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Dynamics and mechanism of dimer dissociation of UVR8 photoreceptor

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Abstract

UVR8 (UV RESISTANCE LOCUS 8) proteins are a class of UV-B photoreceptors in high plants. UVR8 is a homodimer that dissociates into monomers upon UV-B irradiation (280 to 315 nm), which triggers various protective mechanisms against UV damages. Uniquely, UVR8 does not contain any external chromophores and utilizes the natural amino-acid tryptophan (Trp) to perceive UV-B light. Each UVR8 monomer has 14 tryptophan residues. However, only the two Trp residues (W285 W233) are critical to the light-induced dimer-to-monomer transformation. Here, combining time-resolved spectroscopy, extensive site-directed mutations and quantum calculations, we have revealed the entire dynamics of UV perception to lead to monomerization, including a series of critical dynamic processes of a striking energy-flow network, exciton charge separation and recombination, charge neutralization, salt-bridge unzipping, and protein solvation, providing a complete molecular picture of the initial biological function.