SBML Model Report

Model name: "Hernjak2005_Calcium_Signaling"

May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by Harish Dharuri[1] at January 28th 2008 at 11:44 a. m. and last time modified at February 20th 2014 at 5:06 p. m. Table 1 shows an overview of the quantities of all components of this model.

Table 1: Number of components in this model, which are described in the following sections.

Element	Quantity	Element	Quantity
compartment types	0	compartments	5
species types	0	species	32
events	0	constraints	0
reactions	45	function definitions	0
global parameters	28	unit definitions	23
rules	3	initial assignments	0

Model Notes

The model reproduces the time profiles of Calcium in the spine and dendrites as depicted in Fig 8 and Fig 9 of the paper for CF activation.

The model was reproduced using MathSBML.

Please note that the units of volume species is molecules/micrometer cubed as against the units of microMolar given in the paper. To convert the units to microMolar multiply the species

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concentration by the conversion factor 1/602.

2 Unit Definitions

This is an overview of 25 unit definitions of which two are predefined by SBML and not mentioned in the model.

2.1 Unit substance

Definition item

2.2 Unit volume

Definition μm^3

2.3 Unit area

Definition μm^2

2.4 Unit molecules

Definition item

2.5 Unit umol_um3_litre_1

Definition 10^{-21} mol

2.6 Unit um2

Definition μm^2

2.7 Unit uM_um3_molecules_1

Definition 10^{-21} dimensionless $\cdot$ item^{-1} $\cdot$ mol

2.8 Unit uM_s_1

Definition $0.0010\ \text{dimensionless} \cdot \text{m}^{-3} \cdot \text{mol} \cdot \text{s}^{-1}$

2.9 Unit uM_1_s_1

Definition $1000\ \text{dimensionless} \cdot \text{m}^{3} \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$

2.10 Unit s_1

Definition s^{-1}

2.11 Unit um2_s_1

Definition $10^{-12}\ \text{dimensionless} \cdot \text{m}^{2} \cdot \text{s}^{-1}$

2.12 Unit um

Definition μm

2.13 Unit uM

Definition $0.0010\ \text{dimensionless} \cdot \text{m}^{-3} \cdot \text{mol}$

2.14 Unit molecules_um_2_s_1

Definition $10^{12}\ \text{dimensionless} \cdot \text{item} \cdot \text{m}^{-2} \cdot \text{s}^{-1}$

2.15 Unit pA_um_2

Definition $\text{dimensionless} \cdot \text{A} \cdot \text{m}^{-2}$

2.16 Unit molecules_um_2_uM_1_s_1

Definition $10^{15}\ \text{dimensionless} \cdot \text{item} \cdot \text{m} \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$

2.17 Unit um_1

Definition μm^{-1}

2.18 Unit uM_um_s_1

Definition $10^{-9}\ \text{dimensionless} \cdot \text{m}^{-2} \cdot \text{mol} \cdot \text{s}^{-1}$

2.19 Unit _one_

Definition dimensionless

2.20 Unit s

Definition s

2.21 Unit uM_um3_molecules_1_s_1

Definition 10^{-21} dimensionless $\cdot$ item^{-1} $\cdot$ mol $\cdot$ s^{-1}

2.22 Unit _one__0E_57_item_4_m6_mol_s_1

Definition 10^{-57} dimensionless $\cdot$ item^{-4} $\cdot$ m^{6} $\cdot$ mol $\cdot$ s^{-1}

2.23 Unit um_s_1

Definition μm $\cdot$ s^{-1}

2.24 Unit length

Notes Metre is the predefined SBML unit for `length` since SBML Level 2 Version 1.

Definition m

2.25 Unit time

Notes Second is the predefined SBML unit for `time`.

Definition s

3 Compartments

This model contains five compartments.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
Extracellular	Extracellular		3	1	μm^3	☑	
Cytosol	Cytosol		3	14169.5000044198	μm^3	☑	PM
ER	ER		3	2500	μm^3	☑	ERM
PM	PM		2	16669.5000051998	μm^2	☑	Extracellular
ERM	ERM		2	50000	μm^2	☑	Cytosol

3.1 Compartment Extracellular

This is a three dimensional compartment with a constant size of one μm^3.

Name Extracellular

3.2 Compartment `Cytosol`

This is a three dimensional compartment with a constant size of 14169.5000044198 μm^3, which is surrounded by `PM` (PM).

Name Cytosol

3.3 Compartment `ER`

This is a three dimensional compartment with a constant size of 2500 μm^3, which is surrounded by `ERM` (ERM).

Name ER

3.4 Compartment `PM`

This is a two dimensional compartment with a constant size of 16669.5000051998 μm^2, which is surrounded by `Extracellular` (Extracellular).

Name PM

3.5 Compartment `ERM`

This is a two dimensional compartment with a constant size of 50000 μm^2, which is surrounded by `Cytosol` (Cytosol).

Name ERM

4 Species

This model contains 32 species. The boundary condition of eight of these species is set to `true` so that these species' amount cannot be changed by any reaction. Section 8 provides further details and the derived rates of change of each species.

Table 3: Properties of each species.

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
ERDensity_ERM		ERM	$\text{item} \cdot \mu\text{m}^{-2}$	⊟	☑
PA_D_Cytosol		Cytosol	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	⊟
PABCa_D_Cytosol		Cytosol	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	⊟
Ca_D_ER		ER	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	☑
h_D_ERM		ERM	$\text{item} \cdot \mu\text{m}^{-2}$	⊟	⊟
PABMg_D_Cytosol		Cytosol	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	⊟
ERDensity_D_ERM		ERM	$\text{item} \cdot \mu\text{m}^{-2}$	⊟	☑
CG_D_Cytosol		Cytosol	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	⊟
D28kB_D_Cytosol		Cytosol	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	⊟
PA_Cytosol		Cytosol	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	⊟
CG_Cytosol		Cytosol	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	⊟
PABCa_Cytosol		Cytosol	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	⊟
Mg_Cytosol		Cytosol	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	☑
D28k_high_Cytosol		Cytosol	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	⊟
D28k_high_D-_Cytosol		Cytosol	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	⊟
Ca_ER		ER	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	☑
D28kB_high_D-_Cytosol		Cytosol	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	⊟
CGB_D_Cytosol		Cytosol	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	⊟
Ca_D_Cytosol		Cytosol	$\text{item} \cdot \mu\text{m}^{-3}$	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
CGB_Cytosol		Cytosol	$\mathrm{item} \cdot \mu\mathrm{m}^{-3}$	⊟	⊟
D28k_Cytosol		Cytosol	$\mathrm{item} \cdot \mu\mathrm{m}^{-3}$	⊟	⊟
D28kB_high-_Cytosol		Cytosol	$\mathrm{item} \cdot \mu\mathrm{m}^{-3}$	⊟	⊟
PABMg_Cytosol		Cytosol	$\mathrm{item} \cdot \mu\mathrm{m}^{-3}$	⊟	⊟
IP3_Cytosol		Cytosol	$\mathrm{item} \cdot \mu\mathrm{m}^{-3}$	⊟	⊟
Ca_Extracellular		Extracellular	$\mathrm{item} \cdot \mu\mathrm{m}^{-3}$	⊟	☑
D28k_D_Cytosol		Cytosol	$\mathrm{item} \cdot \mu\mathrm{m}^{-3}$	⊟	⊟
IP3_D_Cytosol		Cytosol	$\mathrm{item} \cdot \mu\mathrm{m}^{-3}$	⊟	⊟
Mg_D_Cytosol		Cytosol	$\mathrm{item} \cdot \mu\mathrm{m}^{-3}$	⊟	☑
Ca_Cytosol		Cytosol	$\mathrm{item} \cdot \mu\mathrm{m}^{-3}$	⊟	⊟
h_ERM		ERM	$\mathrm{item} \cdot \mu\mathrm{m}^{-2}$	⊟	⊟
Ca_D-_Extracellular		Extracellular	$\mathrm{item} \cdot \mu\mathrm{m}^{-3}$	⊟	☑
D28kB_Cytosol		Cytosol	$\mathrm{item} \cdot \mu\mathrm{m}^{-3}$	⊟	⊟

5 Parameters

This model contains 28 global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
KMOLE			0.002	10^{-21} dimensionless $\cdot$ item^{-1} $\cdot$ mol	☑
pulses0			0.000		⊟
p0			1.000		☑
delta			0.000		☑
tau			0.012		☑
Ks			1.188		☑
A1			1.000		☑
B1			2.000		☑
flux0_ar			0.000		⊟
Jch			13.250		☑
t1			0.100		☑
t2			0.105		☑
flux1_ar			0.000		⊟
JchD			6.250		☑
pulses_ar			0.000		⊟
p1			1.000		☑
p2			1.000		☑
p3			1.000		☑
p4			1.000		☑
p5			1.000		☑
p6			1.000		☑
p7			1.000		☑
p8			1.000		☑
p9			1.000		☑
p10			1.000		☑
p11			1.000		☑
p12			1.000		☑
p13			1.000		☑

6 Rules

This is an overview of three rules.

6.1 Rule `pulses_ar`

Rule `pulses_ar` is an assignment rule for parameter `pulses_ar`:

