SBML Model Report

Model name: “Goldbeter1991_MinMitOscil”

9th February 2009

1 General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by Bruce Shapiro[1] at February sixth 2005 at 11:39 p. m. and last modified at August 21st 2008 at 11:31 a. m. Table 1 gives an overview of the quantities of all components of this model.

Table 1: The SBML components in this model.
All components are described in more detail in the following sections.

Element	Quantity	Element	Quantity
compartment types	0	compartments	1
species types	0	species	3
events	0	constraints	0
reactions	7	function definitions	0
global parameters	5	unit definitions	0
rules	2	initial assignments	0

Model Notes

A Simple Mitotic Oscillator

This is a Systems Biology Markup Language (SBML) file, generated by MathSBML 2.4.6 (14-January-2005) 14-January-2005 18:33:39.806932. SBML is a form of XML, and most XML files will not display properly in an internet browser. To view the contents of an XML file use the „Page Source„ or equivalent button on you browser.

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Model Annotation

The following resources provide further information about this model:
This model is urn:miriam:biomodels.db:BIOMD0000000003.
This model is described by urn:miriam:pubmed:1833774.
This biological entity is homolog to urn:miriam:reactome:REACT_152.
This biological entity is a version of:

- urn:miriam:kegg.pathway:hsa04110.
- urn:miriam:obo.go:GO%3A0000278.

This biological entity is urn:miriam:taxonomy:8292.

2 Unit Definitions

This is an overview of five unit definitions. All units are 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 Compartment

This model contains one compartment.

Table 2: Properties of all compartments.

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

3.1 Compartment cell

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

Name cell

MIRIAM Annotation This biological entity is urn:miriam:obo.go:GO%3A0005623.

4 Species

This model contains three 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
C	Cyclin	cell	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
M	CDC-2 Kinase	cell	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
X	Cyclin Protease	cell	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟

5 Parameters

This model contains five global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
`V1`	V1		0.0		☐
`V3`	V3		0.0		☐
`VM1`	VM1		3.0		☑
`VM3`	VM3		1.0		☑
`Kc`	Kc		0.5		☑

6 Rules

This is an overview of two rules.

6.1 Rule `V1`

Rule `V1` is an assignment rule for parameter `V1`:

$$\mathrm{V1} = [\mathrm{C}] \cdot \mathrm{VM1} \cdot ([\mathrm{C}] + \mathrm{Kc})^{-1} \tag{1}$$

6.2 Rule `V3`

Rule `V3` is an assignment rule for parameter `V3`:

$$\mathrm{V3} = [\mathrm{M}] \cdot \mathrm{VM3} \tag{2}$$

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 one or more modifiers, the identifiers of the modifier species are written above the reaction arrow.

Table 5: Overview of all reactions

№	Id	Name	Reaction Equation	SBO
1	`reaction1`	creation of cyclin	$\emptyset \longrightarrow C$	
2	`reaction2`	default degradation of cyclin	$C \longrightarrow \emptyset$	
3	`reaction3`	cdc2 kinase triggered degration of cyclin	$C \xrightarrow{X} \emptyset$	
4	`reaction4`	activation of cdc2 kinase	$\emptyset \longrightarrow M$	
5	`reaction5`	deactivation of cdc2 kinase	$M \longrightarrow \emptyset$	
6	`reaction6`	activation of cyclin protease	$\emptyset \longrightarrow X$	
7	`reaction7`	deactivation of cyclin protease	$X \longrightarrow \emptyset$	

7.1 Reaction reaction1

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

Name creation of cyclin

MIRIAM Annotation This biological entity is a version of urn:miriam:obo.go:GO%3A0006412.

Reaction equation

$$\emptyset \longrightarrow \mathrm{C} \tag{3}$$

Product

Table 6: Properties of each product.

Id	Name	SBO
C	Cyclin	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \mathrm{vol}\,(\mathrm{cell}) \cdot \mathrm{vi} \tag{4}$$

Table 7: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
vi			0.025		☑

7.2 Reaction reaction2

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

Name default degradation of cyclin

MIRIAM Annotation This biological entity is a version of urn:miriam:obo.go:GO%3A0008054.

Reaction equation

$$\mathrm{C} \longrightarrow \emptyset \tag{5}$$

Reactant

Table 8: Properties of each reactant.

Id	Name	SBO
C	Cyclin	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = [\mathrm{C}] \cdot \mathrm{vol}\,(\mathrm{cell}) \cdot \mathrm{kd} \tag{6}$$

Table 9: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kd			0.01		☑

7.3 Reaction reaction3

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

Name cdc2 kinase triggered degration of cyclin

MIRIAM Annotation This biological entity is a version of urn:miriam:obo.go:GO%3A0008054.

