lines and overexpression lines.

Publications du laboratoire (5 max) / Lab publications (5 max):

Yassin Refahi, Géraldine Brunoud, Etienne Farcot, Alain Jean-Marie, Minna Pulkkinen, Teva Vernoux*, Christophe Godin* (2016). A stochastic multicellular model identifies biological watermarks from disorders in self-organized patterns of phyllotaxis. **eLife** Accepted

Larrieu A, Champion A, Legrand J, Lavenus J, Mast D, Brunoud G, Oh J, Guyomarc'h S, Pizot M, Farmer EE, Turnbull C, Vernoux T*, Bennett M* & Laplaze L* (2015) A novel fluorescent hormone biosensor reveals the dynamics of jasmonate signaling in plants. **Nature Communications** 6:6043

Besnard, F., Refahi, Y., Morin, V., Marteaux, B., Brunoud, G., Chambrier, P., Rozier, F., Mirabet, V., Legrand, J., Lainé, S., Thévenon, E., Farcot, E., Cellier, C., Das, P., Bishopp, A., Dumas, R., Parcy, F., Helariutta, Y., Boudaoud, A., Godin, C., Traas, J., Guédon., Y & Vernoux, T.* (2014). Cytokinin signalling inhibitory fields provide robustness to phyllotaxis. **Nature** 505, 417–421

Brunoud G, Wells DM, Oliva M, Larrieu A, Mirabet V, Burrow AH, Beeckman T, Kepinski S, Traas J, Bennett MJ, Vernoux T* (2012) A novel sensor to map auxin response and distribution at high spatio-temporal resolution. **Nature** 482: 103-106