SBML Model Report

Model name: “Somogyi1990_CaOscillations-_SingleCaSpike”

May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by Enuo He[1] at May tenth 2007 at 8:46 a. m. and last time modified at April sixth 2014 at 10:02 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	3
species types	0	species	2
events	0	constraints	0
reactions	5	function definitions	0
global parameters	8	unit definitions	0
rules	1	initial assignments	0

Model Notes

Another model from *Hormone induced Calcium Oscillations in Liver Cells Can Be Explained by a Simply One Pool Model.* Anatomy of a single Ca2+ spike. Figure4A has been simulated by COPASI4.0.20(development). However, the simulated figure is slightly different from the paper, single spike of Ca2+ is around „6„ time arbitrary units instead „9„ time arbitrary units displayed in the paper.

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2 Unit Definitions

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

2.1 Unit `substance`

Notes Mole is the predefined SBML unit for `substance`.

Definition mol

2.2 Unit `volume`

Notes Litre is the predefined SBML unit for `volume`.

Definition l

2.3 Unit `area`

Notes Square metre is the predefined SBML unit for `area` since SBML Level 2 Version 1.

Definition m^2

2.4 Unit `length`

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

Definition m

2.5 Unit `time`

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

Definition s

3 Compartments

This model contains three compartments.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
Cytosol			3	1	litre	☑	
ER	Endoplasmic Reticulum		3	1	litre	☑	
Extracellular			3	1	litre	☑	

3.1 Compartment Cytosol

This is a three dimensional compartment with a constant size of one litre.

3.2 Compartment ER

This is a three dimensional compartment with a constant size of one litre.

Name Endoplasmic Reticulum

3.3 Compartment Extracellular

This is a three dimensional compartment with a constant size of one litre.

4 Species

This model contains two species. 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
x	Ca_ER	ER	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
y	Ca_Cyt	Cytosol	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟

5 Parameters

This model contains eight global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k			0.01		☑
alpha			10.00		☑
n			4.00		☑
a			1.40		☑
k1			2.00		☑
beta			1.00		☑
fy			0.00		☐
gamma			1.00		☑

6 Rule

This is an overview of one rule.

6.1 Rule fy

Rule fy is an assignment rule for parameter fy:

$$\mathrm{fy} = \frac{[\mathrm{y}]^{\mathrm{n}}}{\mathrm{a}^{\mathrm{n}} + [\mathrm{y}]^{\mathrm{n}}} \tag{1}$$

Notes InsP3 induced calcium release channel.

7 Reactions

This model contains five 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	reaction_0000001	Ca flux into the cell	$\emptyset \longrightarrow y$	
2	reaction_0000002	Ca translocation from ER to Cytosol	$x \longrightarrow y$	
3	reaction_0000003	Ca transport from Cytosol to ER	$y \longrightarrow x$	
4	reaction_0000004	InsP3 channel	$x \longrightarrow y$	
5	reaction_0000005	Ca pumped ouside the cell	$y \longrightarrow \emptyset$	

7.1 Reaction reaction_0000001

This is an irreversible reaction of no reactant forming one product.

Name Ca flux into the cell

Reaction equation

$$\emptyset \longrightarrow \mathrm{y} \tag{2}$$

Product

Table 6: Properties of each product.

Id	Name	SBO
y	Ca_Cyt	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \mathrm{gamma} \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \tag{3}$$

7.2 Reaction reaction_0000002

This is an irreversible reaction of one reactant forming one product.

Name Ca translocation from ER to Cytosol

Reaction equation

$$\mathrm{x} \longrightarrow \mathrm{y} \tag{4}$$

Reactant

Table 7: Properties of each reactant.

Id	Name	SBO
x	Ca_ER	

Product

Table 8: Properties of each product.

Id	Name	SBO
y	Ca_Cyt	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \mathrm{vol}\,(\mathrm{Cytosol}) \cdot \mathrm{k} \cdot ([\mathrm{x}] - [\mathrm{y}]) \tag{5}$$

7.3 Reaction `reaction_0000003`

This is an irreversible reaction of one reactant forming one product.

Name Ca transport from Cytosol to ER

Reaction equation

$$\mathrm{y} \longrightarrow \mathrm{x} \tag{6}$$

Reactant

Table 9: Properties of each reactant.

Id	Name	SBO
y	Ca_Cyt	

Product

Table 10: Properties of each product.

Id	Name	SBO
x	Ca_ER	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \mathrm{k1} \cdot [\mathrm{y}] \cdot \mathrm{vol}\,(\mathrm{ER}) \tag{7}$$

7.4 Reaction reaction_0000004

This is an irreversible reaction of one reactant forming one product.

Name InsP3 channel

Reaction equation

$$\mathrm{x} \longrightarrow \mathrm{y} \tag{8}$$

Reactant

Table 11: Properties of each reactant.

Id	Name	SBO
x	Ca_ER	

Product

Table 12: Properties of each product.

Id	Name	SBO
y	Ca_Cyt	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \mathrm{alpha} \cdot \mathrm{fy} \cdot ([\mathrm{x}] - [\mathrm{y}]) \cdot \mathrm{vol}\,(\mathrm{Cytosol}) \tag{9}$$

7.5 Reaction reaction_0000005

This is an irreversible reaction of one reactant forming no product.

Name Ca pumped ouside the cell

Reaction equation

$$\mathrm{y} \longrightarrow \emptyset \tag{10}$$

Reactant

Table 13: Properties of each reactant.

Id	Name	SBO
y	Ca_Cyt	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \text{beta} \cdot [\text{y}] \cdot \text{vol}\,(\text{Extracellular}) \tag{11}$$

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 x

Name Ca_ER

Initial concentration $1\ \text{mol} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in reaction_0000002, reaction_0000004 and as a product in reaction_0000003).

$$\frac{\text{d}}{\text{d}t}\text{x} = v_3 - v_2 - v_4 \tag{12}$$

8.2 Species y

Name Ca_Cyt

Initial concentration $1\ \text{mol} \cdot \text{l}^{-1}$

This species takes part in five reactions (as a reactant in reaction_0000003, reaction_0000005 and as a product in reaction_0000001, reaction_0000002, reaction_0000004).

$$\frac{\text{d}}{\text{d}t}\text{y} = v_1 + v_2 + v_4 - v_3 - v_5 \tag{13}$$

SBML2LaTeX was developed by Andreas Dräger[a], Hannes Planatscher[a], Dieudonné M Wouamba[a], Adrian Schröder[a], Michael Hucka[b], Lukas Endler[c], Martin Golebiewski[d] and Andreas Zell[a]. Please see http://www.ra.cs.uni-tuebingen.de/software/SBML2LaTeX for more information.

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