$$
\begin{aligned}
\text{pulses\_ar} = &\begin{cases} \text{p0} \cdot \exp(((\text{t} + (\text{delta})) \cdot \text{Ks})) & \text{if t} > \text{delta} \\ 0 & \text{otherwise} \end{cases} \\
&+ \begin{cases} \text{p1} \cdot \exp(((\text{t} + ((\text{tau} + \text{delta}))) \cdot \text{Ks})) & \text{if t} > \text{tau} + \text{delta} \\ 0 & \text{otherwise} \end{cases} \\
&+ \begin{cases} \text{p2} \cdot \exp((\text{Ks} \cdot (\text{t} + ((2 \cdot \text{tau} + \text{delta}))))) & \text{if t} > 2 \cdot \text{tau} + \text{delta} \\ 0 & \text{otherwise} \end{cases} \\
&+ \begin{cases} \text{p3} \cdot \exp((\text{Ks} \cdot (\text{t} + ((3 \cdot \text{tau} + \text{delta}))))) & \text{if t} > 3 \cdot \text{tau} + \text{delta} \\ 0 & \text{otherwise} \end{cases} \\
&+ \begin{cases} \text{p4} \cdot \exp((\text{Ks} \cdot (\text{t} + ((4 \cdot \text{tau} + \text{delta}))))) & \text{if t} > 4 \cdot \text{tau} + \text{delta} \\ 0 & \text{otherwise} \end{cases} \\
&+ \begin{cases} \text{p5} \cdot \exp((\text{Ks} \cdot (\text{t} + ((5 \cdot \text{tau} + \text{delta}))))) & \text{if t} > 5 \cdot \text{tau} + \text{delta} \\ 0 & \text{otherwise} \end{cases} \\
&+ \begin{cases} \text{p6} \cdot \exp((\text{Ks} \cdot (\text{t} + ((6 \cdot \text{tau} + \text{delta}))))) & \text{if t} > 6 \cdot \text{tau} + \text{delta} \\ 0 & \text{otherwise} \end{cases} \\
&+ \begin{cases} \text{p7} \cdot \exp((\text{Ks} \cdot (\text{t} + ((7 \cdot \text{tau} + \text{delta}))))) & \text{if t} > 7 \cdot \text{tau} + \text{delta} \\ 0 & \text{otherwise} \end{cases} \\
&+ \begin{cases} \text{p8} \cdot \exp((\text{Ks} \cdot (\text{t} + ((8 \cdot \text{tau} + \text{delta}))))) & \text{if t} > 8 \cdot \text{tau} + \text{delta} \\ 0 & \text{otherwise} \end{cases} \\
&+ \begin{cases} \text{p9} \cdot \exp((\text{Ks} \cdot (\text{t} + ((9 \cdot \text{tau} + \text{delta}))))) & \text{if t} > 9 \cdot \text{tau} + \text{delta} \\ 0 & \text{otherwise} \end{cases} \\
&+ \begin{cases} \text{p10} \cdot \exp((\text{Ks} \cdot (\text{t} + ((10 \cdot \text{tau} + \text{delta}))))) & \text{if t} > 10 \cdot \text{tau} + \text{delta} \\ 0 & \text{otherwise} \end{cases} \\
&+ \begin{cases} \text{p11} \cdot \exp((\text{Ks} \cdot (\text{t} + ((11 \cdot \text{tau} + \text{delta}))))) & \text{if t} > 11 \cdot \text{tau} + \text{delta} \\ 0 & \text{otherwise} \end{cases}
\end{aligned} \tag{1}
$$

6.2 Rule `flux0_ar`

Rule `flux0_ar` is an assignment rule for parameter `flux0_ar`:

$$
\begin{aligned}
&\text{flux0\_ar} \\
&= \begin{cases} \text{Jch} \cdot (0.0016611295681 \cdot [\text{Ca\_Extracellular}] + ((0.0016611295681 \cdot [\text{Ca\_Cytosol}]))) & \text{if } (\text{t} > \text{t1}) \wedge (\text{t} < \text{t2}) \\ 0 & \text{otherwise} \end{cases}
\end{aligned} \tag{2}
$$

6.3 Rule `flux1_ar`

Rule `flux1_ar` is an assignment rule for parameter `flux1_ar`:

$$\text{flux1\_ar} = \begin{cases} \text{JchD} \cdot (0.0016611295681 \cdot [\text{Ca\_D\_Extracellular}] + ((0.0016611295681 \cdot [\text{Ca\_D\_Cytosol}]))) & \text{if } (t > t1) \wedge (t < \\ 0 & \text{otherwise} \end{cases} \tag{3}$$

7 Reactions

This model contains 45 reactions. All reactions are listed in the following table and are subsequently described in detail. If a reaction is affected by a modifier, the identifier of this species is written above the reaction arrow.

Table 5: Overview of all reactions

№	Id	Name	Reaction Equation	SBO
1	CD28k_highDbinding	CD28k_highDbinding	$\mathrm{Ca\_D\_Cytosol} + \mathrm{D28k\_high\_D\_Cytosol} \rightleftharpoons \mathrm{D28kB\_high\_D\_Cytosol}$	
2	PA_Dbinding	PA_Dbinding	$\mathrm{PA\_D\_Cytosol} + \mathrm{Ca\_D\_Cytosol} \rightleftharpoons \mathrm{PABCa\_D\_Cytosol}$	
3	CG_deg	CG_deg	$\mathrm{CG\_D\_Cytosol} \overset{\mathrm{CG\_Cytosol}}{\rightleftharpoons} \emptyset$	
4	IP3deg	IP3deg	$\mathrm{IP3\_D\_Cytosol} \overset{\mathrm{IP3\_Cytosol}}{\rightleftharpoons} \emptyset$	
5	D28kB_deg	D28kB_deg	$\mathrm{D28kB\_D\_Cytosol} \overset{\mathrm{D28kB\_Cytosol}}{\rightleftharpoons} \emptyset$	
6	D28k_deg	D28k_deg	$\mathrm{D28k\_D\_Cytosol} \overset{\mathrm{D28k\_Cytosol}}{\rightleftharpoons} \emptyset$	
7	PA_MgD	PA_MgD	$\mathrm{Mg\_D\_Cytosol} + \mathrm{PA\_D\_Cytosol} \rightleftharpoons \mathrm{PABMg\_D\_Cytosol}$	
8	PA_Ca	PA_Ca	$\mathrm{PA\_Cytosol} + \mathrm{Ca\_Cytosol} \rightleftharpoons \mathrm{PABCa\_Cytosol}$	
9	PABMg_deg	PABMg_deg	$\mathrm{PABMg\_D\_Cytosol} \overset{\mathrm{PABMg\_Cytosol}}{\rightleftharpoons} \emptyset$	
10	D28k_high_deg	D28k_high_deg	$\mathrm{D28k\_high\_D\_Cytosol} \overset{\mathrm{D28k\_high\_Cytosol}}{\rightleftharpoons} \emptyset$	
11	Ca_d	Ca_d	$\mathrm{Ca\_Cytosol} \overset{\mathrm{Ca\_D\_Cytosol}}{\rightleftharpoons} \emptyset$	
12	D28kB_high_deg	D28kB_high_deg	$\mathrm{D28kB\_high\_D\_Cytosol} \overset{\mathrm{D28kB\_high\_Cytosol}}{\rightleftharpoons} \emptyset$	
13	CG_d	CG_d	$\mathrm{CG\_Cytosol} \overset{\mathrm{CG\_D\_Cytosol}}{\rightleftharpoons} \emptyset$	
14	D28kB_d	D28kB_d	$\mathrm{D28kB\_Cytosol} \overset{\mathrm{D28kB\_D\_Cytosol}}{\rightleftharpoons} \emptyset$	
15	reaction1	reaction1	$\mathrm{h\_D\_ERM} \overset{\mathrm{Ca\_D\_Cytosol}}{\rightleftharpoons} \emptyset$	
16	CGbinding	CGbinding	$\mathrm{Ca\_Cytosol} + \mathrm{CG\_Cytosol} \rightleftharpoons \mathrm{CGB\_Cytosol}$	

№	Id	Name	Reaction Equation	SBO
17	CaD28k_med	CaD28k_med	$\text{D28k\_Cytosol} + \text{Ca\_Cytosol} \rightleftharpoons \text{D28kB\_Cytosol}$	
18	PABCa_deg	PABCa_deg	$\text{PABCa\_D\_Cytosol} \overset{\text{PABCa\_Cytosol}}{\rightleftharpoons} \emptyset$	
19	IP3_d	IP3_d	$\text{IP3\_Cytosol} \overset{\text{IP3\_D\_Cytosol}}{\rightleftharpoons} \emptyset$	
20	D28k_high_d	D28k_high_d	$\text{D28k\_high\_Cytosol} \overset{\text{D28k\_high\_D\_Cytosol}}{\rightleftharpoons} \emptyset$	
21	reaction0	reaction0	$\text{h\_ERM} \overset{\text{Ca\_Cytosol}}{\rightleftharpoons} \emptyset$	
22	PABMg_d	PABMg_d	$\text{PABMg\_Cytosol} \overset{\text{PABMg\_D\_Cytosol}}{\rightleftharpoons} \emptyset$	
23	CD28k_high	CD28k_high	$\text{Ca\_Cytosol} + \text{D28k\_high\_Cytosol} \rightleftharpoons \text{D28kB\_high\_Cytosol}$	
24	D28kBDbinding	D28kBDbinding	$\text{D28k\_D\_Cytosol} + \text{Ca\_D\_Cytosol} \rightleftharpoons \text{D28kB\_D\_Cytosol}$	
25	PABCa_d	PABCa_d	$\text{PABCa\_Cytosol} \overset{\text{PABCa\_D\_Cytosol}}{\rightleftharpoons} \emptyset$	
26	PA_d	PA_d	$\text{PA\_Cytosol} \overset{\text{PA\_D\_Cytosol}}{\rightleftharpoons} \emptyset$	
27	CGB_deg	CGB_deg	$\text{CGB\_D\_Cytosol} \overset{\text{CGB\_Cytosol}}{\rightleftharpoons} \emptyset$	
28	PA_Mg	PA_Mg	$\text{PA\_Cytosol} + \text{Mg\_Cytosol} \rightleftharpoons \text{PABMg\_Cytosol}$	
29	PA_deg	PA_deg	$\text{PA\_D\_Cytosol} \overset{\text{PA\_Cytosol}}{\rightleftharpoons} \emptyset$	
30	IP3_degr	IP3_degr	$\text{IP3\_Cytosol} \rightleftharpoons \emptyset$	
31	D28kB_high_d	D28kB_high_d	$\text{D28kB\_high\_Cytosol} \overset{\text{D28kB\_high\_D\_Cytosol}}{\rightleftharpoons} \emptyset$	
32	D28k_d	D28k_d	$\text{D28k\_Cytosol} \overset{\text{D28k\_D\_Cytosol}}{\rightleftharpoons} \emptyset$	
33	CGB_d	CGB_d	$\text{CGB\_Cytosol} \overset{\text{CGB\_D\_Cytosol}}{\rightleftharpoons} \emptyset$	
34	CG_Dbinding	CG_Dbinding	$\text{Ca\_D\_Cytosol} + \text{CG\_D\_Cytosol} \rightleftharpoons \text{CGB\_D\_Cytosol}$	
35	IP3_degr1	IP3_degr1	$\text{IP3\_D\_Cytosol} \rightleftharpoons \emptyset$	
36	Ca_deg	Ca_deg	$\text{Ca\_D\_Cytosol} \overset{\text{Ca\_Cytosol}}{\rightleftharpoons} \emptyset$	
37	pulses	pulses	$\emptyset \rightleftharpoons \text{IP3\_Cytosol}$	

№	Id	Name	Reaction Equation	SBO
38	ER_leak_flux	ER_leak_flux	Ca_Cytosol $\overset{\text{ERDensity\_ERM}}{\rightleftharpoons}$ Ca_ER	
39	SERCA_fluxD	SERCA_fluxD	Ca_D_Cytosol $\overset{\text{ERDensity\_D\_ERM}}{\rightleftharpoons}$ Ca_D_ER	
40	IP3R_fluxD	IP3R_fluxD	Ca_D_Cytosol $\overset{\text{IP3\_D\_Cytosol, ERDensity\_D\_ERM, h\_D\_ERM}}{\rightleftharpoons}$ Ca_D_ER	
41	SERCA_flux	SERCA_flux	Ca_Cytosol $\overset{\text{ERDensity\_ERM}}{\rightleftharpoons}$ Ca_ER	
42	flux0	flux0	Ca_Extracellular $\rightleftharpoons$ Ca_Cytosol	
43	IP3R_flux	IP3R_flux	Ca_Cytosol $\overset{\text{IP3\_Cytosol, h\_ERM, ERDensity\_ERM}}{\rightleftharpoons}$ Ca_ER	
44	flux1	flux1	Ca_D_Extracellular $\rightleftharpoons$ Ca_D_Cytosol	
45	ER_leak_fluxD	ER_leak_fluxD	Ca_D_Cytosol $\overset{\text{ERDensity\_D\_ERM}}{\rightleftharpoons}$ Ca_D_ER	

7.1 Reaction CD28k_highDbinding

This is a reversible reaction of two reactants forming one product.

