SBML Model Report

Model name: "Fuss2006_MitoticActivation"

May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by the following two authors: Nicolas Le Novre[1] and Hendrik Fu[2] at September 14th 2006 at 12:14 a. m. and last time modified at April eighth 2016 at 3:27 p. m. Table 1 gives 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	1
species types	0	species	10
events	0	constraints	0
reactions	7	function definitions	0
global parameters	20	unit definitions	0
rules	2	initial assignments	0

Model Notes

The model was curated with XPP. The figure 3 was successfully reproduced.

2 Unit Definitions

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

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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 Compartment

This model contains one compartment.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
default			3	1	litre	☑	

3.1 Compartment default

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

4 Species

This model contains ten 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
srci		default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
srco		default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
srca		default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
srcc		default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
Cbp_P_CSK		default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
CSK_cytoplasm		default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
PTP		default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
PTP_pY789		default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
Cbp		default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
Cbp_P		default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟

5 Parameters

This model contains 20 global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			1.000		☑
k2			0.800		☑
k3			1.000		☑
k4			10.000		☑
kPTP			1.000		☑
kCbp			1.000		☑
p1			0.050		☑
p2			0.150		☑
p3			0.035		☑
src_background			10^{-4}		☑
PTP_background			0.000		☑
kCSKon			0.100		☑
kCSKoff			0.010		☑
rho_srca			1.000		☑
rho_srco			0.000		☑
rho_srcc			1.000		☑
Kser			1.000		☑
acsk0			0.000		☑
ptp_activity			0.000		⊟
src_activity			0.000		⊟

6 Rules

This is an overview of two rules.

6.1 Rule src_activity

Rule src_activity is an assignment rule for parameter src_activity:

$$\text{src\_activity} = \text{rho\_srco} \cdot [\text{srco}] + \text{rho\_srca} \cdot [\text{srca}] + \text{src\_background} + \text{rho\_srcc} \cdot [\text{srcc}] \quad (1)$$

6.2 Rule ptp_activity

Rule ptp_activity is an assignment rule for parameter ptp_activity:

$$\text{ptp\_activity} = \text{PTP\_background} + \text{Kser} \cdot [\text{PTP\_pY789}] \quad (2)$$

7 Reactions

This model contains seven 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	v1		$\text{srci} \overset{\text{Cbp\_P\_CSK}}{\rightleftharpoons} \text{srco}$	
2	v2		$\text{srco} \rightleftharpoons \text{srca}$	
3	v3		$\text{srca} \overset{\text{Cbp\_P\_CSK}}{\rightleftharpoons} \text{srcc}$	
4	v4		$\text{srcc} \longrightarrow \text{srci}$	
5	CSK_translocation		$\text{CSK\_cytoplasm} + \text{Cbp\_P} \rightleftharpoons \text{Cbp\_P\_CSK}$	
6	PTP_phosphorylation		$\text{PTP} \rightleftharpoons \text{PTP\_pY789}$	
7	Cbp_phosphorylation		$\text{Cbp} \longrightarrow \text{Cbp\_P}$	

7.1 Reaction v1

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

Reaction equation

$$\text{srci} \overset{\text{Cbp\_P\_CSK}}{\rightleftharpoons} \text{srco} \tag{3}$$

Reactant

Table 6: Properties of each reactant.

Id	Name	SBO
srci		

Modifier

Table 7: Properties of each modifier.

Id	Name	SBO
Cbp_P_CSK		

Product

Table 8: Properties of each product.

Id	Name	SBO
srco		

Kinetic Law

Derived unit contains undeclared units

$$v_1 = (\text{k2} \cdot \text{ptp\_activity} \cdot [\text{srci}] - \text{k1} \cdot [\text{Cbp\_P\_CSK}] \cdot [\text{srco}]) \cdot \text{vol}\,(\text{default}) \tag{4}$$

7.2 Reaction v2

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

Reaction equation

$$\text{srco} \rightleftharpoons \text{srca} \tag{5}$$

Reactant

Table 9: Properties of each reactant.

Id	Name	SBO
srco		

Product

Table 10: Properties of each product.

Id	Name	SBO
srca		

Kinetic Law

Derived unit contains undeclared units

$$v_2 = (\mathrm{k3} \cdot \mathrm{src\_activity} \cdot [\mathrm{srco}] - \mathrm{p1} \cdot [\mathrm{srca}]) \cdot \mathrm{vol}\,(\mathrm{default}) \tag{6}$$

7.3 Reaction v3

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

Reaction equation

$$\mathrm{srca} \overset{\mathrm{Cbp\_P\_CSK}}{\rightleftharpoons} \mathrm{srcc} \tag{7}$$

Reactant

Table 11: Properties of each reactant.

