SBMLsqueezer: Differential Equation System "Xu2003 Phosphoinositide turnover"

September 11, 2009

1 Rate Laws

1.1 Reaction: PIPSyn

$$v_1 = \text{area}\,(\text{PM}) \cdot (\text{Ratebasal\_PIPsyn} + \text{Ratestim\_PIPsyn}) \cdot [\text{PI\_PM}] \tag{1}$$

1.2 Reaction: PIP2_hyd

$$v_2 = \text{area}\,(\text{PM}) \cdot \text{k\_PIP2hyd} \cdot [\text{PIP2\_PM}] \cdot [\text{PLC\_act\_PM}] \tag{2}$$

1.3 Reaction: IP3_uncaging

$$v_3 = \text{vol}\,(\text{Cytosol}) \cdot \text{intensity} \cdot [\text{IP3X\_Cytosol}] \cdot [\text{hv\_Cytosol}] \tag{3}$$

1.4 Reaction: PLCact

$$v_4 = \text{area}\,(\text{PM}) \cdot (\text{KfPLCact} \cdot [\text{PLC\_PM}] \cdot \text{signal} - \text{krPLCact} \cdot [\text{PLC\_act\_PM}]) \tag{4}$$

1.5 Reaction: PIP2_PH_hyd

$$v_5 = \text{area}\,(\text{PM}) \cdot \text{k\_PIP2PHhyd} \cdot [\text{PLC\_act\_PM}] \cdot [\text{PIP2\_PHGFP\_PM}] \tag{5}$$

1.6 Reaction: PIP2_PH

$$v_6 = \text{area}\,(\text{PM}) \cdot ([\text{PIP2\_PM}] \cdot \text{kf\_PIP2PH} \cdot [\text{PH\_GFP\_Cyt}] - \text{kr\_PIP2PH} \cdot [\text{PIP2\_PHGFP\_PM}]) \tag{6}$$

1.7 Reaction: IP3deg

$$v_7 = \text{vol}\,(\text{Cytosol}) \cdot \text{kIP3deg} \cdot ([\text{IP3\_Cyt}] - \text{IP3\_basal}) \tag{7}$$

1.8 Reaction: PIP2Syn

$$v_8 = \text{area}\,(\text{PM}) \cdot (\text{Rate\_PIP2Synbasal} + \text{Rate\_PIP2SynStim}) \cdot [\text{PIP\_PM}] \tag{8}$$

1.9 Reaction: IP3_PHGFP

$$v_9 = \mathrm{vol}\,(\mathtt{Cytosol}) \cdot ([\mathtt{PH\_GFP\_Cyt}] \cdot \mathtt{kf\_IP3PH} \cdot [\mathtt{IP3\_Cyt}] - \mathtt{kr\_IP3PH} \cdot [\mathtt{IP3\_PHGFP\_Cyt}]) \quad (9)$$

2 Equations

2.1 Species: PIP2_PHGFP_PM

$$\frac{\mathrm{d}[\mathrm{PIP2\_PHGFP\_PM}]}{\mathrm{dt}} = -v_5 \quad (10)$$

2.2 Species: PH_GFP_Cyt

$$\frac{\mathrm{d}[\mathrm{PH\_GFP\_Cyt}]}{\mathrm{dt}} = -v_9 - v_6 \quad (11)$$