Name CD28k_highDbinding

Reaction equation

$$\text{Ca\_D\_Cytosol} + \text{D28k\_high\_D\_Cytosol} \rightleftharpoons \text{D28kB\_high\_D\_Cytosol} \tag{4}$$

Reactants

Table 6: Properties of each reactant.

Id	Name	SBO
Ca_D_Cytosol		
D28k_high_D_Cytosol		

Product

Table 7: Properties of each product.

Id	Name	SBO
D28kB_high_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_1 = (&\text{Kf} \cdot 0.00166112956810631 \cdot [\text{Ca\_D\_Cytosol}] \cdot 0.00166112956810631 \\ &\cdot [\text{D28k\_high\_D\_Cytosol}] + ((\text{Kr} \cdot 0.00166112956810631 \cdot [\text{D28kB\_high\_D\_Cytosol}]))) \\ &\cdot \text{vol}(\text{Cytosol}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \end{aligned} \tag{5}$$

Table 8: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Kf			5.5	$1000\,\text{dimensionless} \cdot \text{m}^3 \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$	☑
Kr			2.6	s^{-1}	☑

7.2 Reaction PA_Dbinding

This is a reversible reaction of two reactants forming one product.

Name PA_Dbinding

Reaction equation

$$\text{PA\_D\_Cytosol} + \text{Ca\_D\_Cytosol} \rightleftharpoons \text{PABCa\_D\_Cytosol} \tag{6}$$

Reactants

Table 9: Properties of each reactant.

Id	Name	SBO
PA_D_Cytosol		
Ca_D_Cytosol		

Product

Table 10: Properties of each product.

Id	Name	SBO
PABCa_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_2 = (\text{Kf} \cdot 0.00166112956810631 \cdot [\text{PA\_D\_Cytosol}] \cdot 0.00166112956810631 \cdot [\text{Ca\_D\_Cytosol}] + ((\text{Kr} \cdot 0.00166112956810631 \cdot [\text{PABCa\_D\_Cytosol}]))) \cdot \text{vol}(\text{Cytosol}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \tag{7}$$

Table 11: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Kf			107.00	$1000\,\text{dimensionless} \cdot \text{m}^3 \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$	☑
Kr			0.95	s^{-1}	☑

7.3 Reaction CG_deg

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name CG_deg

Reaction equation

$$\mathrm{CG\_D\_Cytosol} \overset{\mathrm{CG\_Cytosol}}{\rightleftharpoons} \emptyset \tag{8}$$

Reactant

Table 12: Properties of each reactant.

Id	Name	SBO
CG_D_Cytosol		

Modifier

Table 13: Properties of each modifier.

Id	Name	SBO
CG_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_3 = \Bigg(& \mathrm{D} \cdot \mathrm{r\_n}^2 \\ & \cdot (0.00166112956810631 \cdot [\mathrm{CG\_D\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{CG\_Cytosol}]))) \\ & \cdot \frac{1}{\mathrm{l\_n}} \cdot \frac{1}{\mathrm{r\_d}^2} \cdot \frac{1}{\mathrm{l\_star}} + \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{CG\_D\_Cytosol}] + (\mathrm{CG\_F})) \cdot \frac{1}{\mathrm{l\_star}} \cdot \frac{1}{\mathrm{lc}} \Bigg) \\ & \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \end{aligned} \tag{9}$$

Table 14: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			15.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑

Id	Name	SBO	Value	Unit	Constant
r_n			0.100	µm	☑
l_n			0.660	µm	☑
r_d			1.000	µm	☑
l_star			27.981	µm	☑
CG_F			140.476	0.0010 dimensionless · $m^{-3} \cdot mol$	☑
lc			5.627	µm	☑

7.4 Reaction IP3deg

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name IP3deg

Reaction equation

$$\text{IP3\_D\_Cytosol} \overset{\text{IP3\_Cytosol}}{\rightleftharpoons} \emptyset \tag{10}$$

Reactant

Table 15: Properties of each reactant.

Id	Name	SBO
IP3_D_Cytosol		

Modifier

Table 16: Properties of each modifier.

Id	Name	SBO
IP3_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \Bigg(\mathrm{D} \cdot \mathrm{r\_n}^2 \cdot (0.00166112956810631 \cdot [\mathrm{IP3\_D\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{IP3\_Cytosol}]))) \cdot \frac{1}{\mathrm{l\_n}} \cdot \frac{1}{\mathrm{r\_d}^2} \cdot \frac{1}{\mathrm{l\_star}} + \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{IP3\_D\_Cytosol}] + (\mathrm{IP3\_F})) \cdot \frac{1}{\mathrm{l\_star}} \cdot \frac{1}{\mathrm{lc}} \Bigg) \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \tag{11}$$

Table 17: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			283.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_n			0.100	µm	☑
l_n			0.660	µm	☑
r_d			1.000	µm	☑
l_star			27.981	µm	☑
IP3_F			0.160	0.0010 dimensionless $\cdot$ $\mathrm{m}^{-3} \cdot \mathrm{mol}$	☑
lc			5.627	µm	☑

7.5 Reaction D28kB_deg

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name D28kB_deg

Reaction equation

$$\mathrm{D28kB\_D\_Cytosol} \underset{}{\overset{\mathrm{D28kB\_Cytosol}}{\rightleftharpoons}} \emptyset \tag{12}$$

Reactant

Table 18: Properties of each reactant.

Id	Name	SBO
D28kB_D_Cytosol		

Modifier

Table 19: Properties of each modifier.

Id	Name	SBO
D28kB_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \left(\mathrm{D} \cdot \mathrm{r\_n}^2 \cdot (0.00166112956810631 \cdot [\mathrm{D28kB\_D\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{D28kB\_Cytosol}]))) \cdot \frac{1}{\mathrm{l\_n}} \cdot \frac{1}{\mathrm{r\_D}^2} \cdot \frac{1}{\mathrm{l\_star}} + \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{D28kB\_D\_Cytosol}] + (\mathrm{D28kB\_F})) \cdot \frac{1}{\mathrm{l\_star}} \cdot \frac{1}{\mathrm{lc}} \right) \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \tag{13}$$

Table 20: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			28.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_n			0.100	µm	☑
l_n			0.660	µm	☑
r_D			1.000	µm	☑
l_star			27.981	µm	☑
D28kB_F			4.170	0.0010 dimensionless $\cdot$ $\mathrm{m}^{-3} \cdot \mathrm{mol}$	☑
lc			5.627	µm	☑

7.6 Reaction D28k_deg

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name D28k_deg

Reaction equation

$$\mathrm{D28k\_D\_Cytosol} \underset{}{\overset{\mathrm{D28k\_Cytosol}}{\rightleftharpoons}} \emptyset \tag{14}$$

Reactant

Table 21: Properties of each reactant.

Id	Name	SBO
D28k_D_Cytosol		

Modifier

Table 22: Properties of each modifier.

Id	Name	SBO
D28k_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \Bigg(\mathrm{D} \cdot \mathrm{r\_n}^2 \cdot (0.00166112956810631 \cdot [\mathrm{D28k\_D\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{D28k\_Cytosol}]))) \cdot \frac{1}{\mathrm{l\_n}} \cdot \frac{1}{\mathrm{r\_D}^2} \cdot \frac{1}{\mathrm{l\_star}} + \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{D28k\_D\_Cytosol}] + (\mathrm{D28k\_F})) \cdot \frac{1}{\mathrm{l\_star}} \cdot \frac{1}{\mathrm{lc}} \Bigg) \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \tag{15}$$

Table 23: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			28.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_n			0.100	µm	☑
l_n			0.660	µm	☑
r_D			1.000	µm	☑
l_star			27.981	µm	☑
D28k_F			75.830	0.0010 dimensionless $\cdot$ $\mathrm{m}^{-3} \cdot \mathrm{mol}$	☑
lc			5.627	µm	☑

7.7 Reaction PA_MgD

This is a reversible reaction of two reactants forming one product.

Name PA_MgD

Reaction equation

$$\text{Mg\_D\_Cytosol} + \text{PA\_D\_Cytosol} \rightleftharpoons \text{PABMg\_D\_Cytosol} \tag{16}$$

Reactants

Table 24: Properties of each reactant.

Id	Name	SBO
Mg_D_Cytosol		
PA_D_Cytosol		

Product

Table 25: Properties of each product.

Id	Name	SBO
PABMg_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_7 = (\text{Kf} \cdot 0.00166112956810631 \cdot [\text{Mg\_D\_Cytosol}] \cdot 0.00166112956810631 \cdot [\text{PA\_D\_Cytosol}] + ((\text{Kr} \cdot 0.00166112956810631 \cdot [\text{PABMg\_D\_Cytosol}]))) \cdot \text{vol}(\text{Cytosol}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \tag{17}$$

Table 26: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Kf			0.8	$1000\,\text{dimensionless} \cdot \text{m}^3 \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$	☑
Kr			25.0	s^{-1}	☑

7.8 Reaction PA_Ca

This is a reversible reaction of two reactants forming one product.

Name PA_Ca

Reaction equation

$$\text{PA\_Cytosol} + \text{Ca\_Cytosol} \rightleftharpoons \text{PABCa\_Cytosol} \tag{18}$$

Reactants

Table 27: Properties of each reactant.

Id	Name	SBO
PA_Cytosol		
Ca_Cytosol		

Product

Table 28: Properties of each product.

Id	Name	SBO
PABCa_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_8 = (\text{Kf} \cdot 0.00166112956810631 \cdot [\text{PA\_Cytosol}] \cdot 0.00166112956810631 \cdot [\text{Ca\_Cytosol}] + ((\text{Kr} \cdot 0.00166112956810631 \cdot [\text{PABCa\_Cytosol}]))) \cdot \text{vol}(\text{Cytosol}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \tag{19}$$

Table 29: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Kf			107.00	$1000\,\text{dimensionless} \cdot \text{m}^3 \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$	☑
Kr			0.95	s^{-1}	☑

7.9 Reaction PABMg_deg

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name PABMg_deg

Reaction equation

$$\text{PABMg\_D\_Cytosol} \xrightleftharpoons{\text{PABMg\_Cytosol}} \emptyset \tag{20}$$

Reactant

Table 30: Properties of each reactant.

