

SBML Model Report

Model name: “Zeilinger2006_PRR7-PRR9-Y”



May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by Harish Dharuri¹ at December eleventh 2006 at 5:12 p. m. and last time modified at July fifth 2012 at 2:39 p. 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	2
species types	0	species	19
events	1	constraints	0
reactions	46	function definitions	0
global parameters	91	unit definitions	5
rules	0	initial assignments	0

Model Notes

The model reproduces the circadian charecteristics as given in Table 1 for the PRR7-PRR9-Y model. The model makes use of the event section to introduce light at 30 hours. The Zeitgeber (ZT) times for species shown in Table 1 can be reproduced by looking at the time it takes for species to reach peak values after the introduction of light. The model was successfully tested on MathSBML.

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2 Unit Definitions

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

2.1 Unit `substance`

Name nanomoles

Definition nmol

2.2 Unit `time`

Name hour

Definition 3600 s

2.3 Unit `Hr_inv`

Name Hour_inv

Definition $(3600\text{ s})^{-1}$

2.4 Unit `nM`

Name nM

Definition $\text{nmol} \cdot \text{l}^{-1}$

2.5 Unit `nM_per_hour`

Name nM_per_hour

Definition $\text{nmol} \cdot \text{l}^{-1} \cdot (3600\text{ s})^{-1}$

2.6 Unit volume

Notes Litre is the predefined SBML unit for volume.

Definition 1

2.7 Unit area

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

Definition m^2

2.8 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
cytoplasm	cytoplasm		3	1	litre	<input checked="" type="checkbox"/>	
nucleus	nucleus		3	1	litre	<input checked="" type="checkbox"/>	cytoplasm

3.1 Compartment cytoplasm

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

Name cytoplasm

3.2 Compartment nucleus

This is a three dimensional compartment with a constant size of one litre, which is surrounded by cytoplasm (cytoplasm).

Name nucleus

4 Species

This model contains 19 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
cLc	cLc	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cLm	cLm	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cLn	cLn	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cP7c	cP7c	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cP7m	cP7m	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cP7n	cP7n	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cP9c	cP9c	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cP9m	cP9m	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cP9n	cP9n	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cPn	cPn	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cTc	cTc	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cTm	cTm	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cTn	cTn	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cXc	cXc	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cXm	cXm	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cXn	cXn	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cYc	cYc	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cYm	cYm	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square
cYn	cYn	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	\square	\square

5 Parameters

This model contains 91 global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
q1	q1		13.145	$(3600 \text{ s})^{-1}$	✓
n1	n1		1.099	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	✓
g1	g1		11.799	$\text{nmol} \cdot \text{l}^{-1}$	✓
m1	m1		3.762	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	✓
k1	k1		4.103	$\text{nmol} \cdot \text{l}^{-1}$	✓
p1	p1		7.541	$(3600 \text{ s})^{-1}$	✓
r1	r1		9.938	$(3600 \text{ s})^{-1}$	✓
r2	r2		9.644	$(3600 \text{ s})^{-1}$	✓
m2	m2		22.520	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	✓
k2	k2		29.568	$\text{nmol} \cdot \text{l}^{-1}$	✓
m3	m3		4.555	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	✓
k3	k3		18.634	$\text{nmol} \cdot \text{l}^{-1}$	✓
n2	n2		13.507	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	✓
g2	g2		8.733	$\text{nmol} \cdot \text{l}^{-1}$	✓
g3	g3		17.989	$\text{nmol} \cdot \text{l}^{-1}$	✓
m4	m4		7.160	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	✓
k4	k4		4.773	$\text{nmol} \cdot \text{l}^{-1}$	✓
p2	p2		1.445	$(3600 \text{ s})^{-1}$	✓
p3	p3		3.147	$(3600 \text{ s})^{-1}$	✓
r5	r5		31.008	$(3600 \text{ s})^{-1}$	✓
r6	r6		12.504	$(3600 \text{ s})^{-1}$	✓
m10	m10		35.198	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	✓
k8	k8		9.534	$\text{nmol} \cdot \text{l}^{-1}$	✓
m11	m11		7.027	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	✓
k9	k9		45.134	$\text{nmol} \cdot \text{l}^{-1}$	✓
q2	q2		12.744	$(3600 \text{ s})^{-1}$	✓
n4	n4		1.883	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	✓

