

1st grade: Signal transduction in a rod photoreceptor cell

Summary: Retina receives light and transmits the event to the brain. Retinal photoreceptors are the first cells detecting photons converting into electric signals (Fig.1 left). Rhodopsin, a visual pigment protein in a photoreceptor, detects a

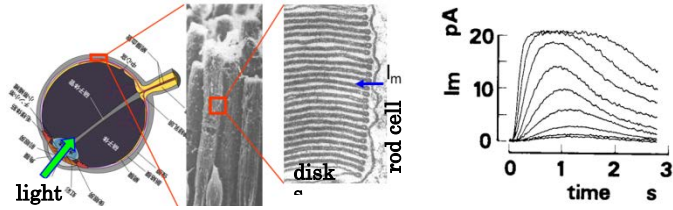


Fig.1 Rod photoreceptor cell (left) and its current response (right)

photon leading to a closure of cation channels on the plasma membrane, and this generates a current response in a rod photoreceptor (Fig.1 right). A simplified signal transduction is shown below:

① Rhodopsin (Rh)→②transducin (G protein)→③PDE (cGMP catalase)→④cation channels

Cartoon and A-Cell model: A cartoon at the center in Fig.2 describes above process in detail. The numbering ①-④ correspond to the that shown above. Signal transduction in the cartoon is converted into an A-cell model (gray rectangles in Fig.2). When constructing an A-Cell model, first draw cartoon of signal transduction, next construct detail reactions, and finally draw them by using 7 reaction arrows of A-Cell. A cartoon is the starting point of constructing A-Cell model. A model shown in Fig.2 includes ion current through cation channels on the plasma membrane, which is not expressed in the cartoon explicitly. Simulation results can be found in the references below. Simulation conditions can be as follows: simulation time = 0-2 s; calculation step = 1 μs; output step = 2 ms.

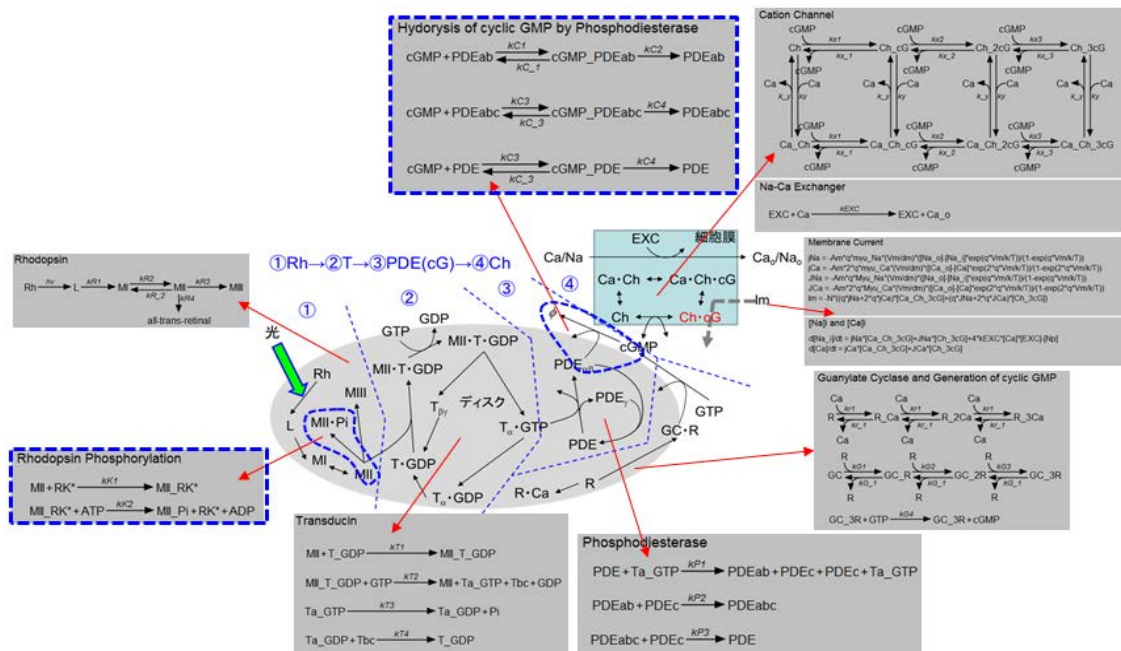


Fig.2 Cartoon of signal transduction in rod (center) and corresponding reactions in A-Cell model (gray rectangles)

References: Ichikawa, K., Neurosci.Res., Vol.19(1994), pp.201-212.
 Ichikawa, K., Neurosci.Res., Vol.20(1994), pp.337-343.
 Imai, H., et al., J.Biol.Chem., Vol.282(2007), pp.6677-6684.