Id	Name	SBO
PABMg_D_Cytosol		

Modifier

Table 31: Properties of each modifier.

Id	Name	SBO
PABMg_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_9 = \Bigg(& \mathrm{D} \cdot \mathrm{r\_n}^2 \cdot (0.00166112956810631 \cdot [\mathrm{PABMg\_D\_Cytosol}] \\ & + ((0.00166112956810631 \cdot [\mathrm{PABMg\_Cytosol}]))) \cdot \frac{1}{\mathrm{l\_n}} \cdot \frac{1}{\mathrm{r\_d}^2} \cdot \frac{1}{\mathrm{l\_star}} + \mathrm{D} \\ & \cdot (0.00166112956810631 \cdot [\mathrm{PABMg\_D\_Cytosol}] + (\mathrm{PABMg\_F})) \cdot \frac{1}{\mathrm{l\_star}} \cdot \frac{1}{\mathrm{lc}} \Bigg) \\ & \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \end{aligned} \tag{21}$$

Table 32: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			43.000	10^{-12} dimensionless $\cdot$ $m^2 \cdot s^{-1}$	☑
r_n			0.100	µm	☑
l_n			0.660	µm	☑
r_d			1.000	µm	☑
l_star			27.981	µm	☑
PABMg_F			60.472	0.0010 dimensionless $\cdot$ $m^{-3} \cdot mol$	☑
lc			5.627	µm	☑

7.10 Reaction D28k_high_deg

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name D28k_high_deg

Reaction equation

$$\text{D28k\_high\_D\_Cytosol} \xrightleftharpoons{\text{D28k\_high\_Cytosol}} \emptyset \tag{22}$$

Reactant

Table 33: Properties of each reactant.

Id	Name	SBO
D28k_high_D_Cytosol		

Modifier

Table 34: Properties of each modifier.

Id	Name	SBO
D28k_high_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \Bigg(\mathrm{D} \cdot \mathrm{r\_n}^2 \cdot (0.00166112956810631 \cdot [\mathrm{D28k\_high\_D\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{D28k\_high\_Cytosol}]))) \cdot \frac{1}{\mathrm{l\_n}} \cdot \frac{1}{\mathrm{r\_D}^2} \cdot \frac{1}{\mathrm{l\_star}} + \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{D28k\_high\_D\_Cytosol}] + (\mathrm{D28k\_high\_F})) \cdot \frac{1}{\mathrm{l\_star}} \cdot \frac{1}{\mathrm{lc}} \Bigg) \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \tag{23}$$

Table 35: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			28.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_n			0.100	µm	☑
l_n			0.660	µm	☑
r_D			1.000	µm	☑
l_star			27.981	µm	☑
D28k_high_F			73.011	0.0010 dimensionless $\cdot$ $\mathrm{m}^{-3} \cdot \mathrm{mol}$	☑
lc			5.627	µm	☑

7.11 Reaction Ca_d

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name Ca_d

Reaction equation

$$\mathrm{Ca\_Cytosol} \underset{}{\overset{\mathrm{Ca\_D\_Cytosol}}{\rightleftharpoons}} \emptyset \tag{24}$$

Reactant

Table 36: Properties of each reactant.

Id	Name	SBO
Ca_Cytosol		

Modifier

Table 37: Properties of each modifier.

Id	Name	SBO
Ca_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{11} = 0.75 \cdot \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{Ca\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{Ca\_D\_Cytosol}]))) \cdot \mathrm{r\_neck}^2 \cdot \frac{1}{\mathrm{l}} \cdot \frac{1}{\mathrm{r\_spine}^3} \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \tag{25}$$

Table 38: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			223.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_neck			0.100	µm	☑
l			0.660	µm	☑
r_spine			0.288	µm	☑

7.12 Reaction D28kB_high_deg

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name D28kB_high_deg

Reaction equation

$$\mathrm{D28kB\_high\_D\_Cytosol} \xrightleftharpoons{\mathrm{D28kB\_high\_Cytosol}} \emptyset \tag{26}$$

Reactant

Table 39: Properties of each reactant.

Id	Name	SBO
D28kB_high_D_Cytosol		

Modifier

Table 40: Properties of each modifier.

Id	Name	SBO
D28kB_high_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = \Bigg(\mathrm{D} \cdot \mathrm{r\_n}^2 \cdot (0.00166112956810631 \cdot [\mathrm{D28kB\_high\_D\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{D28kB\_high\_Cytosol}]))) \cdot \frac{1}{\mathrm{l\_n}} \cdot \frac{1}{\mathrm{r\_D}^2} \cdot \frac{1}{\mathrm{l\_star}} + \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{D28kB\_high\_D\_Cytosol}] + (\mathrm{D28kB\_high\_F})) \cdot \frac{1}{\mathrm{l\_star}} \cdot \frac{1}{\mathrm{lc}} \Bigg) \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \tag{27}$$

Table 41: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			28.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_n			0.100	µm	☑
l_n			0.660	µm	☑
r_D			1.000	µm	☑
l_star			27.981	µm	☑
D28kB_high_F			6.989	0.0010 dimensionless $\cdot$ $\mathrm{m}^{-3} \cdot \mathrm{mol}$	☑
lc			5.627	µm	☑

7.13 Reaction CG_d

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name CG_d

Reaction equation

$$\text{CG\_Cytosol} \xrightleftharpoons{\text{CG\_D\_Cytosol}} \emptyset \tag{28}$$

Reactant

Table 42: Properties of each reactant.

Id	Name	SBO
CG_Cytosol		

Modifier

Table 43: Properties of each modifier.

Id	Name	SBO
CG_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_{13} = {} & 0.75 \cdot \mathrm{D} \\ & \cdot (0.00166112956810631 \cdot [\mathrm{CG\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{CG\_D\_Cytosol}]))) \\ & \cdot \mathrm{r\_neck}^2 \cdot \frac{1}{\mathrm{l}} \cdot \frac{1}{\mathrm{r\_spine}^3} \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \end{aligned} \tag{29}$$

Table 44: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			15.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_neck			0.100	µm	☑
l			0.660	µm	☑
r_spine			0.288	µm	☑

7.14 Reaction D28kB_d

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name D28kB_d

Reaction equation

$$\text{D28kB\_Cytosol} \underset{}{\overset{\text{D28kB\_D\_Cytosol}}{\rightleftharpoons}} \emptyset \tag{30}$$

Reactant

Table 45: Properties of each reactant.

Id	Name	SBO
D28kB_Cytosol		

Modifier

Table 46: Properties of each modifier.

Id	Name	SBO
D28kB_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_{14} = 0.75 \cdot \mathrm{D} \cdot (&0.00166112956810631 \cdot [\mathrm{D28kB\_Cytosol}] \\ &+ ((0.00166112956810631 \cdot [\mathrm{D28kB\_Cytosol}]))) \\ &\cdot \mathrm{r\_neck}^2 \cdot \frac{1}{1} \cdot \frac{1}{\mathrm{r\_spine}^3} \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \end{aligned} \tag{31}$$

Table 47: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			28.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_neck			0.100	µm	☑
l			0.660	µm	☑
r_spine			0.288	µm	☑

7.15 Reaction reaction1

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name reaction1

Reaction equation

$$\mathrm{h\_D\_ERM} \xrightleftharpoons{\mathrm{Ca\_D\_Cytosol}} \emptyset \tag{32}$$

Reactant

Table 48: Properties of each reactant.

Id	Name	SBO
h_D_ERM		

Modifier

Table 49: Properties of each modifier.

Id	Name	SBO
Ca_D_Cytosol		

Kinetic Law

Derived unit $\mathrm{item} \cdot \mathrm{s}^{-1}$

$$v_{15} = ((\mathrm{Kinh} + (((0.00166112956810631 \cdot [\mathrm{Ca\_D\_Cytosol}] + \mathrm{Kinh}) \cdot [\mathrm{h\_D\_ERM}]))) \cdot \mathrm{Kon}) \cdot \mathrm{area}(\mathrm{ERM}) \tag{33}$$

Table 50: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
I			0.0	dimensionless $\cdot$ A $\cdot$ m^{-2}	☑
Kinh			0.2	0.0010 dimensionless $\cdot$ $\mathrm{m}^{-3} \cdot \mathrm{mol}$	☑
Kon			2.7	10^{15} dimensionless $\cdot$ $\mathrm{item} \cdot \mathrm{m} \cdot \mathrm{mol}^{-1} \cdot \mathrm{s}^{-1}$	☑

7.16 Reaction CGbinding

This is a reversible reaction of two reactants forming one product.

Name CGbinding

Reaction equation

$$\text{Ca\_Cytosol} + \text{CG\_Cytosol} \rightleftharpoons \text{CGB\_Cytosol} \tag{34}$$

Reactants

Table 51: Properties of each reactant.

Id	Name	SBO
Ca_Cytosol		
CG_Cytosol		

Product

Table 52: Properties of each product.

Id	Name	SBO
CGB_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_{16} = (&\text{Kf} \cdot 0.00166112956810631 \cdot [\text{Ca\_Cytosol}] \cdot 0.00166112956810631 \cdot [\text{CG\_Cytosol}] \\ &+ ((\text{Kr} \cdot 0.00166112956810631 \cdot [\text{CGB\_Cytosol}]))) \cdot \text{vol}(\text{Cytosol}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \end{aligned} \tag{35}$$

Table 53: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Kf			430.0	$1000\,\text{dimensionless} \cdot \text{m}^3 \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$	☑
Kr			140.0	s^{-1}	☑

7.17 Reaction CaD28k_med

This is a reversible reaction of two reactants forming one product.

Name CaD28k_med

Reaction equation

$$\text{D28k\_Cytosol} + \text{Ca\_Cytosol} \rightleftharpoons \text{D28kB\_Cytosol} \tag{36}$$

Reactants

Table 54: Properties of each reactant.

Id	Name	SBO
D28k_Cytosol		
Ca_Cytosol		

Product

Table 55: Properties of each product.

Id	Name	SBO
D28kB_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_{17} = &(\text{Kf} \cdot 0.00166112956810631 \cdot [\text{D28k\_Cytosol}] \cdot 0.00166112956810631 \cdot [\text{Ca\_Cytosol}] \\ &+ ((\text{Kr} \cdot 0.00166112956810631 \cdot [\text{D28kB\_Cytosol}]))) \cdot \text{vol}(\text{Cytosol}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \end{aligned} \tag{37}$$

Table 56: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Kf			43.5	$1000\,\text{dimensionless} \cdot \text{m}^3 \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$	☑
Kr			35.8	s^{-1}	☑

7.18 Reaction PABCa_deg

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name PABCa_deg

Reaction equation

$$\text{PABCa\_D\_Cytosol} \overset{\text{PABCa\_Cytosol}}{\rightleftharpoons} \emptyset \tag{38}$$

Reactant

Table 57: Properties of each reactant.

