

SBML Model Report

Model name: “Leloup2003_CircClock_DD”



May 5, 2016

1 General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by Enuo He¹ at October 17th 2006 at 3:43 p. m. and last time modified at February 25th 2015 at 12:58 a. 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	16
events	0	constraints	0
reactions	48	function definitions	4
global parameters	0	unit definitions	2
rules	0	initial assignments	0

Model Notes

This model is according to the paper *Toward a detailed computational model for the mammalian circadian clock*. In this model only interlocked negative and positive regulation of Per, Cry, Bmal gene are involved. Some initial values were not provided, therefore they were chosen to fit the curve from the paper.

Figure2A re-produced by Copasi 4.0.19 and roadRunner online.

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2 Unit Definitions

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

2.1 Unit time

Definition 3600 s

2.2 Unit substance

Definition nmol

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 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`

4 Species

This model contains 16 species. 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
species_0	Mb	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_1	Bc	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_2	Bcp	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_3	Bn	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_4	Cc	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_5	Mc	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_6	Ccp	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_7	Mp	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_8	Pc	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_9	Pcp	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_10	PCc	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_11	PCcp	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_12	PCn	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_13	Bnp	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_14	PCnp	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
species_15	In	cell	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square

5 Function definitions

This is an overview of four function definitions.

5.1 Function definition `function_3`

Name Activation of gene

Arguments V_s , B , n , K

Mathematical Expression

$$\frac{V_s \cdot B^n}{K^n + B^n} \quad (1)$$

5.2 Function definition `function_2`

Name Michaelis-Menten(irreversible)

Arguments V , substrate, K_m

Mathematical Expression

$$\frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (2)$$

5.3 Function definition `function_1`

Name mRNA translated into protein

Arguments k , mRNA

Mathematical Expression

$$k \cdot \text{mRNA} \quad (3)$$

5.4 Function definition `function_0`

Name Inhibition of gene

Arguments v_{sb} , K , m , B_n

Mathematical Expression

$$\frac{v_{sb} \cdot K^m}{K^m + B_n^m} \quad (4)$$

6 Reactions

This model contains 48 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 4: Overview of all reactions

Nº	Id	Name	Reaction Equation	SBO
1	reaction_0	Mb synthesized	$\emptyset \xrightarrow{\text{species_3}} \text{species_0}$	
2	reaction_1	Mb translated into protein	$\emptyset \xrightarrow{\text{species_0}} \text{species_1}$	
3	reaction_2	Mb nonspecific degradation	$\text{species_0} \longrightarrow \emptyset$	
4	reaction_3	Bc phosphorylation	$\text{species_1} \longrightarrow \text{species_2}$	
5	reaction_4	Bc transfered from cytosolic to nuclear	$\text{species_1} \rightleftharpoons \text{species_3}$	
6	reaction_5	Mc translated into protein	$\emptyset \xrightarrow{\text{species_5}} \text{species_4}$	
7	reaction_6	Mc nonspecific degradation	$\text{species_5} \longrightarrow \emptyset$	
8	reaction_7	Cc phosphorylation	$\text{species_4} \longrightarrow \text{species_6}$	
9	reaction_8	Ccp specific degradation	$\text{species_6} \longrightarrow \emptyset$	
10	reaction_9	Mp synthesis	$\emptyset \xrightarrow{\text{species_3}} \text{species_7}$	
11	reaction_10	Mp translated into protein	$\emptyset \xrightarrow{\text{species_7}} \text{species_8}$	
12	reaction_11	Pcp specific degradation	$\text{species_9} \longrightarrow \emptyset$	
13	reaction_12	Pc phosphorylation	$\text{species_8} \longrightarrow \text{species_9}$	
14	reaction_13	Cc and Pc produce complex Per_Cry	$\text{species_4} + \text{species_8} \rightleftharpoons \text{species_10}$	
15	reaction_14	PCc phosphorylation	$\text{species_10} \longrightarrow \text{species_11}$	
16	reaction_15	PCcp specific degradation	$\text{species_11} \longrightarrow \emptyset$	
17	reaction_16	PCc transfered into nuclear	$\text{species_10} \rightleftharpoons \text{species_12}$	
18	reaction_17	PCnp nonspecific degradation	$\text{species_14} \longrightarrow \emptyset$	
19	reaction_18	Bcp nonspecific degradation	$\text{species_2} \longrightarrow \emptyset$	
20	reaction_19	Bnp nonspecific degradation	$\text{species_13} \longrightarrow \emptyset$	

