

Table S1: Parameters for calcium transient

Parameters	Symbols	Values
Time step	$\Delta t$	$10^{-7}$ s
Diffusion	$D$	$600 \mu m^2 s^{-1}$ [37]
Initial number of calcium ions	$N$	1000
Spine head radius	$R$	$1 \mu m$
Spine neck radius	$a$	$0.15 \mu m$
Spine neck length	$L$	$1.5 \mu m$
SA head radius	$R_{SA}$	$0.25 \mu m$
SA neck length	$L_{SA}$	$1.5 \mu m$
SA neck radius	$a_{SA}$	$0.05 \mu m$
Spine head-SA head center distance	$l$	$0.5 \mu m$
Radius (RyR and SERCA)	$a_{RyR}, a_{SERCA}$	$10 nm$
# SERCA pumps in the SA head		36
# ions absorbed by one SERCA		2
# RyR in the SA base		36
# ions to activate one RyR		2
# calcium released from one RyR	$n_{Ca}$	varies (2-8)
# calcium released from one RyR	$\tau_{SER,TL}$	$\infty$