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CHLOROPHAGY

Preventing sunburn

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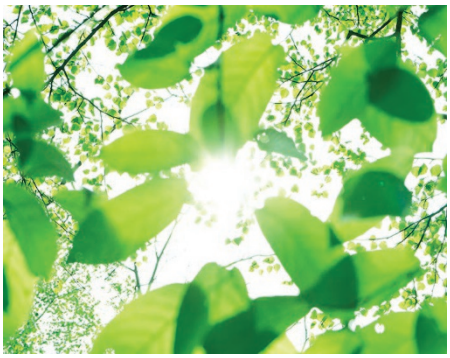

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Chloroplasts are the organelles in which sunlight energy is captured and converted. Mostly found in leaf mesophyll cells, these green organelles are often exposed to direct sunlight as well as harmful ultraviolet B (UVB). Recently, Masanori Izumi of Frontier Research Institute for Interdisciplinary Sciences, Tohoku University, Sendai, Japan, and colleagues reported that autophagy of entire chloroplasts, termed chlorophagy, was responsible for the degradation and recycling of UVB-damaged chloroplasts in *Arabidopsis*.

They compared the responses of wild-type plants and autophagy-defective mutants (*atg* mutants) to UVB exposure, and revealed that *atg* mutants were hypersensitive to UVB in a dose-dependent manner. Using a stromal fluorescent marker to distinguish healthy chloroplasts from damaged ones, they observed an elevated frequency of damaged chloroplasts following UVB exposure. The damaged organelles were transported into the cell vacuole in wild-type leaves, while in *atg* mutants they accumulated in the cytosol. In UVB-exposed leaf mesophyll cells, a fluorescent autophagosome membrane marker was found to be closely associated with distinct cytosolic chloroplasts, indicating that the UVB-damaged chloroplasts were potentially transported to the vacuole via autophagosomes. All together, these observations lead to a conclusion that autophagosome-mediated chlorophagy controls the elimination of UVB-damaged chloroplasts and helps the plants to sustain normal growth under photodamaging conditions.

In addition to the UVB condition, the study also included an investigation of chlorophagy under a high visible light condition, which suggested that natural-sunlight-induced damage not only resulted from UVB, but also from visible light.

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