Nº	Id	Name	Reaction Equation	SBO
21	reaction_20	Mc synthesis	$\emptyset \xrightarrow{\text{species}_3} \text{species}_5$	
22	reaction_21	PCn phosphorylation	$\text{species}_{12} \longrightarrow \text{species}_{14}$	
23	reaction_22	Mp nonspecific degradation	$\text{species}_7 \longrightarrow \emptyset$	
24	reaction_23	Per_Cry and Clock_Bmal form inactive complex	$\text{species}_{12} + \text{species}_3 \rightleftharpoons \text{species}_{15}$	
25	reaction_24	Mb specific degradation	$\text{species}_0 \longrightarrow \emptyset$	
26	reaction_25	Mc specific degradation	$\text{species}_5 \longrightarrow \emptyset$	
27	reaction_26	Mp specific degradation	$\text{species}_7 \longrightarrow \emptyset$	
28	reaction_27	Pc nonspecific degradation	$\text{species}_8 \longrightarrow \emptyset$	
29	reaction_28	Cc nonspecific degradation	$\text{species}_4 \longrightarrow \emptyset$	
30	reaction_29	Pcp nonspecific degradation	$\text{species}_9 \longrightarrow \emptyset$	
31	reaction_30	Ccp nonspecific degradation	$\text{species}_6 \longrightarrow \emptyset$	
32	reaction_31	PCcp nonspecific degradation	$\text{species}_{11} \longrightarrow \emptyset$	
33	reaction_32	PCc nonspecific degradation	$\text{species}_{10} \longrightarrow \emptyset$	
34	reaction_33	PCnp specific degradation	$\text{species}_{14} \longrightarrow \emptyset$	
35	reaction_34	Bc nonspecific degradation	$\text{species}_1 \longrightarrow \emptyset$	
36	reaction_35	Bcp specific degradation	$\text{species}_2 \longrightarrow \emptyset$	
37	reaction_36	Bn phosphorylation	$\text{species}_3 \longrightarrow \text{species}_{13}$	
38	reaction_37	Bnp specific degradation	$\text{species}_{13} \longrightarrow \emptyset$	
39	reaction_38	In nonspecific degradation	$\text{species}_{15} \longrightarrow \emptyset$	
40	reaction_39	In specific degradation	$\text{species}_{15} \longrightarrow \emptyset$	
41	reaction_40	Bn nonspecific degradation	$\text{species}_3 \longrightarrow \emptyset$	
42	reaction_41	Bcp dephosphorylation	$\text{species}_2 \longrightarrow \text{species}_1$	
43	reaction_42	Bnp dephosphorylation	$\text{species}_{13} \longrightarrow \text{species}_3$	
44	reaction_43	Ccp dephosphorylation	$\text{species}_6 \longrightarrow \text{species}_4$	
45	reaction_44	Pcp dephosphorylation	$\text{species}_9 \longrightarrow \text{species}_8$	
46	reaction_45	PCnp dephosphorylation	$\text{species}_{14} \longrightarrow \text{species}_{12}$	
47	reaction_46	PCn nonspecific degradation	$\text{species}_{12} \longrightarrow \emptyset$	

Nº	Id	Name	Reaction Equation	SBO
48	reaction_47	PCcp dephosphorylation	species_11 \longrightarrow species_10	

6.1 Reaction `reaction_0`

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

Name Mb synthesized

Reaction equation



Modifier

Table 5: Properties of each modifier.

Id	Name	SBO
species_3	Bn	

Product

Table 6: Properties of each product.

Id	Name	SBO
species_0	Mb	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \text{vol}(\text{cell}) \cdot \text{function_0}(\text{vsb}, K, m, [\text{species_3}]) \quad (6)$$

$$\text{function_0}(\text{vsb}, K, m, \text{Bn}) = \frac{\text{vsb} \cdot K^m}{K^m + \text{Bn}^m} \quad (7)$$

$$\text{function_0}(\text{vsb}, K, m, \text{Bn}) = \frac{\text{vsb} \cdot K^m}{K^m + \text{Bn}^m} \quad (8)$$

Table 7: Properties of each parameter.

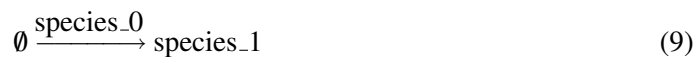
Id	Name	SBO	Value	Unit	Constant
vsb	Kib		1.0		✓
K			2.2		✓
m			2.0		✓

6.2 Reaction `reaction_1`

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

Name Mb translated into protein

Reaction equation



Modifier

Table 8: Properties of each modifier.

Id	Name	SBO
species_0	Mb	

Product

Table 9: Properties of each product.

Id	Name	SBO
species_1	Bc	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \text{vol}(\text{cell}) \cdot \text{function_1}(k, [\text{species_0}]) \quad (10)$$

$$\text{function_1}(k, \text{mRNA}) = k \cdot \text{mRNA} \quad (11)$$

$$\text{function_1}(k, \text{mRNA}) = k \cdot \text{mRNA} \quad (12)$$

Table 10: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k	ksb		0.12		<input checked="" type="checkbox"/>

6.3 Reaction [reaction_2](#)

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

Name Mb nonspecific degradation

Reaction equation



Reactant

Table 11: Properties of each reactant.

Id	Name	SBO
species_0	Mb	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \text{vol}(\text{cell}) \cdot k1 \cdot [\text{species_0}] \quad (14)$$

Table 12: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kdmb		0.01		<input checked="" type="checkbox"/>

6.4 Reaction [reaction_3](#)

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

Name Bc phosphorylation

Reaction equation



Reactant

Table 13: Properties of each reactant.

Id	Name	SBO
species_1	Bc	

Product

Table 14: Properties of each product.

Id	Name	SBO
species_2	Bcp	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_1}], K_m) \quad (16)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (17)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (18)$$

Table 15: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V1b		0.5		<input checked="" type="checkbox"/>
Km	Kp		0.1		<input checked="" type="checkbox"/>

6.5 Reaction `reaction_4`

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

Name Bc transfered from cytosolic to nuclear

Reaction equation



Reactant

Table 16: Properties of each reactant.

Id	Name	SBO
species_1	Bc	

Product

Table 17: Properties of each product.

