Never Before Seen :

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Abstract

Light governs plant life both as an energy source and as an information cue, and regulates virtually every aspect of plant growth and development from seed to senescence. This dissertation examines the role of light as a source of information in regulating early seedling development. Specifically, the role of chromatin modification in light- regulated photomorphogenesis in Arabidopsis thaliana was studied using a mutant, det1-1, which undergoes premature photomorphogenesis in darkness. Global

DNA de-methylation was observed from whole-genome tiling arrays in det1-1 in comparison to wild-type, yet this phenotype was insufficient to explain the suite of defects associated with the det1-1 mutation, and the mechanistic details of how these changes come about are still unclear. A similar role by light in changing plant architectural development is exemplified by the shade avoidance syndrome, where plants attempt to evade vegetative shade by reallocation of energy towards apical growth. Hypocotyl (the embryonic stem) elongation is one feature which is altered dramatically in response to shade, and this phenotype was measured with unbiased temporal precision through a novel image-based assay and accompanying software. Using this tool to measure hypocotyl length in time-resolved image stacks, hypocotyls were shown to have a dynamic multi- phasic growth pattern in response to shade, which consisted of an initiation elongation phase, followed by a period of slower growth, and finally a second major elongation phase, all occurring over a period of 10 hours. New biosynthesis of the phytohormone, auxin, was demonstrated to have a clear role in the initiation of this dynamic growth pattern, which was reflected at the level of transcriptional regulation. Another hormone, brassinosteroid, and the signal transduction pathway following its synthesis and perception was also investigated and found to have a role in regulating shade- induced elongation. When brassinosteroid perception was impared, seedlings failed to resume elongation growth after the slowing phase following shade exposure, and modulation of endogenous brassinosteroid signaling components in wild-type seedlings was also apparent, implying a role for brassinosteroid regulation in controlling the observed growth patterns. Thus, multiple light and hormone signaling pathways must integrate environmental cues to initiate appropriate responses to adverse conditions

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