Id	Name	SBO
PABCa_D_Cytosol		

Modifier

Table 58: Properties of each modifier.

Id	Name	SBO
PABCa_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_{18} = \Bigg(& \text{D} \cdot \text{r\_n}^2 \cdot (0.00166112956810631 \cdot [\text{PABCa\_D\_Cytosol}] \\ & + ((0.00166112956810631 \cdot [\text{PABCa\_Cytosol}]))) \cdot \frac{1}{\text{l\_n}} \cdot \frac{1}{\text{r\_d}^2} \cdot \frac{1}{\text{l\_star}} + \text{D} \\ & \cdot (0.00166112956810631 \cdot [\text{PABCa\_D\_Cytosol}] + (\text{PABCa\_F})) \cdot \frac{1}{\text{l\_star}} \cdot \frac{1}{\text{lc}} \Bigg) \\ & \cdot \text{vol}\,(\text{Cytosol}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \end{aligned} \tag{39}$$

Table 59: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			43.000	10^{-12} dimensionless $\cdot$ $m^2 \cdot s^{-1}$	☑
r_n			0.100	µm	☑
l_n			0.660	µm	☑
r_d			1.000	µm	☑
l_star			27.981	µm	☑
PABCa_F			16.325	0.0010 dimensionless $\cdot$ $m^{-3} \cdot mol$	☑
lc			5.627	µm	☑

7.19 Reaction IP3_d

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name IP3_d

Reaction equation

$$\text{IP3\_Cytosol} \xrightleftharpoons{\text{IP3\_D\_Cytosol}} \emptyset \tag{40}$$

Reactant

Table 60: Properties of each reactant.

Id	Name	SBO
IP3_Cytosol		

Modifier

Table 61: Properties of each modifier.

Id	Name	SBO
IP3_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{19} = 0.75 \cdot \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{IP3\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{IP3\_D\_Cytosol}]))) \cdot \mathrm{r\_neck}^2 \cdot \frac{1}{\mathrm{l}} \cdot \frac{1}{\mathrm{r\_spine}^3} \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \tag{41}$$

Table 62: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			283.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_neck			0.100	µm	☑
l			0.660	µm	☑
r_spine			0.288	µm	☑

7.20 Reaction D28k_high_d

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name D28k_high_d

Reaction equation

$$\mathrm{D28k\_high\_Cytosol} \xrightleftharpoons{\mathrm{D28k\_high\_D\_Cytosol}} \emptyset \tag{42}$$

Reactant

Table 63: Properties of each reactant.

Id	Name	SBO
D28k_high_Cytosol		

Modifier

Table 64: Properties of each modifier.

Id	Name	SBO
D28k_high_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{20} = 0.75 \cdot \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{D28k\_high\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{D28k\_high\_D\_Cytosol}]))) \cdot \mathrm{r\_neck}^2 \cdot \frac{1}{1} \cdot \frac{1}{\mathrm{r\_spine}^3} \cdot \mathrm{vol}(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \quad (43)$$

Table 65: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			28.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_neck			0.100	µm	☑
l			0.660	µm	☑
r_spine			0.288	µm	☑

7.21 Reaction reaction0

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name reaction0

Reaction equation

$$\mathrm{h\_ERM} \overset{\mathrm{Ca\_Cytosol}}{\rightleftharpoons} \emptyset \quad (44)$$

Reactant

Table 66: Properties of each reactant.

Id	Name	SBO
h_ERM		

Modifier

Table 67: Properties of each modifier.

Id	Name	SBO
Ca_Cytosol		

Id	Name	SBO

Kinetic Law

Derived unit $\text{item} \cdot \text{s}^{-1}$

$$v_{21} = ((\text{Kinh} + (((0.00166112956810631 \cdot [\text{Ca\_Cytosol}] + \text{Kinh}) \cdot [\text{h\_ERM}]))) \cdot \text{Kon}) \cdot \text{area}(\text{ERM}) \tag{45}$$

Table 68: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
I			0.0	dimensionless · A · m^{-2}	☑
Kinh			0.2	0.0010 dimensionless · $\text{m}^{-3} \cdot \text{mol}$	☑
Kon			2.7	10^{15} dimensionless · $\text{item} \cdot \text{m} \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$	☑

7.22 Reaction PABMg_d

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name PABMg_d

Reaction equation

$$\text{PABMg\_Cytosol} \xrightleftharpoons{\text{PABMg\_D\_Cytosol}} \emptyset \tag{46}$$

Reactant

Table 69: Properties of each reactant.

Id	Name	SBO
PABMg_Cytosol		

Modifier

Table 70: Properties of each modifier.

Id	Name	SBO
PABMg_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{22} = 0.75 \cdot \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{PABMg\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{PABMg\_D\_Cytosol}]))) \cdot \mathrm{r\_neck}^2 \cdot \frac{1}{\mathrm{l}} \cdot \frac{1}{\mathrm{r\_spine}^3} \cdot \mathrm{vol}(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \quad (47)$$

Table 71: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			43.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_neck			0.100	µm	☑
l			0.660	µm	☑
r_spine			0.288	µm	☑

7.23 Reaction CD28k_high

This is a reversible reaction of two reactants forming one product.

Name CD28k_high

Reaction equation

$$\mathrm{Ca\_Cytosol} + \mathrm{D28k\_high\_Cytosol} \rightleftharpoons \mathrm{D28kB\_high\_Cytosol} \quad (48)$$

Reactants

Table 72: Properties of each reactant.

Id	Name	SBO
Ca_Cytosol		
D28k_high_Cytosol		

Product

Table 73: Properties of each product.

Id	Name	SBO
D28kB_high_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{23} = (\mathrm{Kf} \cdot 0.00166112956810631 \cdot [\mathrm{Ca\_Cytosol}] \cdot 0.00166112956810631 \cdot [\mathrm{D28k\_high\_Cytosol}] + ((\mathrm{Kr} \cdot 0.00166112956810631 \cdot [\mathrm{D28kB\_high\_Cytosol}]))) \cdot \mathrm{vol}(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \quad (49)$$

Table 74: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Kf			5.5	1000 dimensionless $\cdot$ $\mathrm{m}^3 \cdot \mathrm{mol}^{-1} \cdot \mathrm{s}^{-1}$	☑
Kr			2.6	s^{-1}	☑

7.24 Reaction D28kBDbinding

This is a reversible reaction of two reactants forming one product.

Name D28kBDbinding

Reaction equation

$$\mathrm{D28k\_D\_Cytosol} + \mathrm{Ca\_D\_Cytosol} \rightleftharpoons \mathrm{D28kB\_D\_Cytosol} \quad (50)$$

Reactants

Table 75: Properties of each reactant.

Id	Name	SBO
D28k_D_Cytosol		
Ca_D_Cytosol		

Product

Table 76: Properties of each product.

Id	Name	SBO
D28kB_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{24} = (\mathrm{Kf} \cdot 0.00166112956810631 \cdot [\mathrm{D28k\_D\_Cytosol}] \cdot 0.00166112956810631 \cdot [\mathrm{Ca\_D\_Cytosol}] + ((\mathrm{Kr} \cdot 0.00166112956810631 \cdot [\mathrm{D28kB\_D\_Cytosol}]))) \cdot \mathrm{vol}(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \quad (51)$$

Table 77: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Kf			43.5	$1000\,\mathrm{dimensionless} \cdot \mathrm{m}^3 \cdot \mathrm{mol}^{-1} \cdot \mathrm{s}^{-1}$	☑
Kr			35.8	s^{-1}	☑

7.25 Reaction PABCa_d

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name PABCa_d

Reaction equation

$$\mathrm{PABCa\_Cytosol} \underset{}{\overset{\mathrm{PABCa\_D\_Cytosol}}{\rightleftharpoons}} \emptyset \quad (52)$$

Reactant

Table 78: Properties of each reactant.

Id	Name	SBO
PABCa_Cytosol		

Modifier

Table 79: Properties of each modifier.

Id	Name	SBO
PABCa_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{25} = 0.75 \cdot \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{PABCa\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{PABCa\_D\_Cytosol}]))) \cdot \mathrm{r\_neck}^2 \cdot \frac{1}{\mathrm{l}} \cdot \frac{1}{\mathrm{r\_spine}^3} \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \tag{53}$$

Table 80: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			43.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_neck			0.100	µm	☑
l			0.660	µm	☑
r_spine			0.288	µm	☑

7.26 Reaction PA_d

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name PA_d

Reaction equation

$$\mathrm{PA\_Cytosol} \xrightleftharpoons{\mathrm{PA\_D\_Cytosol}} \emptyset \tag{54}$$

Reactant

Table 81: Properties of each reactant.

Id	Name	SBO
PA_Cytosol		

Id	Name	SBO

Modifier

Table 82: Properties of each modifier.

Id	Name	SBO
PA_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{26} = 0.75 \cdot \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{PA\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{PA\_D\_Cytosol}]))) \cdot \mathrm{r\_neck}^2 \cdot \frac{1}{\mathrm{l}} \cdot \frac{1}{\mathrm{r\_spine}^3} \cdot \mathrm{vol}(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \tag{55}$$

Table 83: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			43.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_neck			0.100	µm	☑
l			0.660	µm	☑
r_spine			0.288	µm	☑

7.27 Reaction CGB_deg

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name CGB_deg

Reaction equation

$$\mathrm{CGB\_D\_Cytosol} \rightleftharpoons[\mathrm{CGB\_Cytosol}] \emptyset \tag{56}$$

Reactant

Table 84: Properties of each reactant.

Id	Name	SBO
CGB_D_Cytosol		

Modifier

Table 85: Properties of each modifier.

Id	Name	SBO
CGB_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{27} = \Big(\mathrm{D} \cdot \mathrm{r\_n}^2 \cdot (0.00166112956810631 \cdot [\mathrm{CGB\_D\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{CGB\_Cytosol}]))) \cdot \frac{1}{\mathrm{l\_n}} \cdot \frac{1}{\mathrm{r\_d}^2} \cdot \frac{1}{\mathrm{l\_star}} + \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{CGB\_D\_Cytosol}] + (\mathrm{CGB\_F})) \cdot \frac{1}{\mathrm{l\_star}} \cdot \frac{1}{\mathrm{lc}} \Big) \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \tag{57}$$

Table 86: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			15.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_n			0.100	µm	☑
l_n			0.660	µm	☑
r_d			1.000	µm	☑
l_star			27.981	µm	☑
CGB_F			19.524	0.0010 dimensionless $\cdot$ $\mathrm{m}^{-3} \cdot \mathrm{mol}$	☑
lc			5.627	µm	☑

7.28 Reaction PA_Mg

This is a reversible reaction of two reactants forming one product.

