Contribution ID: **83** Type: **Poster**

Acetylated HY5 Mediates Chloroplast Gene Expression for Improved High Light Stress Defense in Arabidopsis thaliana

Monday 18 November 2024 21:50 (20 minutes)

Light is the primary energy source for photosynthesis and plays a crucial role in regulating numerous developmental processes in plants. However, high light (HL) conditions that exceed chloroplast energy requirements can trigger oxidative stress, necessitating protective responses within plant nuclei. The transcription factor ELONGATED HYPOCOTYL5 (HY5) operates downstream of multiple photoreceptor families and regulates diverse developmental pathways, including photomorphogenesis, anthocyanin biosynthesis, and chloroplast development. Despite its well-known functions, the molecular mechanisms underlying HY5-mediated transcriptional regulation of chloroplast-related genes under HL conditions remain largely unexplored. N-ε-lysine acetylation, a dynamic post-translational modification (PTM), is essential for modulating protein functions, particularly in transcriptional regulation. HY5 is known to interact with histone deacetylases, such as HDA15 (a negative regulator) and HDA19 (a positive regulator), to influence photomorphogenesis through co-regulated histone acetylation. Additionally, we identified an HL-induced acetylation site on the HY5 protein. Here, we aim to investigate the role of this acetylation in promoting phenotypic changes and explore its potential function in HY5-mediated transcriptional regulation. Our findings will provide insights into how acetylation of HY5 contributes to the plant's defense against HL-induced oxidative stress, ultimately supporting chloroplast protection and development.

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Session Classification: Poster session

Track Classification: Environmental Acclimation & Proteostasis