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Light Activation Mechanism of Retinal Proteins

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Abstract: Light Activation Mechanism of Retinal Proteins

Retinal proteins serve as photoreceptors and are found in lower and higher organisms. They play a key role in signal transduction by signaling the presence and characteristics of ambient light and triggering important concomitant functions.
It is widely assumed that isomerization around the retinal chromophore double bond is a prerequisite for all light induced conformational changes in retinal proteins. Following light absorption, the retinal chromophore experiences very large dipolar changes in the vertically excited state. This light-induced dipole is at least 50% larger than that of the retinal chromophore in films or in solution. Formation of the excited state leads to highly efficient and specific double bond isomerization process, which initiates the pigment photocycle.
In this presentation I shall discuss the origin of the protein effect on the light-induced dipole, and the photochemical isomerization using artificial pigments derived from synthetic retinal analogs, and Tryptophans modified pigments. We have observed that major protein conformation alterations in retinal-based pigments take place following light absorption, even when isomerization around the double bond is prevented by a rigid ring structure. Moreover, we have shown that isomerization of the retinal chromophore is prevented if light induced dipole is eliminated. These observations reflect on the activation mechanism of retinal proteins.