Reaction equation

$$\mathrm{C} \xrightarrow{\mathrm{X}} \emptyset \tag{7}$$

Reactant

Table 10: Properties of each reactant.

Id	Name	SBO
C	Cyclin	

Modifier

Table 11: Properties of each modifier.

Id	Name	SBO
X	Cyclin Protease	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = [\mathrm{C}] \cdot \mathrm{vol}\,(\mathrm{cell}) \cdot \mathrm{vd} \cdot [\mathrm{X}] \cdot ([\mathrm{C}] + \mathrm{Kd})^{-1} \tag{8}$$

Table 12: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
vd			0.25		☑
Kd			0.02		☑

7.4 Reaction reaction4

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

Name activation of cdc2 kinase

MIRIAM Annotation This biological entity is a version of:

- urn:miriam:ec-code:3.1.3.16.
- urn:miriam:obo.go:GO%3A0006470.
- urn:miriam:obo.go:GO%3A0045737.

Reaction equation

$$\emptyset \longrightarrow \mathrm{M} \tag{9}$$

Product

Table 13: Properties of each product.

Id	Name	SBO
M	CDC-2 Kinase	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \mathrm{vol}\,(\mathrm{cell}) \cdot (1 + -1 \cdot [\mathrm{M}]) \cdot \mathrm{V1} \cdot (\mathrm{K1} + -1 \cdot [\mathrm{M}] + 1)^{-1} \tag{10}$$

Table 14: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
K1			0.005		☑

7.5 Reaction reaction5

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

Name deactivation of cdc2 kinase

MIRIAM Annotation This biological entity is a version of:

- urn:miriam:ec-code:2.7.10.2.
- urn:miriam:obo.go:GO%3A0045736.
- urn:miriam:obo.go:GO%3A0006468.

Reaction equation

$$\mathrm{M} \longrightarrow \emptyset \tag{11}$$

Reactant

Table 15: Properties of each reactant.

Id	Name	SBO
M	CDC-2 Kinase	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \mathrm{vol}\,(\mathrm{cell}) \cdot [\mathrm{M}] \cdot \mathrm{V2} \cdot (\mathrm{K2} + [\mathrm{M}])^{-1} \tag{12}$$

Table 16: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V2			1.500		☑
K2			0.005		☑

7.6 Reaction reaction6

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

Name activation of cyclin protease

Reaction equation

$$\emptyset \longrightarrow \mathrm{X} \tag{13}$$

Product

Table 17: Properties of each product.

Id	Name	SBO
X	Cyclin Protease	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \mathrm{vol}\,(\mathrm{cell}) \cdot \mathrm{V3} \cdot (1 + -1 \cdot [\mathrm{X}]) \cdot (\mathrm{K3} + -1 \cdot [\mathrm{X}] + 1)^{-1} \tag{14}$$

Table 18: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
K3			0.005		☑

7.7 Reaction reaction7

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

Name deactivation of cyclin protease

Reaction equation

$$\mathrm{X} \longrightarrow \emptyset \tag{15}$$

Reactant

Table 19: Properties of each reactant.

Id	Name	SBO
X	Cyclin Protease	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \mathrm{vol}\,(\mathrm{cell}) \cdot \mathrm{V4} \cdot [\mathrm{X}] \cdot (\mathrm{K4} + [\mathrm{X}])^{-1} \tag{16}$$

Table 20: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
K4			0.005		☑
V4			0.500		☑

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 a 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 C

Name Cyclin

MIRIAM Annotation This biological entity is a version of urn:miriam:interpro:IPR006670.

Initial concentration $0.01\ \mathrm{mol} \cdot \mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in reaction2, reaction3 and as a product in reaction1).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{C} = v_1 - v_2 - v_3 \tag{17}$$

8.2 Species M

Name CDC-2 Kinase

MIRIAM Annotation This biological entity has the version:

- urn:miriam:uniprot:P35567.
- urn:miriam:uniprot:P24033.

Initial concentration $0.01\ \mathrm{mol} \cdot \mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in reaction5 and as a product in reaction4).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{M} = v_4 - v_5 \tag{18}$$

8.3 Species X

Name Cyclin Protease

Initial concentration $0.01\ \mathrm{mol} \cdot \mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in reaction7 and as a product in reaction6 and as a modifier in reaction3).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{X} = v_6 - v_7 \tag{19}$$

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], Wolfgang Müller[d], and Andreas Zell[a]. Please see http://www.ra.cs.uni-tuebingen.de/software/SBML2LaTeX for more information.

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