Id	Name	SBO
species_3	Bn	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \text{vol}(\text{cell}) \cdot (k1 \cdot [\text{species}_1] - k2 \cdot [\text{species}_3]) \quad (20)$$

Table 18: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k5		0.4		<input checked="" type="checkbox"/>
k2	k6		0.2		<input checked="" type="checkbox"/>

6.6 Reaction `reaction_5`

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

Name Mc translated into protein

Reaction equation



Modifier

Table 19: Properties of each modifier.

Id	Name	SBO
species_5	Mc	

Product

Table 20: Properties of each product.

Id	Name	SBO
species_4	Cc	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \text{vol}(\text{cell}) \cdot \text{function_1}(k, [\text{species_5}]) \quad (22)$$

$$\text{function_1}(k, \text{mRNA}) = k \cdot \text{mRNA} \quad (23)$$

$$\text{function_1}(k, \text{mRNA}) = k \cdot \text{mRNA} \quad (24)$$

Table 21: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k	ksc		1.6		<input checked="" type="checkbox"/>

6.7 Reaction `reaction_6`

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

Name Mc nonspecific degradation

Reaction equation



Reactant

Table 22: Properties of each reactant.

Id	Name	SBO
species_5	Mc	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \text{vol}(\text{cell}) \cdot k_1 \cdot [\text{species}_5] \quad (26)$$

Table 23: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kdmc		0.01		<input checked="" type="checkbox"/>

6.8 Reaction `reaction_7`

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

Name Cc phosphorylation

Reaction equation



Reactant

Table 24: Properties of each reactant.

Id	Name	SBO
species_4	Cc	

Product

Table 25: Properties of each product.

Id	Name	SBO
species_6	Ccp	

Kinetic Law

Derived unit contains undeclared units

$$v_8 = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_4}], K_m) \quad (28)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (29)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (30)$$

Table 26: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V1c		0.6		<input checked="" type="checkbox"/>
Km	Kp		0.1		<input checked="" type="checkbox"/>

6.9 Reaction `reaction_8`

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

Name Ccp specific degradation

Reaction equation



Reactant

Table 27: Properties of each reactant.

Id	Name	SBO
<code>species_6</code>	Ccp	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_6}], K_m) \quad (32)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (33)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (34)$$

Table 28: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	vdcc		0.7		<input checked="" type="checkbox"/>
K _m	K _d		0.3		<input checked="" type="checkbox"/>

6.10 Reaction `reaction_9`

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

Name Mp synthesis

Reaction equation



Modifier

Table 29: Properties of each modifier.

Id	Name	SBO
species_3	Bn	

Product

Table 30: Properties of each product.

Id	Name	SBO
species_7	Mp	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \text{vol}(\text{cell}) \cdot \text{function_3}(V_s, [\text{species_3}], n, K) \quad (36)$$

$$\text{function_3}(V_s, B, n, K) = \frac{V_s \cdot B^n}{K^n + B^n} \quad (37)$$

$$\text{function_3}(V_s, B, n, K) = \frac{V_s \cdot B^n}{K^n + B^n} \quad (38)$$

Table 31: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vs	vsp		1.5		<input checked="" type="checkbox"/>
n			4.0		<input checked="" type="checkbox"/>
K	Kap		0.7		<input checked="" type="checkbox"/>

6.11 Reaction `reaction_10`

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

Name Mp translated into protein

Reaction equation



Modifier

Table 32: Properties of each modifier.

Id	Name	SBO
species_7	Mp	

Product

Table 33: Properties of each product.

Id	Name	SBO
species_8	Pc	

Kinetic Law

Derived unit contains undeclared units

$$v_{11} = \text{vol}(\text{cell}) \cdot \text{function_1}(k, [\text{species_7}]) \quad (40)$$

$$\text{function_1}(k, \text{mRNA}) = k \cdot \text{mRNA} \quad (41)$$

$$\text{function_1}(k, \text{mRNA}) = k \cdot \text{mRNA} \quad (42)$$

Table 34: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k	ksp		0.6		<input checked="" type="checkbox"/>

6.12 Reaction [reaction_11](#)

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

Name Pcp specific degradation

Reaction equation



Reactant

Table 35: Properties of each reactant.

Id	Name	SBO
species_9	Pcp	

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_9}], K_m) \quad (44)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (45)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (46)$$

Table 36: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	vdpc		0.7		<input checked="" type="checkbox"/>
K _m	Kd		0.3		<input checked="" type="checkbox"/>

6.13 Reaction `reaction_12`

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

Name Pc phosphorylation

Reaction equation



Reactant

Table 37: Properties of each reactant.

Id	Name	SBO
species_8	Pc	

Product

Table 38: Properties of each product.

Id	Name	SBO
species_9	Pcp	

Kinetic Law

Derived unit contains undeclared units

$$v_{13} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_8}], \text{Km}) \quad (48)$$

$$\text{function_2}(V, \text{substrate}, \text{Km}) = \frac{V \cdot \text{substrate}}{\text{Km} + \text{substrate}} \quad (49)$$

$$\text{function_2}(V, \text{substrate}, \text{Km}) = \frac{V \cdot \text{substrate}}{\text{Km} + \text{substrate}} \quad (50)$$

Table 39: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V1p		0.4		<input checked="" type="checkbox"/>
Km	Kp		0.1		<input checked="" type="checkbox"/>

6.14 Reaction `reaction_13`

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

Name Cc and Pc produce complex Per_Cry

Reaction equation



Reactants

Table 40: Properties of each reactant.

Id	Name	SBO
species_4	Cc	
species_8	Pc	

Product

Table 41: Properties of each product.

