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Mammalian rhodopsin dynamics using an X-ray free electron laser.

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Mammalian Rhodopsin, a prototype of the largest druggable G Protein-Coupled Receptors family (GPCRs), is our light receptor for night vision. Upon photon absorption, its chromophore 11-cis retinal undergoes one of the fastest events in biology, which happens in the femtosecond range, the isomerization into the agonist form, all-trans retinal. We have developed a new crystal form of rho-dopsin, diffracting to better than 2 Å, which is suitable for room temperature time-resolved serial crystallography. At SACLA and SwissFEL, we were able to collect a number of time-resolved data sets. The rhodopsin microcrystals grown in the dark are successively injected in the light of a pump laser and directly probed with the XFEL beam after various time-delays from femtoseconds to milliseconds. The results can be compared to those of the prokaryotic proton pump bacteriorhodopsin studied using the same method [1-3]. Time-resolved serial femtosecond crystallography on rhodopsin will not only give details on the photophysical trigger of retinal excitation upon photon absorption, but also general insights on the molecular activation of a class A GPCR.

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