

Is 3-Methyl[15]annulenone-Hydroxy-3-methyl[15]annulenylum Ion Cycle Mimic to Bacteriorhodopsin Cycle?

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Annulenone cycle [Fig. 3] constitutes four state model for light driven H^+ -pumping of bacteriorhodopsin (bR) [Fig. 2], satisfying requirements of better H^+ -binding in E_1H [Fig. 1] [$K_t = \frac{[E_1]}{[E_2]} < 1$ and $pK_a E_1H > pK_a E_2H$]. It also satisfies an essential requirement for the active transport of H^+ by illuminating orange light (>470 nm) [$K_L = \frac{[E_1H]}{[E_2H]} < 1$]. Our annulenone cycle enables us to consider design principles for H^+ -pumping. The rate enhancement effects of the 13-methyl group in retinal Schiff's base for the regeneration of B_{568} from $M_{412}(I)$ could be representable in the annulenone cycle by introducing one Me group into the parent

[15]annulenone molecule [Me in place of H at the 3-position].

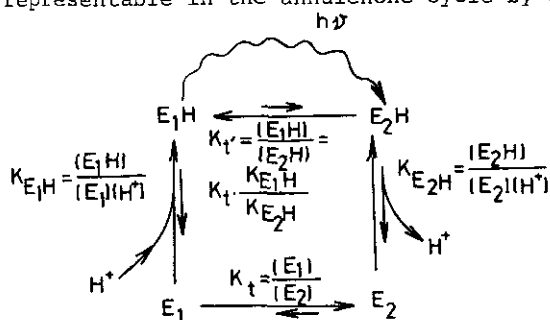


Fig. 1 Four state model for light-driven H^+ -pumping in bR or annulenone cycle. (Three essential equilibrium constants are shown).

Cell Membrane of *H. halobium*

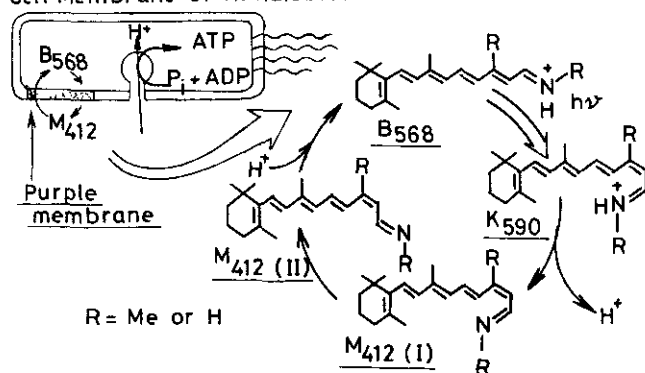


Fig. 2 Bacteriorhodopsin Cycle
(K. Schulten and P. Tavan, 1978)

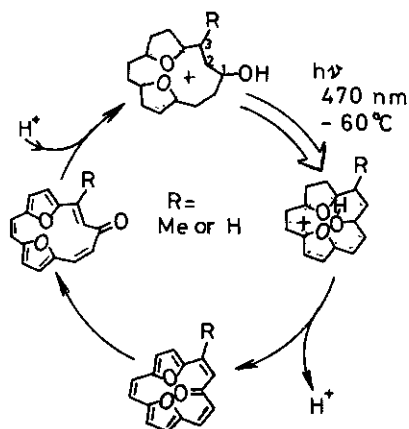


Fig. 3 Annulenone Cycle
(H. Ogawa et al. 1980)