Contribution ID: **49**　　　　　　　　　　　　　　　　　Type: **not specified**

Functional imaging in plants: deciphering molecular regulators of stem cell niche maintenance

In plant biology, functional imaging enables the visualization and quantitative analysis of molecular activities in living cells with high spatiotemporal resolution. It involves fluorescent protein (FP) tagging combined with advanced fluorescence microscopy techniques, such as laser-scanning confocal imaging, super-resolution Airyscan detection, Förster Resonance Energy Transfer (FRET) and Fluorescence Lifetime Imaging Microscopy (FLIM). In our study, we combined these techniques to investigate the transcription factors (TFs) regulating the stem cell niche (SCN) maintenance in Arabidopsis thaliana. First, we analyzed their subcellular localization and temporal behavior within the root meristem. Then, we quantified their protein-protein interactions within protein complexes using FRET-FLIM. Furthermore, we simulated and predicted their regulatory dynamics in the SCN via computational modeling. This integrative approach revealed how different assemblies of TFs regulate SCN maintenance and cell-fate determination.

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Session Classification:　POSTER SESSION