

From Cell Fate to Tissue Organization: Regulatory Networks Shaping Plant Development

Dr. Ross Sozzani

WNR Distinguished Professor and Director of
Plant Improvement North Carolina Plant
Science Initiative, North Carolina State
University, USA



Date : September 14 (Mon), 2026

14:00 ~ 15:30

**Place : SA329 Seminar Room
(Science and Agricultural Build.)**

How do individual cells acquire their identities, coordinate their divisions, and communicate with their neighbors to generate an organized and functional tissue? Understanding how these processes are integrated across spatial and temporal scales remains a central challenge in developmental biology. Using the Arabidopsis root as a model system, our laboratory investigates the regulatory mechanisms that connect cell identity, cell division, and differentiation to the emergence of tissue organization. Our work has shown that developmental decisions cannot be understood through individual transcription factors or signaling pathways in isolation. Rather, cell fate emerges from dynamic gene regulatory networks that operate both within individual cells and across cell types. In this seminar, I will discuss our efforts to uncover how transcriptional regulation, positional information, and cell-to-cell communication are integrated to control stem cell maintenance, asymmetric cell division, and cell fate specification. I will highlight examples in which mobile transcriptional regulators and intercellular signaling provide mechanisms for coordinating developmental decisions between neighboring cell populations. I will also discuss how advances in quantitative imaging and single-cell genomics are changing our ability to resolve these regulatory processes. By integrating genetic and molecular approaches with cell-type-specific and single-cell data, computational analyses, and mathematical modeling, we can begin to reconstruct the regulatory networks underlying developmental trajectories and examine how their dynamics generate robust patterns of cell behavior. Finally, I will describe our efforts to move from identifying the components of developmental networks toward establishing predictive principles for plant development. An important goal is to determine which regulatory interactions are necessary and sufficient to generate particular cell behaviors and tissue-level outcomes. Combining mechanistic experiments with quantitative models and synthetic approaches provides an opportunity not only to test our understanding of developmental systems but also to explore whether developmental programs can be rationally modified. Ultimately, this work aims to bridge molecular mechanisms, cellular decisions, and tissue organization, providing a framework for predicting plant developmental outcomes.



連絡先 :
榊原 均 (sakaki@agr.nagoya-u.ac.jp)
下遠野明恵 (ashimo@itbm.nagoya-u.ac.jp)