

Low aqueous solubility of 11-cis-retinal limits the rate of pigment formation and dark adaptation in salamander rods

Rikard Frederiksen, Nicholas P. Boyer, Benjamin Nickle, Kalyan S. Chakrabarti, Yiannis Koutalos, Rosalie K. Crouch, Daniel Oprian, and M. Carter Cornwall

Volume 139, No. 6, June 4, 2012. Pages 493–505.

The values for ψ on page 504 should be roughly 1,000-fold higher than reported. The correct calculation is as follows:

$$\psi = D 2 \pi r l C_{\text{pm}} / d, \text{ where}$$

$$D = 5 \times 10^{-6} \text{ cm}^2 \text{ s}^{-1} = 5 \times 10^{-10} \text{ m}^2 \text{ s}^{-1}$$

$$r = 5.7 \text{ } \mu\text{m} = 5.7 \times 10^{-6} \text{ m}$$

$$l = 29.8 \text{ } \mu\text{m} = 29.8 \times 10^{-6} \text{ m}$$

$$d = 50 \text{ nm} = 50 \times 10^{-9} \text{ m}$$

$$C_{\text{pm}} \text{ for 11-cis retinal} = 3.5 \text{ } \mu\text{M} = 3.5 \times 10^{-3} \text{ mol m}^{-3}$$

$$C_{\text{pm}} \text{ for 11-cis 4-OH retinal} = 10 \text{ } \mu\text{M} = 10 \times 10^{-3} \text{ mol m}^{-3}$$

This gives $\psi_{11\text{-cis}} = 3.7 \times 10^{-14} \text{ mol s}^{-1}$, and $\psi_{4\text{OH}} = 1.1 \times 10^{-13} \text{ mol s}^{-1}$, which is roughly 1,000-fold greater than originally reported. Thus, the values of ψ are roughly 2,700 times greater than the experimentally measured K for 11-cis retinal ($K_{11\text{-cis}} = 1.4 \times 10^{-17} \text{ mol s}^{-1}$) and 1,600 times greater than K for 11-cis 4-OH retinal ($K_{4\text{OH}} = 6.8 \times 10^{-17} \text{ mol s}^{-1}$). This indicates that the simple model presented on page 503 for diffusional translocation of 11-cis retinal is not sufficient to explain the slowness of the rate of regeneration that the authors observed.

The authors would like to thank Professor Trevor Lamb for bringing this error to their attention.