Id	Name	SBO
species_10	PCc	

Kinetic Law

Derived unit contains undeclared units

$$v_{14} = \text{vol}(\text{cell}) \cdot (k1 \cdot [\text{species_4}] \cdot [\text{species_8}] - k2 \cdot [\text{species_10}]) \quad (52)$$

Table 42: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k3		0.4		<input checked="" type="checkbox"/>
k2	k4		0.2		<input checked="" type="checkbox"/>

6.15 Reaction `reaction_14`

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

Name PCc phosphorylation

Reaction equation



Reactant

Table 43: Properties of each reactant.

Id	Name	SBO
species_10	PCc	

Product

Table 44: Properties of each product.

Id	Name	SBO
species_11	PCcp	

Kinetic Law

Derived unit contains undeclared units

$$v_{15} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_10}], \text{Km}) \quad (54)$$

$$\text{function_2}(V, \text{substrate}, \text{Km}) = \frac{V \cdot \text{substrate}}{\text{Km} + \text{substrate}} \quad (55)$$

$$\text{function_2}(V, \text{substrate}, \text{Km}) = \frac{V \cdot \text{substrate}}{\text{Km} + \text{substrate}} \quad (56)$$

Table 45: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	Vlpc		0.4		<input checked="" type="checkbox"/>
Km	Kp		0.1		<input checked="" type="checkbox"/>

6.16 Reaction `reaction_15`

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

Name PCcp specific degradation

Reaction equation



Reactant

Table 46: Properties of each reactant.

Id	Name	SBO
species_11	PCcp	

Kinetic Law

Derived unit contains undeclared units

$$v_{16} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_11}], \text{Km}) \quad (58)$$

$$\text{function_2}(V, \text{substrate}, \text{Km}) = \frac{V \cdot \text{substrate}}{\text{Km} + \text{substrate}} \quad (59)$$

$$\text{function_2}(V, \text{substrate}, \text{Km}) = \frac{V \cdot \text{substrate}}{\text{Km} + \text{substrate}} \quad (60)$$

Table 47: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	vdpc		0.7		<input checked="" type="checkbox"/>
Km	Kd		0.3		<input checked="" type="checkbox"/>

6.17 Reaction [reaction_16](#)

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

Name PCc transfered into nuclear

Reaction equation



Reactant

Table 48: Properties of each reactant.

Id	Name	SBO
species_10	PCc	

Product

Table 49: Properties of each product.

Id	Name	SBO
species_12	PCn	

Kinetic Law

Derived unit contains undeclared units

$$v_{17} = \text{vol}(\text{cell}) \cdot (k_1 \cdot [\text{species_10}] - k_2 \cdot [\text{species_12}]) \quad (62)$$

Table 50: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.4		<input checked="" type="checkbox"/>
k2	k2		0.2		<input checked="" type="checkbox"/>

6.18 Reaction [reaction_17](#)

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

Name PCnp nonspecific degradation

Reaction equation



Reactant

Table 51: Properties of each reactant.

Id	Name	SBO
species_14	PCnp	

Kinetic Law

Derived unit contains undeclared units

$$v_{18} = \text{vol}(\text{cell}) \cdot k1 \cdot [\text{species_14}] \quad (64)$$

Table 52: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kdn		0.01		<input checked="" type="checkbox"/>

6.19 Reaction `reaction_18`

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

Name Bcp nonspecific degradation

Reaction equation



Reactant

Table 53: Properties of each reactant.

Id	Name	SBO
species_2	Bcp	

Kinetic Law

Derived unit contains undeclared units

$$v_{19} = \text{vol}(\text{cell}) \cdot k1 \cdot [\text{species_2}] \quad (66)$$

Table 54: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kdn		0.01		<input checked="" type="checkbox"/>

6.20 Reaction [reaction_19](#)

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

Name Bnp nonspecific degradation

Reaction equation



Reactant

Table 55: Properties of each reactant.

Id	Name	SBO
species_13	Bnp	

Kinetic Law

Derived unit contains undeclared units

$$v_{20} = \text{vol}(\text{cell}) \cdot k1 \cdot [\text{species_13}] \quad (68)$$

Table 56: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kdn		0.01		<input checked="" type="checkbox"/>

6.21 Reaction [reaction_20](#)

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

Name Mc synthesis

Reaction equation



Modifier

Table 57: Properties of each modifier.

Id	Name	SBO
species_3	Bn	

Product

Table 58: Properties of each product.

Id	Name	SBO
species_5	Mc	

Kinetic Law

Derived unit contains undeclared units

$$v_{21} = \text{vol}(\text{cell}) \cdot \text{function_3}(V_s, [\text{species_3}], n, K) \quad (70)$$

$$\text{function_3}(V_s, B, n, K) = \frac{V_s \cdot B^n}{K^n + B^n} \quad (71)$$

$$\text{function_3}(V_s, B, n, K) = \frac{V_s \cdot B^n}{K^n + B^n} \quad (72)$$

Table 59: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vs	vsc		1.1		<input checked="" type="checkbox"/>
n			4.0		<input checked="" type="checkbox"/>
K	Kac		0.6		<input checked="" type="checkbox"/>

6.22 Reaction [reaction_21](#)

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

Name PCn phosphorylation

Reaction equation



Reactant

Table 60: Properties of each reactant.

Id	Name	SBO
species_12	PCn	

Product

Table 61: Properties of each product.

