

ChR-2: the influence of the membrane and the application of a membrane potential

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Channelrhodopsin-2 is a unique light-induced cation channel that is widely used in the new field of Optogenetics. The influences of both the lipid membrane and the membrane potential on the protein function are not yet understood at a molecular level. Here the reconstituted protein is studied with time resolved infrared and visible spectroscopy with nanosecond time resolution. Polarized light is also used to elucidate the most important features. The protein function as a channel is studied with time resolved visible and fluorescence spectroscopy, with the help of molecular probes encapsulated in unilamellar proteoliposomes. The reconstitution of ChR-2 into PC/PS liposomes affects the photocycle kinetics and the lipid-to-protein ratio plays a modulatory role, in particular on the blue shifted intermediate. Time resolved infrared spectroscopy shows in addition that the lipid membrane limits the protein backbone movements over the whole photocycle.