

Photoelectric Properties of Rhodopsin Doped Black Lipid Membranes

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Discs isolated from bovine rod outer segments and liposomes prepared by sonication of discs can be attached in a sandwich like structure to one side of a positively charged black lipid membrane. After a laser flash (500 nm, 10 ns, 1 mJ/cm² light intensity) the membrane system showed transient photovoltages as demonstrated in Fig. 1.

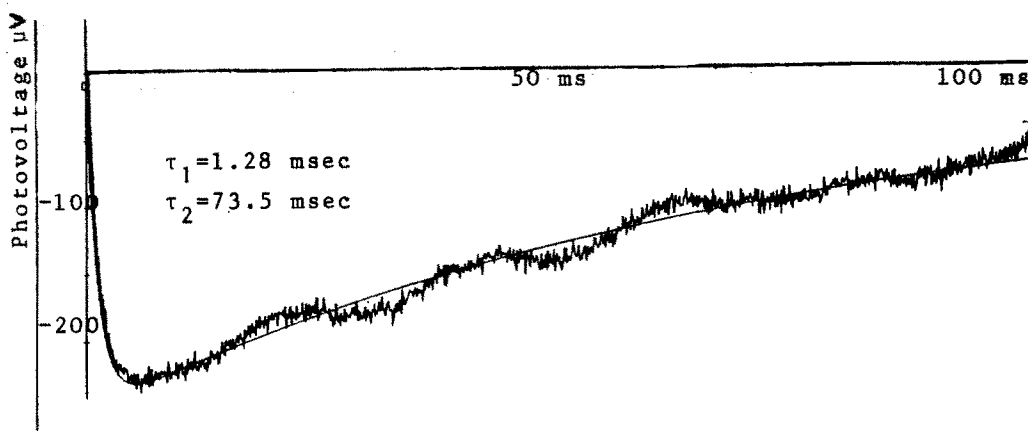


Fig. 1 Time course of the photovoltage of a rhodopsin doped membrane. Aqueous phase: 0.1 M KCl, 0.5 mM TRIS-Cl pH 7.0, 22 °C.

The evaluation of the photovoltage signal results in two relaxation times τ_1 and τ_2 . τ_1 is in the range of 1 ms and τ_2 in the range of 50 ms. The time resolution of the setup is about 0.5 μ s. For both discs and liposomes τ_1 was similar whereas τ_2 was smaller for liposomes than for discs. τ_1 is significantly faster than the Meta I - Meta II transition of rhodopsin (1) and lies in the time range observed for the early receptor potential (2). τ_2 is more than five times slower than the Meta I - Meta II transition (1) and, therefore, cannot be correlated with the chromophore kinetics.

In a second series of experiments, rhodopsin was bleached before it was added to the membrane. No photovoltage could be obtained. Upon addition of 11-cis retinal to the system, discs and liposomes at the membrane became again fully active.

(1) C.N. Rafferty (1979), Photochem. Photobiol. 29, 109

(2) J.D. Spalink, H. Stieve (1980), Biophys. Struct. Mech. 6, 171