2.3 Species: PI_PM

$$\frac{\mathrm{d}[\mathrm{PI_PM}]}{\mathrm{dt}} = -v_1 \quad (12)$$

2.4 Species: IP3_PHGFP_Cyt

$$\frac{\mathrm{d}[\mathrm{IP3\_PHGFP\_Cyt}]}{\mathrm{d}t} = 0 \quad (13)$$

2.5 Species: PIP2_PM

$$\frac{\mathrm{d}[\mathrm{PIP2_PM}]}{\mathrm{dt}} = -v_6 - v_2 \quad (14)$$

2.6 Species: PIP_PM

$$\frac{\mathrm{d}[\mathrm{PIP_PM}]}{\mathrm{dt}} = -v_8 \quad (15)$$

2.7 Species: DAG_PM

$$\frac{\mathrm{d}[\mathrm{DAG_PM}]}{\mathrm{d}t} = 0 \quad (16)$$

2.8 Species: hv_Cytosol

$$\frac{\mathrm{d}[\mathrm{hv_Cytosol}]}{\mathrm{d}t} = 0 \quad (17)$$

2.9 Species: IP3X_Cytosol

$$\frac{\mathrm{d}[\mathrm{IP3X_Cytosol}]}{\mathrm{dt}} = 0 \quad (18)$$

2.10 Species: PLC_PM

$$\frac{\mathrm{d}[\mathrm{PLC_PM}]}{\mathrm{dt}} = -v_4 \tag{19}$$

2.11 Species: PLC_act_PM

$$\frac{\mathrm{d}[\mathrm{PLC\_act\_PM}]}{\mathrm{d}t} = 0 \tag{20}$$

2.12 Species: IP3_Cyt

$$\frac{\mathrm{d}[\mathrm{IP3_Cyt}]}{\mathrm{dt}} = -v_9 - v_7 \tag{21}$$

3 Events

3.1 Event:

Triggers if:

$$[\mathtt{PIP\_PM}] < \mathtt{PIP\_basal} \tag{22}$$

and assigns the following rule:

$$PIPsynbasal = 1 \tag{23}$$

3.2 Event:

Triggers if:

$$\mathrm{time} > \mathtt{tauPIPsyn} \tag{24}$$

and assigns the following rule:

$$PIPsynstim = 1 \tag{25}$$

3.3 Event:

Triggers if:

$$[\mathtt{PIP2\_PM}] < \mathtt{PIP2\_basal} \tag{26}$$

and assigns the following rule:

$$PIP_2 = 1 \tag{27}$$

3.4 Event:

Triggers if:

$$\mathrm{time} > \mathtt{tauPIP2syn} \tag{28}$$

and assigns the following rule:

$$PIP_2 = 1 \tag{29}$$

3.5 Event:

`Triggers if:`

$$\text{time} > \texttt{tau0} \tag{30}$$

`and assigns the following rule:`

$$Signal = 1 \tag{31}$$

4 Parameters

Parameter	Value
PIP	2857.0
PIP_2	4000.0
$PIPsynstim$	0.0
$PIPsynbasal$	0.0
PIP_2	0.0
PIP_2	0.0
$Ratebasal$	NaN
$Ratestim$	NaN
$signal$	NaN
kr_{PIP_2}	NaN
$Rate_{PIP_2}$	NaN
$Rate_{PIP_2}$	NaN
kr_{IP_3}	NaN
$kBasalSynPIP$	0.0055
$kStimSynPIP$	0.019
$tauPIPsyn$	0.05
$PIPsyndecay$	1.0
tau_0	0.05
$stimdecay$	1.0
kf_{PIP_2}	0.12
$KdPIP_2$	2.0
$kBasalSynPIP_2$	0.048
$kStimSynPIP_2$	0.92
$tauPIP_2$	0.05
PIP_2	1.0
kf_{IP_3}	10.0
$KdIP_3$	0.1
$Signal$	0.0
k_{PIP_2}	2.4

5 Species

Species	Initial concentration	compartment

PIP_2	0.0	PM
PH	0.0	Cytosol
PI	142857.0	PM
IP_3	0.0	Cytosol
PIP_2	4000.0	PM
PIP	2857.0	PM
DAG	2000.0	PM
hv	0.0	Cytosol
IP_3	0.0	Cytosol
PLC	100.0	PM
PLC	0.0	PM
IP_3	0.16	Cytosol

6 Compartments

Compartment	Volume
PM	1.0
$Cytosol$	1.0

For a more comprehensive LaTeX export, see
`http://www.ra.cs.uni-tuebingen.de/software/SBML2LaTeX`