Name PA_Mg

Reaction equation

$$\mathrm{PA\_Cytosol} + \mathrm{Mg\_Cytosol} \rightleftharpoons \mathrm{PABMg\_Cytosol} \tag{58}$$

Reactants

Table 87: Properties of each reactant.

Id	Name	SBO
PA_Cytosol		
Mg_Cytosol		

Product

Table 88: Properties of each product.

Id	Name	SBO
PABMg_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{28} = (\mathrm{Kf} \cdot 0.00166112956810631 \cdot [\mathrm{PA\_Cytosol}] \cdot 0.00166112956810631 \cdot [\mathrm{Mg\_Cytosol}] + ((\mathrm{Kr} \cdot 0.00166112956810631 \cdot [\mathrm{PABMg\_Cytosol}]))) \cdot \mathrm{vol}(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \tag{59}$$

Table 89: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Kf			0.8	$1000\,\mathrm{dimensionless} \cdot \mathrm{m}^3 \cdot \mathrm{mol}^{-1} \cdot \mathrm{s}^{-1}$	☑
Kr			25.0	s^{-1}	☑

7.29 Reaction PA_deg

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name PA_deg

Reaction equation

$$\mathrm{PA\_D\_Cytosol} \overset{\mathrm{PA\_Cytosol}}{\rightleftharpoons} \emptyset \tag{60}$$

Reactant

Table 90: Properties of each reactant.

Id	Name	SBO
PA_D_Cytosol		

Modifier

Table 91: Properties of each modifier.

Id	Name	SBO
PA_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_{29} = \Bigg(& \mathrm{D} \cdot \mathrm{r\_n}^2 \\ & \cdot (0.00166112956810631 \cdot [\mathrm{PA\_D\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{PA\_Cytosol}]))) \\ & \cdot \frac{1}{\mathrm{l\_n}} \cdot \frac{1}{\mathrm{r\_d}^2} \cdot \frac{1}{\mathrm{l\_star}} + \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{PA\_D\_Cytosol}] + (\mathrm{PA\_F})) \cdot \frac{1}{\mathrm{l\_star}} \cdot \frac{1}{\mathrm{lc}} \Bigg) \\ & \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \end{aligned} \tag{61}$$

Table 92: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			43.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑

Id	Name	SBO	Value	Unit	Constant
r_n			0.100	µm	☑
l_n			0.660	µm	☑
r_d			1.000	µm	☑
l_star			27.981	µm	☑
PA_F			3.203	0.0010 dimensionless · $m^{-3} \cdot mol$	☑
lc			5.627	µm	☑

7.30 Reaction IP3_degr

This is a reversible reaction of one reactant forming no product.

Name IP3_degr

Reaction equation

$$\text{IP3\_Cytosol} \rightleftharpoons \emptyset \tag{62}$$

Reactant

Table 93: Properties of each reactant.

Id	Name	SBO
IP3_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{30} = \text{Kdegr} \cdot (0.00166112956810631 \cdot [\text{IP3\_Cytosol}] + (\text{IP3\_CytosolS})) \cdot \text{vol}(\text{Cytosol}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \tag{63}$$

Table 94: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Kdegr			0.14	s^{-1}	☑
IP3_CytosolS			0.16	0.0010 dimensionless · $m^{-3} \cdot mol$	☑

7.31 Reaction D28kB_high_d

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name D28kB_high_d

Reaction equation

$$\text{D28kB\_high\_Cytosol} \xrightleftharpoons{\text{D28kB\_high\_D\_Cytosol}} \emptyset \tag{64}$$

Reactant

Table 95: Properties of each reactant.

Id	Name	SBO
D28kB_high_Cytosol		

Modifier

Table 96: Properties of each modifier.

Id	Name	SBO
D28kB_high_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_{31} = 0.75 \cdot \text{D} \cdot (&0.00166112956810631 \cdot [\text{D28kB\_high\_Cytosol}] \\ &+ ((0.00166112956810631 \cdot [\text{D28kB\_high\_D\_Cytosol}]))) \\ &\cdot \text{r\_neck}^2 \cdot \frac{1}{\text{l}} \cdot \frac{1}{\text{r\_spine}^3} \cdot \text{vol}\,(\text{Cytosol}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \end{aligned} \tag{65}$$

Table 97: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			28.000	10^{-12} dimensionless $\cdot$ $\text{m}^2 \cdot \text{s}^{-1}$	☑
r_neck			0.100	µm	☑
l			0.660	µm	☑
r_spine			0.288	µm	☑

7.32 Reaction D28k_d

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name D28k_d

Reaction equation

$$\text{D28k\_Cytosol} \xrightleftharpoons{\text{D28k\_D\_Cytosol}} \emptyset \tag{66}$$

Reactant

Table 98: Properties of each reactant.

Id	Name	SBO
D28k_Cytosol		

Modifier

Table 99: Properties of each modifier.

Id	Name	SBO
D28k_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_{32} = 0.75 \cdot \text{D} \cdot (&0.00166112956810631 \cdot [\text{D28k\_Cytosol}] \\ &+ ((0.00166112956810631 \cdot [\text{D28k\_D\_Cytosol}]))) \\ \cdot\, \text{r\_neck}^2 \cdot \frac{1}{\text{l}} \cdot &\frac{1}{\text{r\_spine}^3} \cdot \text{vol}(\text{Cytosol}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \end{aligned} \tag{67}$$

Table 100: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			28.000	10^{-12} dimensionless $\cdot$ $\text{m}^2 \cdot \text{s}^{-1}$	☑
r_neck			0.100	µm	☑
l			0.660	µm	☑
r_spine			0.288	µm	☑

7.33 Reaction CGB_d

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name CGB_d

Reaction equation

$$\mathrm{CGB\_Cytosol} \overset{\mathrm{CGB\_D\_Cytosol}}{\rightleftharpoons} \emptyset \tag{68}$$

Reactant

Table 101: Properties of each reactant.

Id	Name	SBO
CGB_Cytosol		

Modifier

Table 102: Properties of each modifier.

Id	Name	SBO
CGB_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_{33} = 0.75 \cdot \mathrm{D} \cdot (&0.00166112956810631 \cdot [\mathrm{CGB\_Cytosol}] \\ &+ ((0.00166112956810631 \cdot [\mathrm{CGB\_D\_Cytosol}]))) \\ \cdot\, \mathrm{r\_neck}^2 \cdot \frac{1}{\mathrm{l}} \cdot &\frac{1}{\mathrm{r\_spine}^3} \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \end{aligned} \tag{69}$$

Table 103: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			15.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_neck			0.100	µm	☑
l			0.660	µm	☑
r_spine			0.288	µm	☑

7.34 Reaction CG_Dbinding

This is a reversible reaction of two reactants forming one product.

Name CG_Dbinding

Reaction equation

$$\text{Ca\_D\_Cytosol} + \text{CG\_D\_Cytosol} \rightleftharpoons \text{CGB\_D\_Cytosol} \tag{70}$$

Reactants

Table 104: Properties of each reactant.

Id	Name	SBO
Ca_D_Cytosol		
CG_D_Cytosol		

Product

Table 105: Properties of each product.

Id	Name	SBO
CGB_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{34} = (\text{Kf} \cdot 0.00166112956810631 \cdot [\text{Ca\_D\_Cytosol}] \cdot 0.00166112956810631 \cdot [\text{CG\_D\_Cytosol}] + ((\text{Kr} \cdot 0.00166112956810631 \cdot [\text{CGB\_D\_Cytosol}]))) \cdot \text{vol}(\text{Cytosol}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \tag{71}$$

Table 106: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Kf			430.0	$1000\,\text{dimensionless} \cdot \text{m}^3 \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$	☑
Kr			140.0	s^{-1}	☑

7.35 Reaction IP3_degr1

This is a reversible reaction of one reactant forming no product.

Name IP3_degr1

Reaction equation

$$\text{IP3\_D\_Cytosol} \rightleftharpoons \emptyset \tag{72}$$

Reactant

Table 107: Properties of each reactant.

Id	Name	SBO
IP3_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{35} = \text{Kdegr} \cdot (0.00166112956810631 \cdot [\text{IP3\_D\_Cytosol}] + (\text{IP3\_CytosolD})) \cdot \text{vol}(\text{Cytosol}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \tag{73}$$

Table 108: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Kdegr			0.14	s^{-1}	☑
IP3_CytosolD			0.16	$0.0010\,\text{dimensionless} \cdot m^{-3} \cdot \text{mol}$	☑

7.36 Reaction Ca_deg

This is a reversible reaction of one reactant forming no product influenced by one modifier.

Name Ca_deg

Reaction equation

$$\text{Ca\_D\_Cytosol} \xrightleftharpoons{\text{Ca\_Cytosol}} \emptyset \tag{74}$$

Reactant

Table 109: Properties of each reactant.

Id	Name	SBO
Ca_D_Cytosol		

Modifier

Table 110: Properties of each modifier.

Id	Name	SBO
Ca_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{36} = \Bigg(\mathrm{D} \cdot \mathrm{r\_n}^2 \cdot (0.00166112956810631 \cdot [\mathrm{Ca\_D\_Cytosol}] + ((0.00166112956810631 \cdot [\mathrm{Ca\_Cytosol}]))) \cdot \frac{1}{\mathrm{l\_n}} \cdot \frac{1}{\mathrm{r\_D}^2} \cdot \frac{1}{\mathrm{l\_star}} + \mathrm{D} \cdot (0.00166112956810631 \cdot [\mathrm{Ca\_D\_Cytosol}] + (\mathrm{Ca\_F})) \cdot \frac{1}{\mathrm{l\_star}} \cdot \frac{1}{\mathrm{lc}} \Bigg) \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \cdot 1 \cdot \frac{1}{\mathrm{KMOLE}} \tag{75}$$

Table 111: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D			223.000	10^{-12} dimensionless $\cdot$ $\mathrm{m}^2 \cdot \mathrm{s}^{-1}$	☑
r_n			0.100	µm	☑
l_n			0.660	µm	☑
r_D			1.000	µm	☑
l_star			27.981	µm	☑
Ca_F			0.045	0.0010 dimensionless $\cdot$ $\mathrm{m}^{-3} \cdot \mathrm{mol}$	☑
lc			5.627	µm	☑

7.37 Reaction pulses

This is a reversible reaction of no reactant forming one product.

Name pulses

Reaction equation

$$\emptyset \rightleftharpoons \text{IP3\_Cytosol} \tag{76}$$

Product

Table 112: Properties of each product.

