

Multiscale study of the impact of a molecule, salicylic acid, on plant metabolism

Salicylic acid (SA) is a small phenolic compound. In plants, it is a key phytohormone that controls many physiological processes. Over the past 20 years, much attention has been paid to the role of SA in the defence of plant pathogens (Vlot et al., 2009). At the same time, its detrimental effect on plant growth has been documented (Rivas-San Vicente and Plasencia 2011). Indeed, in addition to the positive effect on resistance to pathogens, the application of SA often leads to negative effects on plant development. An important aspect that was till now not considered enough is the effects that SA can have on plant metabolism. Indeed, it is known that SA has a big impact on gene expression. Many of the genes down-regulated by SA are genes encoding enzymes of the carbon metabolism, including enzymes involved in photosynthesis (Pokotylo et al., 2022). Besides, SA has also been shown to be able to bind multiple enzymes of the carbon metabolism, thus altering their functions (Manohar et al., 2015). Therefore, we want in this project to characterize the effects of SA on plant metabolism and more generally to understand how SA leads to dwarf plants.

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Subjects

Determination of the effect of a molecule on root growth

Genotyping of Arabidopsis mutants
Metabolomic/
lipidomic analysis

Production of recombinant proteins

Mentor

Eric Ruelland is a CNRS researcher at the Enzyme and Cell Engineering laboratory (GEC UMR7025 CNRS/UTC). He works on the role of small molecules on the responses of plants to stresses from the environment. He is currently working on salicylic acid, a molecule that has the main role in triggering plant immunity towards some pathogens. His aim is to understand the molecular determinants that explain how this molecule binds metabolic enzymes. He uses an approach that combines molecular dynamics calculations and biochemistry validation with recombinant proteins in ligand/protein interaction assays. He is also a recognized expert in plant lipid signaling, and is characterizing the phenotypes of *Arabidopsis thaliana* mutants in phosphatidylinositol-4-kinases and diacylglycerol-kinases.

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Student profile

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