Id	Name	SBO
species_14	PCnp	

Kinetic Law

Derived unit contains undeclared units

$$v_{22} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_12}], K_m) \quad (74)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (75)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (76)$$

Table 62: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V3pc		0.4		<input checked="" type="checkbox"/>
K _m	Kp		0.1		<input checked="" type="checkbox"/>

6.23 Reaction `reaction_22`

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

Name Mp nonspecific degradation

Reaction equation



Reactant

Table 63: Properties of each reactant.

Id	Name	SBO
species_7	Mp	

Kinetic Law

Derived unit contains undeclared units

$$v_{23} = \text{vol}(\text{cell}) \cdot k1 \cdot [\text{species}_7] \quad (78)$$

Table 64: Properties of each parameter.

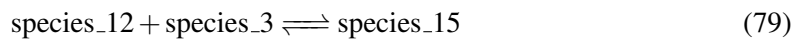
Id	Name	SBO	Value	Unit	Constant
k1	kdmp		0.01		<input checked="" type="checkbox"/>

6.24 Reaction [reaction_23](#)

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

Name Per_Cry and Clock_Bmal form inactive complex

Reaction equation



Reactants

Table 65: Properties of each reactant.

Id	Name	SBO
species_12	PCn	
species_3	Bn	

Product

Table 66: Properties of each product.

Id	Name	SBO
species_15	In	

Kinetic Law**Derived unit** contains undeclared units

$$v_{24} = \text{vol}(\text{cell}) \cdot (k1 \cdot [\text{species}_{12}] \cdot [\text{species}_{3}] - k2 \cdot [\text{species}_{15}]) \quad (80)$$

Table 67: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k7		0.5		<input checked="" type="checkbox"/>
k2	k8		0.1		<input checked="" type="checkbox"/>

6.25 Reaction [reaction_24](#)

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

Name Mb specific degradation**Reaction equation****Reactant**

Table 68: Properties of each reactant.

Id	Name	SBO
species_0	Mb	

Kinetic Law**Derived unit** contains undeclared units

$$v_{25} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species}_0], \text{Km}) \quad (82)$$

$$\text{function_2}(V, \text{substrate}, \text{Km}) = \frac{V \cdot \text{substrate}}{\text{Km} + \text{substrate}} \quad (83)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (84)$$

Table 69: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	vmb		0.8		<input checked="" type="checkbox"/>
K _m	Kmb		0.4		<input checked="" type="checkbox"/>

6.26 Reaction `reaction_25`

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

Name Mc specific degradation

Reaction equation



Reactant

Table 70: Properties of each reactant.

Id	Name	SBO
<code>species_5</code>	Mc	

Kinetic Law

Derived unit contains undeclared units

$$v_{26} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_5}], K_m) \quad (86)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (87)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (88)$$

Table 71: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	vmc		1.0		<input checked="" type="checkbox"/>
Km	Kmc		0.4		<input checked="" type="checkbox"/>

6.27 Reaction [reaction_26](#)

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

Name Mp specific degradation

Reaction equation



Reactant

Table 72: Properties of each reactant.

Id	Name	SBO
species_7	Mp	

Kinetic Law

Derived unit contains undeclared units

$$v_{27} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_7}], \text{Km}) \quad (90)$$

$$\text{function_2}(V, \text{substrate}, \text{Km}) = \frac{V \cdot \text{substrate}}{\text{Km} + \text{substrate}} \quad (91)$$

$$\text{function_2}(V, \text{substrate}, \text{Km}) = \frac{V \cdot \text{substrate}}{\text{Km} + \text{substrate}} \quad (92)$$

Table 73: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	vmp		1.10		<input checked="" type="checkbox"/>
Km	Kmp		0.31		<input checked="" type="checkbox"/>

6.28 Reaction [reaction_27](#)

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

Name Pc nonspecific degradation

Reaction equation



Reactant

Table 74: Properties of each reactant.

Id	Name	SBO
species_8	Pc	

Kinetic Law

Derived unit contains undeclared units

$$v_{28} = \text{vol}(\text{cell}) \cdot k1 \cdot [\text{species_8}] \quad (94)$$

Table 75: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kdn		0.01		<input checked="" type="checkbox"/>

6.29 Reaction [reaction_28](#)

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

Name Cc nonspecific degradation

Reaction equation



Reactant

Table 76: Properties of each reactant.

Id	Name	SBO
species_4	Cc	

Kinetic Law**Derived unit** contains undeclared units

$$v_{29} = \text{vol}(\text{cell}) \cdot k1 \cdot [\text{species}_4] \quad (96)$$

Table 77: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kdnc		0.12		<input checked="" type="checkbox"/>

6.30 Reaction [reaction_29](#)

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

Name Pcp nonspecific degradation**Reaction equation****Reactant**

Table 78: Properties of each reactant.

Id	Name	SBO
species_9	Pcp	

Kinetic Law**Derived unit** contains undeclared units

$$v_{30} = \text{vol}(\text{cell}) \cdot k1 \cdot [\text{species}_9] \quad (98)$$

Table 79: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kdn		0.01		<input checked="" type="checkbox"/>

6.31 Reaction [reaction_30](#)

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

Name Ccp nonspecific degradation

Reaction equation



Reactant

Table 80: Properties of each reactant.

Id	Name	SBO
species_6	Ccp	

Kinetic Law

Derived unit contains undeclared units

$$v_{31} = \text{vol}(\text{cell}) \cdot k1 \cdot [\text{species_6}] \quad (100)$$

Table 81: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kdn		0.01		<input checked="" type="checkbox"/>

6.32 Reaction [reaction_31](#)

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

Name PCcp nonspecific degradation

Reaction equation



Reactant

Table 82: Properties of each reactant.

