

# IRN France-Japan Frontiers in Plant Biology

## IRN-FJFPB

### Webinar « Development and Adaptation »

October 21st, 2021

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#### Live single cell transcriptional dynamics via RNA labelling during the phosphate response in plants

Plants are sessile organisms constantly adapting to ambient fluctuations through spatial and temporal transcriptional responses. We implemented the MS2-MCP system and combined it with microfluidics to visualize transcriptional regulation in living Arabidopsis plants. This enabled quantitative measurements of the transcriptional activity of single loci in single cells, real time and changing environmental conditions. Using phosphate responsive genes as model, we found that active genes displayed high transcription initiation rates ( $\sim 3s$ ) and frequently clustered together in endoreplicated cells. We observed gene bursting and large allelic differences in single cells, revealing that at steady-state, intrinsic noise dominated extrinsic variations. Moreover, we established that transcriptional repression triggered in roots by phosphate, a crucial macronutrient limiting plant development, occurred with fast kinetics ( $\sim$ minutes) and striking heterogeneity between neighboring cells. Access to single cell RNA polymerase II dynamics within live plants will benefit future studies of signaling processes.

