Researchers make discovery in molecular mechanics of phototropism

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In a paper published in the *Journal of Biological Chemistry*, scientists at the University of Missouri-Columbia reported molecular-level discoveries about the mechanisms of phototropism, the directional growth of plants toward or away from light.

Phototropism is initiated when photoreceptors in a plant sense directional blue light. Understanding phototropism is important because it could lead to crop improvement, said Mannie Liscum, professor in the Division of Biological Sciences in MU's College of Arts and Science and Christopher S. Bond Life Sciences Center.

"By understanding how phototropism works at a molecular level, we can work toward engineering plants that produce more biomass or have increased drought tolerance, among other things. For example, we could use this information to optimize plants' ability to capture light for photosynthesis, which would result in more energy capture and thus growth, or potentially agronomically useful biomass," Liscum said.

Liscum and doctoral student Ullas Pedmale studied the regulation of phototropic signaling in Arabidopsis thaliana, a weedy flowering plant commonly used as a model in laboratory studies. Focusing on non-phototropic hypocotyls 3 (NPH3), a protein known to be essential for phototropic responses, they examined its phosphorylation, the addition or removal of a phosphate group to the protein molecule. Using a series of pharmacological treatments and immunoblot assays, the team discovered that NPH3 was a phosphorylated protein – a protein with a phosphate group attached – in seedlings grown in the darkness. When the seedlings were exposed to light, they became dephosphorylated, or lost their phosphate group.

These results suggest that the absorption of light by phot1, the dominant receptor controlling phototropism, leads to NPH3's loss of a phosphate group, allowing further progression of phototropic signaling.

"We found that exposure to directional blue light stimulated NPH3's dephosphorylation," Liscum said. "NPH3 exists as a phosphorylated protein in darkness and is rapidly dephosphorylated by a yet unidentified protein phosphatase in response to phot1 photoactivation by blue light."

Liscum and Pedmale now plan to study which amino acids on NPH3 are reversibly phosporylated and how NPH3 is involved in regulating other processes within plants.

Source: University of Missouri-Columbia