Postdoc position at the interface between intercellular signalling and plant development.

A polyvalent apoplastic barrier-integrity signalling pathway: Mechanistic elucidation and physiological implications.

Large parts of the terrestrial surface of our planet have been successfully colonised by plants. The transition to the fully dry-land adapted life cycles seen in extant higher plants required numerous evolutionary innovations. Key among these was the development of effective, tissue-spanning diffusion barriers that prevent loss of water and allow maintenance of steep concentration gradients between the organism and its environment. Centrally important diffusion barriers in extant plants are the epidermal cuticle of aerial tissues, the Casparian strip and suberin lamellae of the root endodermis and the sporopollenin layer of pollen coats. Even small defects in these barriers cover very large can lead to strong functional impairments, leading to chronic loss of water, nutrients or entry of pathogens.

This project will investigate how plants are able to ensure the effective sealing of their diffusion barriers and monitor their integrity. Work on Arabidopsis mutants with impaired endodermal diffusion barriers has recently defined the outlines of a signalling pathway whose role might be to allow diffusion barrier surveillance during Casparian strip formation [1, 2, 3, 4]. Intriguingly central components of this pathway have also been implicated in forming other apoplastic barriers including the pollen coat and embryonic cuticle [5] (and unpublished). This project will explore the hypothesis that a common regulatory logic underlies the monitoring of the integrity of diverse apoplastic barriers in plants. The project provides an opportunity to contextualise a plant signalling pathway and study its modularity and the mechanism underlying its functional adaptation to different developmental circumstances.

The postdoc will be involved in characterising signalling pathway components implicated in apoplastic barrier monitoring in the Arabidopsis embryo and pollen grain. Understanding the conservation and/or divergence of pathway component function in monitoring the integrity of different apoplastic barriers will form a central objective of the project. This will require an integrated approach involving a wide variety of techniques ranging from molecular genetics and imaging, through biochemical and histological analysis of barrier structure and composition, to biochemical characterisation of ligand/receptor interactions. The postdoc will interact with members of the Seed Development team, and more widely with members of the Plant Reproduction and Development laboratory in Lyon, and with the team of Professor N. Geldner at the University of Lausanne, with whom this project is a collaboration.

Candidates are expected to have a strong interest in plant development and/or in intercellular signalling in plant systems. They should have a strong background in either plant development, molecular genetics or plant cell biology. The postdoc will carry out the project in the Plant Reproduction and Development Laboratory in Lyon, but will also be expected to interact with collaborators in Lausanne. The start date will be between 1/10/2018 and 1/12/2018. The initial contract will be for two years. Requests for information and applications (curriculum vitae, cover letter, and the contact details of two potential referees) should be sent to Gwyneth INGRAM (Gwyneth.Ingram@ens-lyon.fr).

References

1. Doblas VG*, et al.* Root diffusion barrier control by a vasculature-derived peptide binding to the SGN3 receptor. *Science* **355**, 280-284 (2017).
2. Lee Y, Rubio MC, Alassimone J, Geldner N. A mechanism for localized lignin deposition in the endodermis. *Cell* **153**, 402-412 (2013).
3. Pfister A*, et al.* A receptor-like kinase mutant with absent endodermal diffusion barrier displays selective nutrient homeostasis defects. *Elife* **3**, e03115 (2014).
4. Alassimone J*, et al.* Polarly localized kinase SGN1 is required for Casparian strip integrity and positioning. *Nature plants* **2**, 16113 (2016).
5. Xing Q, Creff A, Waters A, Tanaka H, Goodrich J, Ingram GC. ZHOUPI controls embryonic cuticle formation via a signalling pathway involving the subtilisin protease ABNORMAL LEAF-SHAPE1 and the receptor kinases GASSHO1 and GASSHO2. *Development* **140**, 770-779 (2013).