

## **Numerical Modeling and Optimization: Root growth and its underlying molecular networks**

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Roots are of fundamental importance for both plant and human growth and health. Distinct cell type-specific programs within the root perform a variety of functions including defense, nutrient transport, mechanical support and growth. As a result of these cell type-specific developmental programs, root morphology can dynamically and rapidly adapt to its external environment. Root spatiotemporal transcriptome, proteome and metabolome profiling in *Arabidopsis thaliana* roots have given great insight into the diversity of cell type-specific programs. Novel algorithms and methodologies to image root growth in four dimensions will also be highlighted. Finally, I will discuss how we can use these data and other genome-scale and systems and simulation approaches to map gene regulatory networks that regulate root growth in response to the environment.