

SBML Model Report

Model name: “Goldbeter1991_MinMitOscil”



January 16, 2009

1. General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by Bruce Shapiro¹ at February sixth 2005 at 11:39 p.m. and last time modified at August 21st 2008 at 11:31 a.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	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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¹NASA Jet Propulsion Laboratory, bshapiro@jpl.nasa.gov

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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 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 m²

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	<input checked="" type="checkbox"/>	

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:G0%3A0005623](http://miriam.org/obo/go/G0%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	$\text{mol} \cdot \text{l}^{-1}$	\square	\square
M	CDC-2 Kinase	cell	$\text{mol} \cdot \text{l}^{-1}$	\square	\square
X	Cyclin Protease	cell	$\text{mol} \cdot \text{l}^{-1}$	\square	\square

5. Parameters

This model contains five global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V1	V1		0.0		<input type="checkbox"/>
V3	V3		0.0		<input type="checkbox"/>
VM1	VM1		3.0		<input checked="" type="checkbox"/>
VM3	VM3		1.0		<input checked="" type="checkbox"/>
Kc	Kc		0.5		<input checked="" type="checkbox"/>

6. Rules

This is an overview of two rules.

6.1. Rule V1

Rule V1 is an assignment rule for parameter V1:

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

6.2. Rule V3

Rule V3 is an assignment rule for parameter V3:

$$V3 = [M] \cdot VM3 \quad (2)$$

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

Nº	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 degradation 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:G0%3A0006412](http://miriam.org/obo/go/G0%3A0006412).

Reaction equation



Product

Table 6: Properties of each product.

Id	Name	SBO
C	Cyclin	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \text{vol}(\text{cell}) \cdot v_i \quad (4)$$

Table 7: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
v_i			0.025		<input checked="" type="checkbox"/>

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:G0%3A0008054](http://miriam.org/obo/go/G0%3A0008054).

Reaction equation



Reactant

Table 8: Properties of each reactant.

Id	Name	SBO
C	Cyclin	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = [C] \cdot \text{vol}(\text{cell}) \cdot \text{kd} \quad (6)$$

Table 9: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kd			0.01		<input checked="" type="checkbox"/>

7.3. Reaction `reaction3`

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

Name cdc2 kinase triggered degradation of cyclin

MIRIAM Annotation This biological entity is a version of [urn:miriam:obo.go:G0%3A0008054](http://miriam.org/obo/go/G0%3A0008054).

Reaction equation



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

$$v_3 = [C] \cdot \text{vol}(\text{cell}) \cdot v_d \cdot [X] \cdot ([C] + K_d)^{-1} \quad (8)$$

Table 12: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
v _d			0.25		<input checked="" type="checkbox"/>
K _d			0.02		<input checked="" type="checkbox"/>

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](http://miriam.org/ontology/ec-code/3.1.3.16).
- [urn:miriam:obo.go:GO:3A0006470](http://miriam.org/ontology/obo.go:GO:3A0006470).
- [urn:miriam:obo.go:GO:3A0045737](http://miriam.org/ontology/obo.go:GO:3A0045737).

Reaction equation



Product

Table 13: Properties of each product.

Id	Name	SBO
M	CDC-2 Kinase	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \text{vol}(\text{cell}) \cdot (1 + -1 \cdot [M]) \cdot V_1 \cdot (K_1 + -1 \cdot [M] + 1)^{-1} \quad (10)$$

Table 14: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
K1			0.005		<input checked="" type="checkbox"/>

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](http://miriam.org/ontology/ec-code/2.7.10.2).
- [urn:miriam:obo.go:GO%3A0045736](http://miriam.org/ontology/obo.go:GO%3A0045736).
- [urn:miriam:obo.go:GO%3A0006468](http://miriam.org/ontology/obo.go:GO%3A0006468).

Reaction equation



Reactant

Table 15: Properties of each reactant.

Id	Name	SBO
M	CDC-2 Kinase	

Kinetic Law

Derived unit contains undeclared units

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

Table 16: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V2			1.500		<input checked="" type="checkbox"/>
K2			0.005		<input checked="" type="checkbox"/>

7.6. Reaction `reaction6`

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

Name activation of cyclin protease

Reaction equation



Product

Table 17: Properties of each product.

Id	Name	SBO
X	Cyclin Protease	

Kinetic Law

Derived unit contains undeclared units

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

Table 18: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
K3			0.005		<input checked="" type="checkbox"/>

7.7. Reaction `reaction7`

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

Name deactivation of cyclin protease

Reaction equation



Reactant

Table 19: Properties of each reactant.

