

SBML Model Report

Model name: “Tyson1999_CircClock”



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1 General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by Nicolas Le Novre¹ at July seventh 2005 at 3:19 p. m. and last time modified at February 25th 2015 at 1:24 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	2
species types	0	species	3
events	0	constraints	0
reactions	5	function definitions	0
global parameters	1	unit definitions	1
rules	0	initial assignments	0

Model Notes

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To cite BioModels Database, please use: [Li C, Donizelli M, Rodriguez N, Dharuri H, Endler L, Chelliah V, Li L, He E, Henry A, Stefan MI, Snoep JL, Hucka M, Le Novre N, Laibe C \(2010\) BioModels Database: An enhanced, curated and annotated resource for published quantitative kinetic models. BMC Syst Biol., 4:92.](#)

2 Unit Definitions

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

2.1 Unit `time`

Name hour

Definition 3600 s

2.2 Unit `substance`

Notes Mole is the predefined SBML unit for substance.

Definition mol

2.3 Unit `volume`

Notes Litre is the predefined SBML unit for volume.

Definition l

2.4 Unit `area`

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

Definition m²

2.5 Unit `length`

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

Definition m

3 Compartments

This model contains two compartments.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
default			3	1	litre	<input checked="" type="checkbox"/>	
CYTOPLASM			3	1	litre	<input checked="" type="checkbox"/>	

3.1 Compartment default

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

3.2 Compartment CYTOPLASM

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

4 Species

This model contains three species. The boundary condition of one of these species is set to `true` so that this species' amount cannot be changed by any reaction. Section 7 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
EmptySet		default	$\text{mol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
M		CYTOPLASM	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
P	Pt	CYTOPLASM	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>

5 Parameter

This model contains one global parameter.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
N_A			$6.0221367 \cdot 10^{23}$		<input checked="" type="checkbox"/>

6 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

Nº	Id	Name	Reaction Equation	SBO
1	TC	transcription	$\text{EmptySet} \xrightarrow{\text{P}} \text{M}$	
2	TL	translation	$\text{EmptySet} \xrightarrow{\text{M}} \text{P}$	
3	mRNAD	mRNA degradation	$\text{M} \longrightarrow \text{EmptySet}$	
4	ProteinD	protein degradation	$\text{P} \longrightarrow \text{EmptySet}$	
5	DBT	Per phosphorylation and degradation	$\text{P} \longrightarrow \text{EmptySet}$	

6.1 Reaction TC

This is an irreversible reaction of one reactant forming one product influenced by one modifier.

Name transcription

Reaction equation



Reactant

Table 6: Properties of each reactant.

Id	Name	SBO
	EmptySet	

Modifier

Table 7: Properties of each modifier.

Id	Name	SBO
P	Pt	

Product

Table 8: Properties of each product.

Id	Name	SBO
	M	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \text{vol}(\text{CYTOPLASM}) \cdot \frac{V_m}{1 + \left(\frac{[P] \cdot \left(1 - \frac{2}{1 + (1 + 8 \cdot K_{eq} \cdot [P])^{0.5}} \right)}{2 \cdot P_{crit}} \right)^2} \quad (2)$$

Table 9: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vm			1.0		<input checked="" type="checkbox"/>
Pcrit			0.1		<input checked="" type="checkbox"/>
Keq			200.0		<input checked="" type="checkbox"/>

6.2 Reaction TL

This is an irreversible reaction of one reactant forming one product influenced by one modifier.

Name translation

Reaction equation



Reactant

Table 10: Properties of each reactant.

Id	Name	SBO
	EmptySet	

Modifier

Table 11: Properties of each modifier.

Id	Name	SBO
	M	

Product

Table 12: Properties of each product.

Id	Name	SBO
P	Pt	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = V \cdot [M] \cdot \text{vol}(\text{CYTOPLASM}) \quad (4)$$

Table 13: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	Vp		0.5		<input checked="" type="checkbox"/>

6.3 Reaction `mRNAD`

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

Name mRNA degradation

Reaction equation



Reactant

Table 14: Properties of each reactant.

Id	Name	SBO
M		

Product

Table 15: Properties of each product.

Id	Name	SBO
	EmptySet	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = D \cdot [M] \cdot \text{vol}(\text{CYTOPLASM}) \quad (6)$$

Table 16: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D	km		0.1		<input checked="" type="checkbox"/>

6.4 Reaction ProteinD

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

Name protein degradation

Reaction equation



Reactant

Table 17: Properties of each reactant.

Id	Name	SBO
P	Pt	

Product

Table 18: Properties of each product.

Id	Name	SBO
EmptySet		

Kinetic Law

Derived unit contains undeclared units

$$v_4 = D \cdot [P] \cdot \text{vol}(\text{CYTOPLASM}) \quad (8)$$

Table 19: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
D	kp3		0.1		<input checked="" type="checkbox"/>

6.5 Reaction DBT

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

Name Per phosphorylation and degradation

Reaction equation



Reactant

Table 20: Properties of each reactant.

Id	Name	SBO
P	Pt	

Product

Table 21: Properties of each product.

Id	Name	SBO
EmptySet		

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \text{vol}(\text{CYTOPLASM}) \cdot \frac{k1 \cdot [P] \cdot \frac{2}{1+(1+8 \cdot \text{Keq} \cdot [P])^{0.5}} + k2 \cdot [P]}{J + [P]} \quad (10)$$

Table 22: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kp1		10.00		✓
k2	kp2		0.03		✓
J	Jp		0.05		✓
Keq			200.00		✓

7 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.

7.1 Species EmptySet

Initial amount 0 mol

This species takes part in five reactions (as a reactant in `TC`, `TL` and as a product in `mRNAD`, `ProteinD`, `DBT`), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{d}{dt}\text{EmptySet} = 0 \quad (11)$$

7.2 Species M

Initial amount 1 mol

This species takes part in three reactions (as a reactant in `mRNAD` and as a product in `TC` and as a modifier in `TL`).

$$\frac{d}{dt}M = v_1 - v_3 \quad (12)$$

7.3 Species P

Name Pt

Initial amount 1 mol

This species takes part in four reactions (as a reactant in `ProteinD`, `DBT` and as a product in `TL` and as a modifier in `TC`).

$$\frac{d}{dt}P = v_2 - v_4 - v_5 \quad (13)$$

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