Id	Name	SBO
species_11	PCcp	

Kinetic Law

Derived unit contains undeclared units

$$v_{32} = \text{vol}(\text{cell}) \cdot k1 \cdot [\text{species_11}] \quad (102)$$

Table 83: Properties of each parameter.

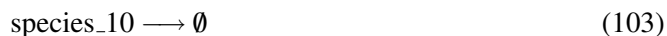
Id	Name	SBO	Value	Unit	Constant
k1	kdn		0.01		<input checked="" type="checkbox"/>

6.33 Reaction [reaction_32](#)

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

Name PCc nonspecific degradation

Reaction equation



Reactant

Table 84: Properties of each reactant.

Id	Name	SBO
species_10	PCc	

Kinetic Law

Derived unit contains undeclared units

$$v_{33} = \text{vol}(\text{cell}) \cdot k1 \cdot [\text{species_10}] \quad (104)$$

Table 85: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kdn		0.01		<input checked="" type="checkbox"/>

6.34 Reaction [reaction_33](#)

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

Name PCnp specific degradation

Reaction equation



Reactant

Table 86: Properties of each reactant.

Id	Name	SBO
species_14	PCnp	

Kinetic Law

Derived unit contains undeclared units

$$v_{34} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_14}], K_m) \quad (106)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (107)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (108)$$

Table 87: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	vdpcn		0.7		<input checked="" type="checkbox"/>
Km	Kd		0.3		<input checked="" type="checkbox"/>

6.35 Reaction [reaction_34](#)

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

Name Bc nonspecific degradation

Reaction equation



Reactant

Table 88: Properties of each reactant.

Id	Name	SBO
species_1	Bc	

Kinetic Law

Derived unit contains undeclared units

$$v_{35} = \text{vol}(\text{cell}) \cdot k1 \cdot [\text{species_1}] \quad (110)$$

Table 89: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kdn		0.01		<input checked="" type="checkbox"/>

6.36 Reaction [reaction_35](#)

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

Name Bcp specific degradation

Reaction equation



Reactant

Table 90: Properties of each reactant.

Id	Name	SBO
species_2	Bcp	

Kinetic Law

Derived unit contains undeclared units

$$v_{36} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_2}], K_m) \quad (112)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (113)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (114)$$

Table 91: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	vdbc		0.5		<input checked="" type="checkbox"/>
K _m	Kd		0.3		<input checked="" type="checkbox"/>

6.37 Reaction [reaction_36](#)

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

Name Bn phosphorylation

Reaction equation



Reactant

Table 92: Properties of each reactant.

Id	Name	SBO
species_3	Bn	

Product

Table 93: Properties of each product.

Id	Name	SBO
species_13	Bnp	

Kinetic Law

Derived unit contains undeclared units

$$v_{37} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_3}], \text{Km}) \quad (116)$$

$$\text{function_2}(V, \text{substrate}, \text{Km}) = \frac{V \cdot \text{substrate}}{\text{Km} + \text{substrate}} \quad (117)$$

$$\text{function_2}(V, \text{substrate}, \text{Km}) = \frac{V \cdot \text{substrate}}{\text{Km} + \text{substrate}} \quad (118)$$

Table 94: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V3b		0.5		<input checked="" type="checkbox"/>
Km	Kp		0.1		<input checked="" type="checkbox"/>

6.38 Reaction `reaction_37`

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

Name Bnp specific degradation

Reaction equation



Reactant

Table 95: Properties of each reactant.

Id	Name	SBO
species_13	Bnp	

Kinetic Law

Derived unit contains undeclared units

$$v_{38} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_13}], K_m) \quad (120)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (121)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (122)$$

Table 96: Properties of each parameter.

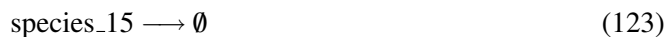
Id	Name	SBO	Value	Unit	Constant
V	vdbn		0.6		<input checked="" type="checkbox"/>
K _m	K _d		0.3		<input checked="" type="checkbox"/>

6.39 Reaction [reaction_38](#)

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

Name In nonspecific degradation

Reaction equation



Reactant

Table 97: Properties of each reactant.

Id	Name	SBO
species_15	In	

Kinetic Law

Derived unit contains undeclared units

$$v_{39} = \text{vol}(\text{cell}) \cdot k_1 \cdot [\text{species_15}] \quad (124)$$

Table 98: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kdn		0.01		<input checked="" type="checkbox"/>

6.40 Reaction [reaction_39](#)

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

Name In specific degradation

Reaction equation



Reactant

Table 99: Properties of each reactant.

Id	Name	SBO
species_15	In	

Kinetic Law

Derived unit contains undeclared units

$$v_{40} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_15}], K_m) \quad (126)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (127)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (128)$$

Table 100: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	vdin		0.8		<input checked="" type="checkbox"/>
Km	Kd		0.3		<input checked="" type="checkbox"/>

6.41 Reaction [reaction_40](#)

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

Name Bn nonspecific degradation

Reaction equation



Reactant

Table 101: Properties of each reactant.

Id	Name	SBO
species_3	Bn	

Kinetic Law

Derived unit contains undeclared units

$$v_{41} = \text{vol}(\text{cell}) \cdot k_1 \cdot [\text{species_3}] \quad (130)$$

Table 102: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kdn		0.01		<input checked="" type="checkbox"/>

6.42 Reaction [reaction_41](#)

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

Name Bcp dephosphorylation

Reaction equation



Reactant

Table 103: Properties of each reactant.

