MASTERBIOSCIENCES
ECOLE NORMALE SUPERIEURE DE LYON

Internship offer

Internship supervisor and Host laboratory:

Host institute
Reproduction and Development of Plants (RDP), http://www.ens-lyon.fr/RDP/?lang=en

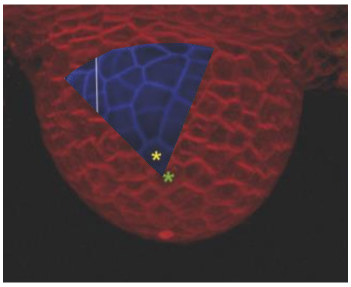
Host team
Biophysics and Development, http://www.ens-lyon.fr/RDP/spip.php?rubrique19&lang=en

Internship supervisors
Arezki BOUDAOUD, Professor, arezki.boudaoud@ens-lyon.fr
Yuchen LONG, Postdoctoral researcher, yuchen.long@ens-lyon.fr

Research project title:

Unravelling the regulation and function of hydrostatic pressure in morphogenesis at the shoot apex of *Arabidopsis thaliana*

Project description:



Morphogenesis is the remarkable process whereby a developing organism acquires its shape. While molecular and genetic studies have been highly successful in explaining the cellular basis of development and the role of biochemical signals in coordinating cell fate, understanding morphogenesis remains a challenge. Indeed, shape is imposed by structural elements, so that an investigation of morphogenesis must also address how these elements are controlled at the cell level, and how the mechanical properties of these elements lead to specific growth patterns.

Using the shoot apical meristem of *Arabidopsis thaliana* as a model system, our team tackles the following questions: Does cell identity correspond to mechanical identity? Do the mechanical properties of different cell domains predict shape changes? How does the intrinsic stochasticity of cell mechanics and cell growth yield reproducible shapes? To address these questions, we combine molecular biology, live imaging with confocal microscopy, and atomic force microscopy.

Turgor (hydrostatic) pressure is essential in plant cell mechanics; however it is unknown how it contributes to regulating morphogenesis. This question will be addressed during the internship. The student will contribute to (i) the generation of transgenic plant lines to manipulate temporally and spatially turgor and water flow, (ii) the characterisation of these lines using macroscopic and microscopic observations, (iii) confocal and atomic force microscopy of wild type plants and transgenic plants.

Lab publications :

1. L. Beauzamy, N. Nakayama* & A. Boudaoud*. Flowers under pressure: ins and outs of turgor regulation in development. *Ann. Bot.* **114**, 1517–1533 (2014).
2. P. Milani#, V. Mirabet#, C. Cellier, F. Rozier, O. Hamant, P. Das*, A. Boudaoud*. Matching patterns of gene expression to mechanical stiffness at cell resolution through quantitative tandem epifluorescence and nano-indentation. *Plant Physiol.* 165, 1399–1408 (2014).
3. D. Bonazzi#, J.-D. Julien#, M. Romao, R. Seddiki, M. Piel, A. Boudaoud* & N. Minc*. Symmetry breaking in spore germination relies on an interplay between polar cap stability and spore wall mechanics. *Dev. Cell* 28, 534-546 (2014).
4. M. Uyttewaal#, A. Burian#, K. Alim#, B. Landrein, D. Borowska-Wykret, A. Dedieu, A. Peaucelle, M. Ludynia, J. Traas, A. Boudaoud*, D. Kwiatkowska* & O. Hamant*. Mechanical Stress Acts via Katanin to Amplify Differences in Growth Rate between Adjacent Cells in Arabidopsis. *Cell* 149, 439-451 (2012).

5. V. Mirabet, F. Besnard, T. Vernoux* & A. Boudaoud*. Noise and robustness in phyllotaxis. *PLoS Comput. Biol*. 8, e1002389 (2012).