Id	Name	SBO
IP3_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{37} = \text{SVR} \cdot \text{Js} \cdot \text{pulses\_ar} \cdot \frac{1}{\text{Rs}} \cdot \text{vol}\left(\text{Cytosol}\right) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \tag{77}$$

Table 113: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
SVR			3.000	μm^{-1}	☑
Js			0.000	10^{-9} dimensionless $\cdot$ $m^{-2} \cdot mol \cdot s^{-1}$	☑
Rs			0.288	dimensionless	☑

7.38 Reaction ER_leak_flux

This is a reversible reaction of one reactant forming one product influenced by one modifier.

Name ER_leak_flux

Reaction equation

$$\text{Ca\_Cytosol} \xrightleftharpoons{\text{ERDensity\_ERM}} \text{Ca\_ER} \tag{78}$$

Reactant

Table 114: Properties of each reactant.

Id	Name	SBO
Ca_Cytosol		

Modifier

Table 115: Properties of each modifier.

Id	Name	SBO
ERDensity_ERM		

Product

Table 116: Properties of each product.

Id	Name	SBO
Ca_ER		

Kinetic Law

Derived unit contains undeclared units

$$v_{38} = \left([\text{ERDensity\_ERM}] \cdot \text{vL} \cdot \left(1 + \left(\left(0.00166112956810631 \cdot [\text{Ca\_Cytosol}] \cdot \frac{1}{0.00166112956810631 \cdot [\text{Ca\_ER}]} \right) \right) \right) \right) \cdot \text{area}\,(\text{ERM}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \tag{79}$$

Table 117: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
I			0.000	dimensionless · A · m^{-2}	☑
vL			0.124	10^{-21} dimensionless · $item^{-1} \cdot mol \cdot s^{-1}$	☑

7.39 Reaction SERCA_fluxD

This is a reversible reaction of one reactant forming one product influenced by one modifier.

Name SERCA_fluxD

Reaction equation

$$\text{Ca\_D\_Cytosol} \overset{\text{ERDensity\_D\_ERM}}{\rightleftharpoons} \text{Ca\_D\_ER} \tag{80}$$

Reactant

Table 118: Properties of each reactant.

Id	Name	SBO
Ca_D_Cytosol		

Modifier

Table 119: Properties of each modifier.

Id	Name	SBO
ERDensity_D_ERM		

Product

Table 120: Properties of each product.

Id	Name	SBO
Ca_D_ER		

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_{39} = {} & [\text{ERDensity\_D\_ERM}] \cdot \text{vP} \cdot 0.00166112956810631 \\ & \cdot [\text{Ca\_D\_Cytosol}] \cdot 0.00166112956810631 \cdot [\text{Ca\_D\_Cytosol}] \\ & \cdot \frac{1}{\text{kP} \cdot \text{kP} + 0.00166112956810631 \cdot [\text{Ca\_D\_Cytosol}] \cdot 0.00166112956810631 \cdot [\text{Ca\_D\_Cytosol}]} \\ & \cdot \text{area}\,(\text{ERM}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \end{aligned} \tag{81}$$

Table 121: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
I			0.00	dimensionless · A · m^{-2}	☑
vP			3.75	10^{-21} dimensionless · $item^{-1} \cdot mol \cdot s^{-1}$	☑
kP			0.27		☑

7.40 Reaction IP3R_fluxD

This is a reversible reaction of one reactant forming one product influenced by three modifiers.

Name IP3R_fluxD

Reaction equation

$$\text{Ca\_D\_Cytosol} \xrightleftharpoons{\text{IP3\_D\_Cytosol, ERDensity\_D\_ERM, h\_D\_ERM}} \text{Ca\_D\_ER} \tag{82}$$

Reactant

Table 122: Properties of each reactant.

Id	Name	SBO
Ca_D_Cytosol		

Modifiers

Table 123: Properties of each modifier.

Id	Name	SBO
IP3_D_Cytosol		
ERDensity_D_ERM		
h_D_ERM		

Product

Table 124: Properties of each product.

Id	Name	SBO
Ca_D_ER		

Kinetic Law

Derived unit contains undeclared units

$$v_{40} = \left([\text{ERDensity\_D\_ERM}] \cdot \text{Jmax2} \cdot \left(1 + \left(\left(0.00166112956810631 \cdot [\text{Ca\_D\_Cytosol}] \cdot \frac{1}{0.00166112956810631 \cdot [\text{Ca\_D\_ER}]} \right) \right) \right) \cdot \left([\text{h\_D\_ERM}] \cdot 0.00166112956810631 \cdot [\text{IP3\_D\_Cytosol}] \cdot 0.00166112956810631 \cdot [\text{Ca\_D\_Cytosol}] \cdot \frac{1}{0.00166112956810631 \cdot [\text{IP3\_D\_Cytosol}] + \text{dI}} \cdot \frac{1}{0.00166112956810631 \cdot [\text{Ca\_D\_Cytosol}] + \text{Kact}} \right)^3 \right) \cdot \text{area}\,(\text{ERM}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \tag{83}$$

Table 125: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
I			0.0	dimensionless · A · m^{-2}	☑
Jmax2			21000.0	10^{-57} dimensionless · $item^{-4}$ · m^6 · mol · s^{-1}	☑
dI			20.0	0.0010 dimensionless · m^{-3} · mol	☑
Kact			0.3	0.0010 dimensionless · m^{-3} · mol	☑

7.41 Reaction SERCA_flux

This is a reversible reaction of one reactant forming one product influenced by one modifier.

Name SERCA_flux

Reaction equation

$$\text{Ca\_Cytosol} \xrightleftharpoons{\text{ERDensity\_ERM}} \text{Ca\_ER} \tag{84}$$

Reactant

Table 126: Properties of each reactant.

Id	Name	SBO
Ca_Cytosol		

Modifier

Table 127: Properties of each modifier.

Id	Name	SBO
ERDensity_ERM		

Product

Table 128: Properties of each product.

Id	Name	SBO
Ca_ER		

Kinetic Law

Derived unit contains undeclared units

$$v_{41} = [\text{ERDensity\_ERM}] \cdot \text{vP} \cdot 0.00166112956810631 \cdot [\text{Ca\_Cytosol}] \cdot 0.00166112956810631 \cdot [\text{Ca\_Cytosol}] \cdot \frac{1}{\text{kP} \cdot \text{kP} + 0.00166112956810631 \cdot [\text{Ca\_Cytosol}] \cdot 0.00166112956810631 \cdot [\text{Ca\_Cytosol}]} \cdot \text{area}(\text{ERM}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \tag{85}$$

Table 129: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
I			0.00	dimensionless $\cdot$ A $\cdot$ m^{-2}	☑
vP			3.75	10^{-21} dimensionless $\cdot$ $\text{item}^{-1} \cdot \text{mol} \cdot \text{s}^{-1}$	☑
kP			0.27		☑

7.42 Reaction `flux0`

This is a reversible reaction of one reactant forming one product.

Name flux0

Reaction equation

$$\text{Ca\_Extracellular} \rightleftharpoons \text{Ca\_Cytosol} \tag{86}$$

Reactant

Table 130: Properties of each reactant.

Id	Name	SBO
`Ca_Extracellular`		

Product

Table 131: Properties of each product.

Id	Name	SBO
`Ca_Cytosol`		

Kinetic Law

Derived unit contains undeclared units

$$v_{42} = \text{flux0\_ar} \cdot \text{area}\,(\text{PM}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \tag{87}$$

Table 132: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
`I`			0.0	dimensionless $\cdot$ A $\cdot$ m^{-2}	☑

7.43 Reaction `IP3R_flux`

This is a reversible reaction of one reactant forming one product influenced by three modifiers.

Name IP3R_flux

Reaction equation

$$\text{Ca\_Cytosol} \xrightleftharpoons{\text{IP3\_Cytosol, h\_ERM, ERDensity\_ERM}} \text{Ca\_ER} \tag{88}$$

Reactant

Table 133: Properties of each reactant.

Id	Name	SBO
Ca_Cytosol		

Modifiers

Table 134: Properties of each modifier.

Id	Name	SBO
IP3_Cytosol		
h_ERM		
ERDensity_ERM		

Product

Table 135: Properties of each product.

Id	Name	SBO
Ca_ER		

Kinetic Law

Derived unit contains undeclared units

$$v_{43} = \Bigg([\text{ERDensity\_ERM}] \cdot \text{Jmax2} \cdot \left(1 + \left(\left(0.00166112956810631 \cdot [\text{Ca\_Cytosol}] \cdot \frac{1}{0.00166112956810631 \cdot [\text{Ca\_ER}]} \right) \right) \right) \cdot \Bigg([\text{h\_ERM}] \cdot 0.00166112956810631 \cdot [\text{IP3\_Cytosol}] \cdot 0.00166112956810631 \cdot [\text{Ca\_Cytosol}] \cdot \frac{1}{0.00166112956810631 \cdot [\text{IP3\_Cytosol}] + \text{dI}} \cdot \frac{1}{0.00166112956810631 \cdot [\text{Ca\_Cytosol}] + \text{Kact}} \Bigg)^3 \Bigg) \cdot \text{area}\,(\text{ERM}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \tag{89}$$

Table 136: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
I			0.0	dimensionless · A · m^{-2}	☑
Jmax2			21000.0	10^{-57} dimensionless · $item^{-4}$ · m^6 · mol · s^{-1}	☑
dI			20.0	0.0010 dimensionless · m^{-3} · mol	☑
Kact			0.3	0.0010 dimensionless · m^{-3} · mol	☑

7.44 Reaction flux1

This is a reversible reaction of one reactant forming one product.

Name flux1

Reaction equation

$$\text{Ca\_D\_Extracellular} \rightleftharpoons \text{Ca\_D\_Cytosol} \tag{90}$$

Reactant

Table 137: Properties of each reactant.

Id	Name	SBO
Ca_D_Extracellular		

Product

Table 138: Properties of each product.

Id	Name	SBO
Ca_D_Cytosol		

Kinetic Law

Derived unit contains undeclared units

$$v_{44} = \text{flux1\_ar} \cdot \text{area}\,(\text{PM}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \tag{91}$$

Table 139: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
I			0.0	dimensionless · A · m^{-2}	☑

7.45 Reaction ER_leak_fluxD

This is a reversible reaction of one reactant forming one product influenced by one modifier.

Name ER_leak_fluxD

Reaction equation

$$\text{Ca\_D\_Cytosol} \xrightleftharpoons{\text{ERDensity\_D\_ERM}} \text{Ca\_D\_ER} \tag{92}$$

Reactant

Table 140: Properties of each reactant.

Id	Name	SBO
Ca_D_Cytosol		

Modifier

Table 141: Properties of each modifier.