Id	Name	SBO
srca		

Modifier

Table 12: Properties of each modifier.

Id	Name	SBO
Cbp_P_CSK		

Id	Name	SBO

Product

Table 13: Properties of each product.

Id	Name	SBO
srcc		

Kinetic Law

Derived unit contains undeclared units

$$v_3 = (\mathrm{k1} \cdot [\mathrm{Cbp\_P\_CSK}] \cdot [\mathrm{srca}] - \mathrm{k2} \cdot \mathrm{ptp\_activity} \cdot [\mathrm{srcc}]) \cdot \mathrm{vol}(\mathrm{default}) \tag{8}$$

7.4 Reaction v4

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

Reaction equation

$$\mathrm{srcc} \longrightarrow \mathrm{srci} \tag{9}$$

Reactant

Table 14: Properties of each reactant.

Id	Name	SBO
srcc		

Product

Table 15: Properties of each product.

Id	Name	SBO
srci		

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \mathrm{vol}(\mathrm{default}) \cdot \mathrm{k4} \cdot \mathrm{p1} \cdot [\mathrm{srcc}] \tag{10}$$

7.5 Reaction CSK_translocation

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

Reaction equation

$$\text{CSK\_cytoplasm} + \text{Cbp\_P} \rightleftharpoons \text{Cbp\_P\_CSK} \tag{11}$$

Reactants

Table 16: Properties of each reactant.

Id	Name	SBO
CSK_cytoplasm		
Cbp_P		

Product

Table 17: Properties of each product.

Id	Name	SBO
Cbp_P_CSK		

Kinetic Law

Derived unit contains undeclared units

$$v_5 = ([\text{Cbp\_P}] \cdot \text{kCSKon} \cdot [\text{CSK\_cytoplasm}] - \text{kCSKoff} \cdot [\text{Cbp\_P\_CSK}]) \cdot \text{vol}\,(\text{default}) \tag{12}$$

7.6 Reaction PTP_phosphorylation

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

Reaction equation

$$\text{PTP} \rightleftharpoons \text{PTP\_pY789} \tag{13}$$

Reactant

Table 18: Properties of each reactant.

Id	Name	SBO
PTP		

Product

Table 19: Properties of each product.

Id	Name	SBO
PTP_pY789		

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \mathrm{vol}\,(\mathrm{default}) \cdot ((\mathrm{kPTP} \cdot \mathrm{src\_activity} + \mathrm{p3}) \cdot [\mathrm{PTP}] - \mathrm{p2} \cdot [\mathrm{PTP\_pY789}]) \tag{14}$$

7.7 Reaction Cbp_phosphorylation

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

Reaction equation

$$\mathrm{Cbp} \longrightarrow \mathrm{Cbp\_P} \tag{15}$$

Reactant

Table 20: Properties of each reactant.

Id	Name	SBO
Cbp		

Product

Table 21: Properties of each product.

Id	Name	SBO
Cbp_P		

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \mathrm{kCbp} \cdot \mathrm{src\_activity} \cdot [\mathrm{Cbp}] \cdot \mathrm{vol}\,(\mathrm{default}) \tag{16}$$

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 `srci`

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

This species takes part in two reactions (as a reactant in `v1` and as a product in `v4`).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{srci} = v_4 - v_1 \tag{17}$$

8.2 Species `srco`

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in `v2` and as a product in `v1`).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{srco} = v_1 - v_2 \tag{18}$$

8.3 Species `srca`

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in `v3` and as a product in `v2`).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{srca} = v_2 - v_3 \tag{19}$$

8.4 Species `srcc`

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in `v4` and as a product in `v3`).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{srcc} = v_3 - v_4 \tag{20}$$

8.5 Species Cbp_P_CSK

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in three reactions (as a product in CSK_translocation and as a modifier in v1, v3).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Cbp\_P\_CSK} = v_5 \tag{21}$$

8.6 Species CSK_cytoplasm

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

This species takes part in one reaction (as a reactant in CSK_translocation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CSK\_cytoplasm} = -v_5 \tag{22}$$

8.7 Species PTP

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

This species takes part in one reaction (as a reactant in PTP_phosphorylation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{PTP} = -v_6 \tag{23}$$

8.8 Species PTP_pY789

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in one reaction (as a product in PTP_phosphorylation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{PTP\_pY789} = v_6 \tag{24}$$

8.9 Species Cbp

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

This species takes part in one reaction (as a reactant in Cbp_phosphorylation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Cbp} = -v_7 \tag{25}$$

8.10 Species Cbp_P

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in CSK_translocation and as a product in Cbp_phosphorylation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Cbp\_P} = v_7 - v_5 \tag{26}$$

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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