
By Haru Ogawa, Minoru Kuribayashi, Hiroshi Morita and Taiji Imoto
Faculty of Pharmaceutical Sciences, Kyushu University, Fukuoka 812 Japan
Izumi Miyamoto, Hidefumi Kato and Yoichi Taniguchi
National Kurume technical College, Kurume 830 Japan

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 E₁H [Fig. 1] \( K_L = \frac{[E_1]}{[E_2]} < 1 \) 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) [\( K_L = \frac{[E_1]}{[E_2]} < 1 \)]. 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 B₅₆₈ from M₄₁₂(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).