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Wed, 9 Oct 2024 | 10 am | DBS Conference Room 1

Hosted by Prof Yu Hao

The Phloem Nexus of Root Growth

By **Christian S. Hardtke**

Department of Plant Molecular Biology, University of Lausanne, Biophore Building, Switzerland

About the Speaker

Christian Hardtke obtained a Ph.D. in Developmental Biology from the Ludwig-Maximilians University of Munich in 1997, for his work on plant embryogenesis. He then moved to Yale University as Human Frontier Science Program fellow to study photomorphogenesis. Eventually he joined McGill University as Assistant Professor to start his own lab in 2001. He was appointed Associate Professor at the University of Lausanne in 2004, where he became Full Professor in 2010 and directed the Department of Plant Molecular Biology from 2009 to 2017. His research revolves around the molecular genetic control of plant development, with a focus on quantitative aspects of plant growth and morphology. He is particularly interested in mechanisms of vascular tissue differentiation and their relation to root system architecture.

The evolution of a vascular distribution network enabled plants to conquer land. Among the plant vascular tissues, the phloem is particularly intriguing because of its complex functionality. The conducting phloem channels, the sieve tubes, are formed from interconnected sieve element cells, which represent a between-life-and-death state because they lack numerous organelles including the nucleus. The unique developmental trajectory of sieve elements is laid out along a spatiotemporal gradient in the root meristem of Arabidopsis thaliana seedlings, where it is amenable to non-invasive investigation. My lab has characterized a network that guides sieve element differentiation through the interplay between controlled auxin transport and receptor kinase signaling pathways. Key players in this network constitute a molecular rheostat that finetunes trans-cellular auxin flux and reinforces its own polarity. Its assembly is antagonized by autocrine action of receptor kinase pathways whose ligands also act in a paracrine manner to safe-guard the phloem lineage by maintaining the plasticity of neighboring cell files. Moreover, quantitative fine-tuning of antagonistic receptor kinase pathways is required to initiate the phloem lineage before transition toward differentiation. I will attempt to synthesize how this highly dosage-sensitive network guides the development of sieve elements from the inception of their precursors towards differentiation.