Id	Name	SBO
species_2	Bcp	

Product

Table 104: Properties of each product.

Id	Name	SBO
species_1	Bc	

Kinetic Law

Derived unit contains undeclared units

$$v_{42} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_2}], \text{Km}) \quad (132)$$

$$\text{function_2}(V, \text{substrate}, \text{Km}) = \frac{V \cdot \text{substrate}}{\text{Km} + \text{substrate}} \quad (133)$$

$$\text{function_2}(V, \text{substrate}, \text{Km}) = \frac{V \cdot \text{substrate}}{\text{Km} + \text{substrate}} \quad (134)$$

Table 105: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V2b		0.1		<input checked="" type="checkbox"/>
Km	Kdp		0.1		<input checked="" type="checkbox"/>

6.43 Reaction `reaction_42`

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

Name Bnp dephosphorylation

Reaction equation



Reactant

Table 106: Properties of each reactant.

Id	Name	SBO
species_13	Bnp	

Product

Table 107: Properties of each product.

Id	Name	SBO
species_3	Bn	

Kinetic Law

Derived unit contains undeclared units

$$v_{43} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_13}], K_m) \quad (136)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (137)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (138)$$

Table 108: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V4b		0.2		<input checked="" type="checkbox"/>
K _m	Kdp		0.1		<input checked="" type="checkbox"/>

6.44 Reaction [reaction_43](#)

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

Name Ccp dephosphorylation

Reaction equation



Reactant

Table 109: Properties of each reactant.

Id	Name	SBO
species_6	Ccp	

Product

Table 110: Properties of each product.

Id	Name	SBO
species_4	Cc	

Kinetic Law

Derived unit contains undeclared units

$$v_{44} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_6}], K_m) \quad (140)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (141)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (142)$$

Table 111: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V2c		0.1		<input checked="" type="checkbox"/>
K _m	Kdp		0.1		<input checked="" type="checkbox"/>

6.45 Reaction [reaction_44](#)

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

Name Pcp dephosphorylation

Reaction equation



Reactant

Table 112: Properties of each reactant.

Id	Name	SBO
species_9	Pcp	

Product

Table 113: Properties of each product.

Id	Name	SBO
species_8	Pc	

Kinetic Law

Derived unit contains undeclared units

$$v_{45} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_9}], K_m) \quad (144)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (145)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (146)$$

Table 114: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V2p		0.3		<input checked="" type="checkbox"/>
K _m	Kdp		0.1		<input checked="" type="checkbox"/>

6.46 Reaction [reaction_45](#)

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

Name PCnp dephosphorylation

Reaction equation



Reactant

Table 115: Properties of each reactant.

Id	Name	SBO
species_14	PCnp	

Product

Table 116: Properties of each product.

Id	Name	SBO
species_12	PCn	

Kinetic Law

Derived unit contains undeclared units

$$v_{46} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_14}], K_m) \quad (148)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (149)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (150)$$

Table 117: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V4pc		0.1		<input checked="" type="checkbox"/>
Km	Kdp		0.1		<input checked="" type="checkbox"/>

6.47 Reaction [reaction_46](#)

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

Name PCn nonspecific degradation

Reaction equation



Reactant

Table 118: Properties of each reactant.

Id	Name	SBO
species_12	PCn	

Kinetic Law

Derived unit contains undeclared units

$$v_{47} = \text{vol}(\text{cell}) \cdot k1 \cdot [\text{species_12}] \quad (152)$$

Table 119: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	kdn		0.01		<input checked="" type="checkbox"/>

6.48 Reaction [reaction_47](#)

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

Name PCcp dephosphorylation

Reaction equation



Reactant

Table 120: Properties of each reactant.

Id	Name	SBO
species_11	PCcp	

Product

Table 121: Properties of each product.

Id	Name	SBO
species_10	PCc	

Id	Name	SBO
----	------	-----

Kinetic Law

Derived unit contains undeclared units

$$v_{48} = \text{vol}(\text{cell}) \cdot \text{function_2}(V, [\text{species_11}], K_m) \quad (154)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (155)$$

$$\text{function_2}(V, \text{substrate}, K_m) = \frac{V \cdot \text{substrate}}{K_m + \text{substrate}} \quad (156)$$

Table 122: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V2pc		0.1		✓
K _m	Kdp		0.1		✓

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 `species_0`

Name Mb

Notes The initial concentration of Mb got from the curve in the paper at time=0

Initial concentration 9 nmol · l⁻¹

This species takes part in four reactions (as a reactant in [reaction_2](#), [reaction_24](#) and as a product in [reaction_0](#) and as a modifier in [reaction_1](#)).

$$\frac{d}{dt}\text{species}_0 = v_1 - v_3 - v_{25} \quad (157)$$

7.2 Species [species_1](#)

Name Bc

Notes In order to get the similar shape of the plot, we assigned 2nM as initial concentration for Bc

Initial concentration $2 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in five reactions (as a reactant in [reaction_3](#), [reaction_4](#), [reaction_34](#) and as a product in [reaction_1](#), [reaction_41](#)).

$$\frac{d}{dt}\text{species}_1 = v_2 + v_{42} - v_4 - v_5 - v_{35} \quad (158)$$

7.3 Species [species_2](#)

Name Bcp

Initial concentration $0 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in four reactions (as a reactant in [reaction_18](#), [reaction_35](#), [reaction_41](#) and as a product in [reaction_3](#)).

