Comparison between light pulse and temperature jump induced meta transitions in the rhodopsin photolysis sequence

J.Cieslik and H.Rüppel
Max Volmer Institut f.Biophysikalische u.Physikalische Chemie
Technische Universität Berlin , 1000 Berlin 12 , Germany

The meta I - meta II transition of the rhodopsin photolysis sequence is strongly temperature dependent.Photometric signals at 380 a.480 nm evoked by small pulses of light bleaching 1 - 3 % of rhodopsin reveal two components of this transition having different reaction times τ_1 and $\tau_2 (\cong 5 \cdot \tau_1)$ and non - linear Arrhenius plots. To explain the complex kinetics of this transition, preceding intermediates of isochromic absorption have been proposed. In this case, after totally bleaching the rhodopsin by an intense light flash a rapid temperature jump excitation of the stationary meta equilibrium should yield different relaxation kinetics.

Repetitive temperature jumps (1) (1-2 Hz) of appr. 1 K were produced by the absorption of 10 GHz microwave pulses (80 kW , 5 µs) in 80 µl of an ultrasonicated suspension of bovine rod outer segments. At different temperatures (14-21 °C) and pH - values (6-9) 16 - 32 photometer signals at both wavelength were averaged and analyzed. The relaxation process of the meta - equilibrium reveals two component kinetics quite similar to that obtained for the light pulse induced meta transition. - Qualitatively, there are no significant differences in the pH-dependence of the kinetics. For the fast component e.g. these deviations are not detectable at all.For the slow component,at pH=7 (maximum of τ_2/E_A) they remain below + 10 % for the re - action time τ_2 and above -30 % for the corresponding activation energy E_A.

From these findings there is strong evidence that the kinetics of the meta transition reflects a normal equilibration mechanism and excludes preceding reaction steps with isochromic components. According to the membrane expansion model of the rhodopsin meta transition (2) small deviations in the relaxation kinetics are indeed to be expected becausethe state of the bleached membrane (temp.excit.) is different from that of the dark adapted one (light excit.).

(1) P.Brumm,F.P.Kilian u.H.Rüppel,(1968),Ber.Buns.Ges.72,1085

(2) G.Schnitzkewitz a.H.Rüppel,(1980),Biophys.Struct.Mech.6 (suppl.),126