Id	Name	SBO
X	Cyclin Protease	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \text{vol}(\text{cell}) \cdot V_4 \cdot [X] \cdot (K_4 + [X])^{-1} \quad (16)$$

Table 20: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
K4			0.005		<input checked="" type="checkbox"/>
V4			0.500		<input checked="" type="checkbox"/>

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 C

Name Cyclin

MIRIAM Annotation This biological entity is a version of [urn:miriam:interpro:IPR006670](http://miriam.org/interpro/IPR006670).

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

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

$$\frac{d}{dt}C = v_1 - v_2 - v_3 \quad (17)$$

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 $0.01 \text{ mol} \cdot \text{l}^{-1}$

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

$$\frac{d}{dt}M = v_4 - v_5 \quad (18)$$

8.3. Species X

Name Cyclin Protease

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

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

$$\frac{d}{dt}X = v_6 - v_7 \quad (19)$$

A. Model Consistency Report

The given SBML document contains 24 problems, which are listed in the remainder of this model report.

A.1. Warnings

This SBML document contains 24 warnings.

Warning 99505 In situations when a mathematical expression contains literal numbers or parameters whose units have not been declared, it is not possible to verify accurately the consistency of the units in the expression. The units of the `<assignmentRule><math>expression` `'C * VM1 * pow(C + Kc, -1)'` cannot be fully checked. Unit consistency reported as either no errors or further unit errors related to this object may not be accurate.

Warning 99505 In situations when a mathematical expression contains literal numbers or parameters whose units have not been declared, it is not possible to verify accurately the consistency of the units in the expression. The units of the `<assignmentRule><math>expression` `'M * VM3'` cannot be fully checked. Unit consistency reported as either no errors or further unit errors related to this object may not be accurate.

Warning 99505 In situations when a mathematical expression contains literal numbers or parameters whose units have not been declared, it is not possible to verify accurately the consistency of the units in the expression. The units of the `<kineticLaw><math>expression` 'cell * vi' cannot be fully checked. Unit consistency reported as either no errors or further unit errors related to this object may not be accurate.

Warning 99505 In situations when a mathematical expression contains literal numbers or parameters whose units have not been declared, it is not possible to verify accurately the consistency of the units in the expression. The units of the `<kineticLaw><math>expression` 'C * cell * kd' cannot be fully checked. Unit consistency reported as either no errors or further unit errors related to this object may not be accurate.

Warning 99505 In situations when a mathematical expression contains literal numbers or parameters whose units have not been declared, it is not possible to verify accurately the consistency of the units in the expression. The units of the `<kineticLaw><math>expression` 'C * cell * vd * X * pow(C + Kd, -1)' cannot be fully checked. Unit consistency reported as either no errors or further unit errors related to this object may not be accurate.

Warning 99505 In situations when a mathematical expression contains literal numbers or parameters whose units have not been declared, it is not possible to verify accurately the consistency of the units in the expression. The units of the `<kineticLaw><math>expression` 'cell * (1 + -1 * M) * V1 * pow(K1 + -1 * M + 1, -1)' cannot be fully checked. Unit consistency reported as either no errors or further unit errors related to this object may not be accurate.

Warning 99505 In situations when a mathematical expression contains literal numbers or parameters whose units have not been declared, it is not possible to verify accurately the consistency of the units in the expression. The units of the `<kineticLaw><math>expression` 'cell * M * V2 * pow(K2 + M, -1)' cannot be fully checked. Unit consistency reported as either no errors or further unit errors related to this object may not be accurate.

Warning 99505 In situations when a mathematical expression contains literal numbers or parameters whose units have not been declared, it is not possible to verify accurately the consistency of the units in the expression. The units of the `<kineticLaw><math>expression` 'cell * V3 * (1 + -1 * X) * pow(K3 + -1 * X + 1, -1)' cannot be fully checked. Unit consistency reported as either no errors or further unit errors related to this object may not be accurate.

Warning 99505 In situations when a mathematical expression contains literal numbers or parameters whose units have not been declared, it is not possible to verify accurately the consistency of the units in the expression. The units of the `<kineticLaw><math>expression` 'cell * V4 * X * pow(K4 + X, -1)' cannot be fully checked. Unit consistency reported as either no errors or further unit errors related to this object may not be accurate.

Warning 80701 As a principle of best modeling practice, the units of a `<parameter>` should be declared rather than be left undefined. Doing so improves the ability of software to check the consistency of units and helps make it easier to detect potential errors in models.

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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.

^aCenter for Bioinformatics Tübingen (ZBIT), Germany

^bCalifornia Institute of Technology, Beckman Institute BNMC, Pasadena, United States

^cEuropean Bioinformatics Institute, Wellcome Trust Genome Campus, Hinxton, United Kingdom

^dEML Research gGmbH, Heidelberg, Germany