

A Parameter Table for the WT SPR for the Dynamics $\tau_{R;eff} \approx 75$ ms and $\nu_{RG} \approx 330s^{-1}$ and the Faster Dynamics $\tau_{R;eff} \approx 40$ ms and $\nu_{RG} \approx 575s^{-1}$

Table S2 collects the simulation parameters for the two indicated dynamics. The ones in black, equal to those of Table S2 reflect the slower dynamics $\tau_{R;eff} \approx 75$ ms and $\nu_{RG} \approx 330s^{-1}$ and those in **bold** are those that need to be modified to accomodate the faster dynamics $\tau_{R;eff} \approx 40$ ms and $\nu_{RG} \approx 575s^{-1}$.

Table S2. Model parameters in mouse phototransduction.

BLACK: $\tau_{R^*} = 75$ ms

Bold: $\tau_{R^*} = 41$ ms

Symbol	Units	Definition	Value	References
α_{max}	μMs^{-1}	Maximum rate of cGMP synthesis at low Ca^{2+} concentration	76.5	[1, 2]
$\alpha_{max}/\alpha_{min}$	-	Suppression ratio of α from high to low Ca^{2+} concentration	13.9	[1–3]
A_{inc}	μm^2	Area of the incisure	0.0403	
β_{dark}	s^{-1}	Rate of cGMP hydrolysis by dark activated PDE	2.9	[2, 4, 5]
B_{cG}	-	Buffering power of cytoplasm for cGMP	1	[6–8]
B_{Ca}	-	Buffering power of cytoplasm for Ca^{2+}	20	[6, 9, 10]
c_{GE}	-	Coupling coefficient from G^* to E^*	1	[8, 11]
$[cGMP]_{dark}$	μM	Concentration of cGMP in the dark	3.80 (3.37)	[2, 3, 6–8, 12–14]
$[Ca^{2+}]_{dark}$	nM	Concentration of Ca^{2+} in the dark	344 (394)	[4, 8, 15–22]
D_{cG}	$\mu m^2 s^{-1}$	Diffusion coefficient for cGMP	120	[23–25]
D_{Ca}	$\mu m^2 s^{-1}$	Diffusion coefficient for Ca^{2+}	15	[9]
D_{E^*}	$\mu m^2 s^{-1}$	Diffusion coefficient for activated PDE	1.2	[7]
D_{G^*}	$\mu m^2 s^{-1}$	Diffusion coefficient for activated G protein	2.2	[7]
D_{R^*}	$\mu m^2 s^{-1}$	Diffusion coefficient for activated Rh	1.5	[7]
ε	nm	Disk thickness	14.5	[7, 26, 27]
η	nm	Volume-to-surface ratio	7.25	
\mathcal{F}	$C mol^{-1}$	Faraday’s constant	96500	
f_{Ca}	-	Fraction of cGMP-activated current carried by Ca^{2+}	0.06	[1, 5, 8, 28, 29]
H	μm	Height of ROS	23.6	[8, 26, 30, 31]
j_{dark}	pA	Dark current	10.9 (12.21)	[1, 3, 4, 8, 32–41]
j_{cG}^{max}	pA	Maximum cGMP-gated channel current	3550	
j_{ex}^{sat}	pA	Saturated exchanger current	1.8	[42–44]
k_{cat}/K_m	$\mu M^{-1} s^{-1}$	Hydrolytic efficiency of activated PDE dimer	540	[7, 11, 45]
$k_{\sigma;hyd}$	$\mu m^3 s^{-1}$	Surface hydrolysis rate of cGMP by dark-activated PDE	2.8×10^{-5}	
$k_{\sigma;hyd}^*$	$\mu m^3 s^{-1}$	Surface hydrolysis rate of cGMP by light-activated PDE	0.9	

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Table S2 – continued from previous page

Symbol	Units	Definition	Value	References
k_E	s^{-1}	Rate constant for inactivation of PDE	6.5	[4, 5, 46, 47]
k_R	s^{-1}	Rate constant for inactivation of Rh	13.3 (24.39)	[4, 10, 47]
k_{T^*E}	$\mu m^2 s^{-1}$	Kinetic constant describing the formation of $T^* - E$ complex and thus the production of E^*	1	[48]
K_{cyc}	nM	Half-saturating $[Ca^{2+}]$ for GC activity	100	[1, 2, 4, 5]
K_{cG}	μM	$[cGMP]$ for half maximum cGMP-gated channel opening	20	[8]
K_{ex}	μM	$[Ca^{2+}]$ for half maximum exchanger channel opening	1.6	[8, 43]
l_b	μm	Width of the incisure	0.2593	[49]
l_r	μm	Length of the incisure	0.3111	[49]
ν	-	Ratio between interdiscal space and disk thickness	1	[7, 8, 11, 26]
$\nu\varepsilon$	nm	Interdiscal space	14.5	[7, 26, 30, 31]
ν_{RG}	s^{-1}	Rate of transducin formation per fully activated Rh	330 (575)	[6, 8, 11, 50]
n	#	Number of disks	814	
n_{inc}	#	Number of incisures	1	[7, 26, 49]
N_{Av}	$\#mol^{-1}$	Avogadro number	6.02×10^{23}	
m_{cyc}	-	Hill coefficient for GC effect	2	[1–5]
m_{cG}	-	Hill coefficient for cGMP-gated channel	3.5 (3.2)	[2–4, 7, 38]
$[PDE]_\sigma$	$\#\mu m^{-2}$	Surface density of dark-activated PDE	750	[7, 8, 27, 30, 51]
R	μm	Radius of disk	0.7	[7, 8, 26, 27, 30, 31, 52, 53]
σ	-	Ratio between outer shell thickness and disk thickness	15/14.5	
$\sigma\varepsilon$	nm	Distance between the disk rim and the plasma membrane (outer shell thickness)	15	[7, 24]
Σ_{rod}	μm^2	Lateral surface area of ROS	103.8	
V_{cyt}	μm^3	Cytoplasmic volume	18.16	