O-20.3 Short talk

How do plants sense temperature? Nanostructure characterization of biological hydrogels formed by the prion-like domain EARLY FLOWERING 3 using SAXS

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Plants are exposed to frequent environmental changes and stress conditions, especially in the context of climate change. Direct environmental sensing, especially of temperature changes, is essential for plant survival, but the mechanisms that plants use to monitor and respond to the environmental cues remain elusive. One important mechanism that allows a fast response to temperature stimuli is the formation of dynamic liquid-liquid phase separated (LLPS) states. LLPS allows for dynamic compartmentalization of macromolecules via the formation of biomolecular condensates as a function of the physicochemical surroundings. EARLY FLOWERING 3 (ELF3), a low-complex prion-like domain (PrD) containing protein, acts as a direct temperature sensor via LLPS.

Using biological small angle X-ray scattering (bioSAXS) in combination with other biophysical and structural techniques, we investigated the dilute and condensed phases of ELF3. We demonstrate that the length of polyQ repeats in the PrD correlates with thermal responsiveness in ELF3 by tuning the properties of the condensate. Furthermore, we show that the gel phase formed a loose lamellar phase.

The ability of ELF3 to switch between active and inactive states through phase transition represents a novel thermosensory mechanism and here we describe the underlying structural, biochemistry and biophysics of this process.