$$\frac{d}{dt}\text{species}_2 = v_4 - v_{19} - v_{36} - v_{42} \quad (159)$$

7.4 Species [species_3](#)

Name Bn

Initial concentration $1.9 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in eight reactions (as a reactant in [reaction_23](#), [reaction_36](#), [reaction_40](#) and as a product in [reaction_4](#), [reaction_42](#) and as a modifier in [reaction_0](#), [reaction_9](#), [reaction_20](#)).

$$\frac{d}{dt}\text{species}_3 = v_5 + v_{43} - v_{24} - v_{37} - v_{41} \quad (160)$$

7.5 Species `species_4`

Name Cc

Initial concentration 0 nmol · l⁻¹

This species takes part in five reactions (as a reactant in [reaction_7](#), [reaction_13](#), [reaction_28](#) and as a product in [reaction_5](#), [reaction_43](#)).

$$\frac{d}{dt}\text{species}_4 = v_6 + v_{44} - v_8 - v_{14} - v_{29} \quad (161)$$

7.6 Species `species_5`

Name Mc

Notes Initial concentration for Mc got from the value of the curve at time=0 in the paper.

Initial concentration 1.4 nmol · l⁻¹

This species takes part in four reactions (as a reactant in [reaction_6](#), [reaction_25](#) and as a product in [reaction_20](#) and as a modifier in [reaction_5](#)).

$$\frac{d}{dt}\text{species}_5 = v_{21} - v_7 - v_{26} \quad (162)$$

7.7 Species `species_6`

Name Ccp

Initial concentration 0 nmol · l⁻¹

This species takes part in four reactions (as a reactant in [reaction_8](#), [reaction_30](#), [reaction_43](#) and as a product in [reaction_7](#)).

$$\frac{d}{dt}\text{species}_6 = v_8 - v_9 - v_{31} - v_{44} \quad (163)$$

7.8 Species `species_7`

Name Mp

Notes Initial concentration for Mp got from the value of curve at time=0 in the paper.

Initial concentration 1.6 nmol · l⁻¹

This species takes part in four reactions (as a reactant in [reaction_22](#), [reaction_26](#) and as a product in [reaction_9](#) and as a modifier in [reaction_10](#)).

$$\frac{d}{dt}\text{species}_7 = v_{10} - v_{23} - v_{27} \quad (164)$$

7.9 Species `species_8`

Name Pc

Initial concentration 0 nmol · l⁻¹

This species takes part in five reactions (as a reactant in [reaction_12](#), [reaction_13](#), [reaction_27](#) and as a product in [reaction_10](#), [reaction_44](#)).

$$\frac{d}{dt}\text{species_8} = v_{11} + v_{45} - v_{13} - v_{14} - v_{28} \quad (165)$$

7.10 Species `species_9`

Name Pcp

Initial concentration 0 nmol · l⁻¹

This species takes part in four reactions (as a reactant in [reaction_11](#), [reaction_29](#), [reaction_44](#) and as a product in [reaction_12](#)).

$$\frac{d}{dt}\text{species_9} = v_{13} - v_{12} - v_{30} - v_{45} \quad (166)$$

7.11 Species `species_10`

Name PCc

Initial concentration 0 nmol · l⁻¹

This species takes part in five reactions (as a reactant in [reaction_14](#), [reaction_16](#), [reaction_32](#) and as a product in [reaction_13](#), [reaction_47](#)).

$$\frac{d}{dt}\text{species_10} = v_{14} + v_{48} - v_{15} - v_{17} - v_{33} \quad (167)$$

7.12 Species `species_11`

Name PCcp

Initial concentration 0 nmol · l⁻¹

This species takes part in four reactions (as a reactant in [reaction_15](#), [reaction_31](#), [reaction_47](#) and as a product in [reaction_14](#)).

$$\frac{d}{dt}\text{species_11} = v_{15} - v_{16} - v_{32} - v_{48} \quad (168)$$

7.13 Species `species_12`

Name PCn

Initial concentration 1 nmol · l⁻¹

This species takes part in five reactions (as a reactant in [reaction_21](#), [reaction_23](#), [reaction_46](#) and as a product in [reaction_16](#), [reaction_45](#)).

$$\frac{d}{dt}\text{species_12} = v_{17} + v_{46} - v_{22} - v_{24} - v_{47} \quad (169)$$

7.14 Species `species_13`

Name Bnp

Initial concentration 0 nmol · l⁻¹

This species takes part in four reactions (as a reactant in [reaction_19](#), [reaction_37](#), [reaction_42](#) and as a product in [reaction_36](#)).

$$\frac{d}{dt}\text{species_13} = v_{37} - v_{20} - v_{38} - v_{43} \quad (170)$$

7.15 Species `species_14`

Name PCnp

Initial concentration 0 nmol · l⁻¹

This species takes part in four reactions (as a reactant in [reaction_17](#), [reaction_33](#), [reaction_45](#) and as a product in [reaction_21](#)).

$$\frac{d}{dt}\text{species_14} = v_{22} - v_{18} - v_{34} - v_{46} \quad (171)$$

7.16 Species `species_15`

Name In

Initial concentration 0 nmol · l⁻¹

This species takes part in three reactions (as a reactant in [reaction_38](#), [reaction_39](#) and as a product in [reaction_23](#)).

$$\frac{d}{dt}\text{species_15} = v_{24} - v_{39} - v_{40} \quad (172)$$

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