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An integrative approach to photoinhibition and photoprotection of photosynthesis ☆

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Solar-energy harnessing by photosynthetic organisms is the ultimate engine for production of food as well as carbon-based materials and fuels. However, absorption of more light than can be converted to photosynthate has the potential to damage the light-processing structures. At the same time, the intensity of sunlight differs tremendously among different environments inhabited by photosynthetic organisms and can, furthermore, fluctuate strongly over the course of a day, and even from minute-to-minute. In addition, excess light varies widely even at a given light intensity impinging on the leaf (Figure 1). Other current conditions, like leaf temperature, impact photosynthesis rate and, thereby, excess light level. Moreover, a plant's growth rate – as affected by recent environmental conditions and species' evolutionary history – exerts control over photosynthetic capacity and excess light level (Demmig-Adams et al. 2017).

To be able to continuously balance light absorption with light utilization, photosynthetic