Regulatory Network behind Systemic Nitrogen Signaling in Arabidopsis

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ABSTRACT BOOK

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Chair: Franziska Fichtner and Milos Tanurdzic, The University of Queensland, Australia

Submission 467

A dual function of SnRK2 kinases in the regulation of SnRK1 and plant growth

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Presenter: Elena Baena-González

Adverse environmental conditions trigger responses in plants that promote stress tolerance and survival at the expense of growth. However, little is known of how stress signaling pathways interact with each other and with growth regulatory components to balance growth and stress responses. In this talk, I will show that plant growth is largely regulated by the interplay between the evolutionarily conserved energy sensing AMPK/SnRK1 kinase and the ABA phytohormone pathway, through an unexpected dual function of the main drivers of ABA signaling, the SnRK2 kinases. In non-stress conditions SnRK2s are required to form complexes that repress SnRK1, thereby promoting TOR signalling, growth and development. In the presence of ABA these repressor complexes dissociate, releasing the two SnRK kinases, and allowing SnRK1 to repress growth through the inhibition of the TOR. Coupling the ABA-SnRK2 module to the evolutionarily conserved SnRK1-TOR axis confers plants the capacity to regulate growth in response to water availability and may have been crucial for the establishment of terrestrial life.

Keywords: abscisic acid, energy signaling, SnRK1, TOR, Arabidopsis thaliana

Submission 462

Regulatory Network behind Systemic Nitrogen Signaling in Arabidopsis

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Presenter: Sandrine Ruffel

Rapid adjustment of plant physiology and development to external fluctuations is critical for sessile organism, giving a singular interest to network signaling controlling these mechanisms. Among many adaptation processes, root plasticity is primordial to optimize nutrient acquisition but relies on a complex network integrating local and systemic signaling. Indeed, locally, plants invest resource in soil area where nutrients are available and systemically they adjust nutrient acquisition to the whole plant demand. Our main goal is to decipher systemic signaling underlying the perception of nitrate heterogeneous provision, in Arabidopsis. Using the split-root system, in which physically isolated root systems of the same plant were challenged with different environments, we previously demonstrated that cytokinin biosynthesis constitutes one critical component of root-shoot-root communication. By combining the use of cytokinin mutants with hormone measurements, transcriptomic analysis, nitrate uptake assays, and root growth measurements, we show that root to shoot trans-zeatin (tZ) translocation is likely crucial for long distance signaling controlling rapid sentinel gene regulation and long-term functional acclimation to heterogeneous nitrate supply. Interestingly, shoot transcriptome profiling revealed that glutamate/glutamine metabolism is likely a target of tZ root-to-shoot translocation, prompting us to revisit the hypothesis of the role of amino acids into systemic nitrogen signaling.

Keywords: Systemic signaling, Nitrogen, Cytokinin, Root transport, Development

Submission 543

Sucrose: The alpha component of stem branching

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Presenter: Bolaji Salam

Shoot branching is an essential feature of plant architecture because it has a significant impact on plant biology and agricultural productivity. In some species, including potato, sugars play a key role in the induction of shoot branching (Solanum tuberosum L.).The method by which sugars alter shoot branching, on the other hand, is largely unclear. In our studies, we used sugar-mediated promotion of bud outgrowth in potato stems under etiolated conditions to answer this question. Sucrose feeding of detached stems stimulates the accumulation of cytokinin (CK) and the expression of vacuolar invertase (VInv), an enzyme that contributes to sugar sink strength, according to our findings. In the absence of sucrose, CK production and perception inhibitors inhibited sucrose's effects, but CK delivered to detached stems promoted bud development and VInv activity. We used genome editing to create vinv