Id	Name	SBO
ERDensity_D_ERM		

Product

Table 142: Properties of each product.

Id	Name	SBO
Ca_D_ER		

Kinetic Law

Derived unit contains undeclared units

$$v_{45} = \left([\text{ERDensity\_D\_ERM}] \cdot \text{vL} \cdot \left(1 + \left(\left(0.00166112956810631 \cdot [\text{Ca\_D\_Cytosol}] \cdot \frac{1}{0.00166112956810631 \cdot [\text{Ca\_D\_ER}]} \right) \right) \right) \right) \cdot \text{area}\,(\text{ERM}) \cdot 1 \cdot \frac{1}{\text{KMOLE}} \tag{93}$$

Table 143: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
I			0.000	dimensionless $\cdot$ A $\cdot$ m^{-2}	☑
vL			0.124	10^{-21} dimensionless $\cdot$ $\text{item}^{-1} \cdot \text{mol} \cdot \text{s}^{-1}$	☑

8 Derived Rate Equations

When interpreted as an ordinary differential equation framework, this model implies the following set of equations for the rates of change of each species.

Identifiers for kinetic laws highlighted in gray cannot be verified to evaluate to units of SBML `substance` per `time`. As a result, some SBML interpreters may not be able to verify the consistency of the units on quantities in the model. Please check if

- parameters without an unit definition are involved or
- volume correction is necessary because the `hasOnlySubstanceUnits` flag may be set to `false` and `spacialDimensions`> 0 for certain species.

8.1 Species ERDensity_ERM

Initial concentration $1\ \text{item} \cdot \mu\text{m}^{-2}$

This species takes part in three reactions (as a modifier in ER_leak_flux, SERCA_flux, IP3R_flux), which do not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{ERDensity\_ERM} = 0 \tag{94}$$

8.2 Species PA_D_Cytosol

Initial concentration $1928.19396\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in four reactions (as a reactant in PA_Dbinding, PA_MgD, PA_deg and as a modifier in PA_d).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{PA\_D\_Cytosol} = -v_2 - v_7 - v_{29} \tag{95}$$

8.3 Species PABCa_D_Cytosol

Initial concentration $9827.53562\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in three reactions (as a reactant in PABCa_deg and as a product in PA_Dbinding and as a modifier in PABCa_d).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{PABCa\_D\_Cytosol} = v_2 - v_{18} \tag{96}$$

8.4 Species Ca_D_ER

Initial concentration $240800\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in three reactions (as a product in SERCA_fluxD, IP3R_fluxD, ER_leak_fluxD), which do not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{Ca\_D\_ER} = 0 \tag{97}$$

8.5 Species h_D_ERM

Initial concentration $0.8\ \text{item} \cdot \mu\text{m}^{-2}$

This species takes part in two reactions (as a reactant in reaction1 and as a modifier in IP3R_fluxD).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{h\_D\_ERM} = -v_{15} \tag{98}$$

8.6 Species PABMg_D_Cytosol

Initial concentration $36404.27644\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in three reactions (as a reactant in PABMg_deg and as a product in PA_MgD and as a modifier in PABMg_d).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{PABMg\_D\_Cytosol} = v_7 - v_9 \tag{99}$$

8.7 Species ERDensity_D_ERM

Initial concentration $1\ \text{item} \cdot \mu\text{m}^{-2}$

This species takes part in three reactions (as a modifier in SERCA_fluxD, IP3R_fluxD, ER_leak_fluxD), which do not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{ERDensity\_D\_ERM} = 0 \tag{100}$$

8.8 Species CG_D_Cytosol

Initial concentration $84566.35334\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in three reactions (as a reactant in CG_deg, CG_Dbinding and as a modifier in CG_d).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{CG\_D\_Cytosol} = -v_3 - v_{34} \tag{101}$$

8.9 Species D28kB_D_Cytosol

Initial concentration $2510.04502\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in three reactions (as a reactant in D28kB_deg and as a product in D28kBDbinding and as a modifier in D28kB_d).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{D28kB\_D\_Cytosol} = v_{24} - v_5 \tag{102}$$

8.10 Species PA_Cytosol

Initial concentration $1928.19396\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in four reactions (as a reactant in PA_Ca, PA_d, PA_Mg and as a modifier in PA_deg).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{PA\_Cytosol} = -v_8 - v_{26} - v_{28} \tag{103}$$

8.11 Species CG_Cytosol

Initial concentration $84566.35334\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in three reactions (as a reactant in CG_d, CGbinding and as a modifier in CG_deg).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{CG\_Cytosol} = -v_{13} - v_{16} \tag{104}$$

8.12 Species PABCa_Cytosol

Initial concentration $9827.53562\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in three reactions (as a reactant in PABCa_d and as a product in PA_Ca and as a modifier in PABCa_deg).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{PABCa\_Cytosol} = v_8 - v_{25} \tag{105}$$

8.13 Species Mg_Cytosol

Initial concentration $355180\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in one reaction (as a reactant in PA_Mg), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{Mg\_Cytosol} = 0 \tag{106}$$

8.14 Species D28k_high_Cytosol

Initial concentration $43952.64608\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in three reactions (as a reactant in D28k_high_d, CD28k_high and as a modifier in D28k_high_deg).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{D28k\_high\_Cytosol} = -v_{20} - v_{23} \tag{107}$$

8.15 Species D28k_high_D_Cytosol

Initial concentration 43952.64608 item · µm^{-3}

This species takes part in three reactions (as a reactant in CD28k_highDbinding, D28k_high_deg and as a modifier in D28k_high_d).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{D28k\_high\_D\_Cytosol} = -v_1 - v_{10} \tag{108}$$

8.16 Species Ca_ER

Initial concentration 240800 item · µm^{-3}

This species takes part in three reactions (as a product in ER_leak_flux, SERCA_flux, IP3R_flux), which do not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Ca\_ER} = 0 \tag{109}$$

8.17 Species D28kB_high_D_Cytosol

Initial concentration 4207.35392 item · µm^{-3}

This species takes part in three reactions (as a reactant in D28kB_high_deg and as a product in CD28k_highDbinding and as a modifier in D28kB_high_d).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{D28kB\_high\_D\_Cytosol} = v_1 - v_{12} \tag{110}$$

8.18 Species CGB_D_Cytosol

Initial concentration 11753.6286 item · µm^{-3}

This species takes part in three reactions (as a reactant in CGB_deg and as a product in CG_Dbinding and as a modifier in CGB_d).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CGB\_D\_Cytosol} = v_{34} - v_{27} \tag{111}$$

8.19 Species Ca_D_Cytosol

Initial concentration 27.09 item · µm^{-3}

This species takes part in eleven reactions (as a reactant in CD28k_highDbinding, PA_Dbinding, D28kBDbinding, CG_Dbinding, Ca_deg, SERCA_fluxD, IP3R_fluxD, ER_leak_fluxD and as a product in flux1 and as a modifier in Ca_d, reaction1).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Ca\_D\_Cytosol} = v_{44} - v_1 - v_2 - v_{24} - v_{34} - v_{36} - v_{39} - v_{40} - v_{45} \tag{112}$$

8.20 Species CGB_Cytosol

Initial concentration 11753.6286 item · µm^{-3}

This species takes part in three reactions (as a reactant in CGB_d and as a product in CGbinding and as a modifier in CGB_deg).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CGB\_Cytosol} = v_{16} - v_{33} \tag{113}$$

8.21 Species D28k_Cytosol

Initial concentration 45649.95498 item · µm^{-3}

This species takes part in three reactions (as a reactant in CaD28k_med, D28k_d and as a modifier in D28k_deg).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{D28k\_Cytosol} = -v_{17} - v_{32} \tag{114}$$

8.22 Species D28kB_high_Cytosol

Initial concentration 4207.35392 item · µm^{-3}

This species takes part in three reactions (as a reactant in D28kB_high_d and as a product in CD28k_high and as a modifier in D28kB_high_deg).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{D28kB\_high\_Cytosol} = v_{23} - v_{31} \tag{115}$$

8.23 Species PABMg_Cytosol

Initial concentration 36404.27644 item · µm^{-3}

This species takes part in three reactions (as a reactant in PABMg_d and as a product in PA_Mg and as a modifier in PABMg_deg).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{PABMg\_Cytosol} = v_{28} - v_{22} \tag{116}$$

8.24 Species IP3_Cytosol

Initial concentration 96.32 item · µm^{-3}

This species takes part in five reactions (as a reactant in IP3_d, IP3_degr and as a product in pulses and as a modifier in IP3deg, IP3R_flux).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IP3\_Cytosol} = v_{37} - v_{19} - v_{30} \tag{117}$$

8.25 Species Ca_Extracellular

Initial concentration $602000\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in one reaction (as a reactant in flux0), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{Ca\_Extracellular} = 0 \tag{118}$$

8.26 Species D28k_D_Cytosol

Initial concentration $45649.95498\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in three reactions (as a reactant in D28k_deg, D28kBDbinding and as a modifier in D28k_d).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{D28k\_D\_Cytosol} = -v_6 - v_{24} \tag{119}$$

8.27 Species IP3_D_Cytosol

Initial concentration $96.32\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in four reactions (as a reactant in IP3deg, IP3_degr1 and as a modifier in IP3_d, IP3R_fluxD).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{IP3\_D\_Cytosol} = -v_4 - v_{35} \tag{120}$$

8.28 Species Mg_D_Cytosol

Initial concentration $355180\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in one reaction (as a reactant in PA_MgD), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{Mg\_D\_Cytosol} = 0 \tag{121}$$

8.29 Species Ca_Cytosol

Initial concentration $27.09\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in eleven reactions (as a reactant in PA_Ca, Ca_d, CGbinding, CaD28k_med, CD28k_high, ER_leak_flux, SERCA_flux, IP3R_flux and as a product in flux0 and as a modifier in reaction0, Ca_deg).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{Ca\_Cytosol} = v_{42} - v_8 - v_{11} - v_{16} - v_{17} - v_{23} - v_{38} - v_{41} - v_{43} \tag{122}$$

8.30 Species h_ERM

Initial concentration $0.8\ \text{item} \cdot \mu\text{m}^{-2}$

This species takes part in two reactions (as a reactant in reaction0 and as a modifier in IP3R_flux).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{h\_ERM} = -v_{21} \tag{123}$$

8.31 Species Ca_D_Extracellular

Initial concentration $602000\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in one reaction (as a reactant in flux1), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{Ca\_D\_Extracellular} = 0 \tag{124}$$

8.32 Species D28kB_Cytosol

Initial concentration $2510.04502\ \text{item} \cdot \mu\text{m}^{-3}$

This species takes part in three reactions (as a reactant in D28kB_d and as a product in CaD28k_med and as a modifier in D28kB_deg).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{D28kB\_Cytosol} = v_{17} - v_{14} \tag{125}$$

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