Id	Name	SBO	Value	Unit	Constant
n5	n5		1.506	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
g5	g5		1.509	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
g6	g6		20.758	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
m12	m12		3.456	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
k10	k10		16.404	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
r3	r3		14.761	$(3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
r4	r4		0.256	$(3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
m5	m5		1.551	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
m6	m6		1.419	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
k5	k5		3.020	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
m7	m7		1.679	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
m8	m8		11.355	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
k6	k6		55.380	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
n3	n3		1.724	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
g4	g4		5.655	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
m9	m9		5.785	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
k7	k7		29.321	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
p4	p4		2.860	$(3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
r7	r7		5.735	$(3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
r8	r8		37.330	$(3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
m13	m13		9.154	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
k11	k11		55.733	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
m14	m14		7.555	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
k12	k12		9.041	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
p5	p5		0.500	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
k13	k13		1.200	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
q3	q3		1.000	$(3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
m15	m15		1.200	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
g7	g7		4.643	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>

Id	Name	SBO	Value	Unit	Constant
g8	g8		4.799	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
n6	n6		4.604	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
g9	g9		4.805	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
m16	m16		10.136	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
k14	k14		14.031	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
p6	p6		2.025	$(3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
r9	r9		3.300	$(3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
r10	r10		30.768	$(3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
m17	m17		7.248	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
k15	k15		19.799	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
m18	m18		7.828	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
k16	k16		8.798	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
n7	n7		4.438	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
g10	g10		17.795	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
m19	m19		10.129	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
k17	k17		16.071	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
p7	p7		1.093	$(3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
r11	r11		9.780	$(3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
r12	r12		15.458	$(3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
m20	m20		0.532	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
k18	k18		48.500	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
m21	m21		8.594	$\text{nmol} \cdot \text{l}^{-1} \cdot (3600 \text{ s})^{-1}$	<input checked="" type="checkbox"/>
k19	k19		57.467	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>
ld	ld		0.000	dimensionless	<input type="checkbox"/>
lmax	lmax		1.000	dimensionless	<input checked="" type="checkbox"/>
a	a		1.878	dimensionless	<input checked="" type="checkbox"/>
b	b		1.541	dimensionless	<input checked="" type="checkbox"/>
c	c		1.472	dimensionless	<input checked="" type="checkbox"/>
d	d		4.063	dimensionless	<input checked="" type="checkbox"/>
e	e		3.572	dimensionless	<input checked="" type="checkbox"/>
f	f		2.013	dimensionless	<input checked="" type="checkbox"/>
h	h		3.329	dimensionless	<input checked="" type="checkbox"/>
i	i		3.590	dimensionless	<input checked="" type="checkbox"/>

Id	Name	SBO	Value	Unit	Constant
j	j		1.269	dimensionless	<input checked="" type="checkbox"/>
k	k		1.521	dimensionless	<input checked="" type="checkbox"/>

6 Event

This is an overview of one event. Each event is initiated whenever its trigger condition switches from `false` to `true`. A delay function postpones the effects of an event to a later time point. At the time of execution, an event can assign values to species, parameters or compartments if these are not set to constant.

6.1 Event `event_0000001`

Trigger condition $t > 30$ (1)

Assignment $ld = 1$ (2)

7 Reactions

This model contains 46 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	R1	Light dependent cLm transcription	$\emptyset \xrightarrow{cPn} cLm$	
2	R2	Light independent cLm transcription	$\emptyset \xrightarrow{cXn, cP7n, cP9n} cLm$	
3	R3	cLm degradation	$cLm \longrightarrow \emptyset$	
4	R4	cLc synthesis	$\emptyset \xrightarrow{cLm} cLc$	
5	R5	cLc transport into nucleus	$cLc \longrightarrow cLn$	
6	R6	cLn transport into cytoplasm	$cLn \longrightarrow cLc$	
7	R7	cLc degradation	$cLc \longrightarrow \emptyset$	
8	R8	cLn degradation	$cLn \longrightarrow \emptyset$	
9	R9	cTm transcription	$\emptyset \xrightarrow{cYn, cLn} cTm$	
10	R10	cTm degradation	$cTm \longrightarrow \emptyset$	
11	R11	cTc synthesis	$\emptyset \xrightarrow{cTm} cTc$	
12	R12	cTc transport into nucleus	$cTc \longrightarrow cTn$	
13	R13	cTn transport into cytoplasm	$cTn \longrightarrow cTc$	
14	R14	cTc degradation	$cTc \longrightarrow \emptyset$	
15	R15	cTn degradation	$cTn \longrightarrow \emptyset$	
16	R16	cXm transcription	$\emptyset \xrightarrow{cTn} cXm$	
17	R17	cXm degradation	$cXm \longrightarrow \emptyset$	
18	R18	cXc synthesis	$\emptyset \xrightarrow{cXm} cXc$	
19	R19	cXc transport into nucleus	$cXc \longrightarrow cXn$	
20	R20	cXn transport into cytoplasm	$cXn \longrightarrow cXc$	

Nº	Id	Name	Reaction Equation	SBO
21	R21	cXc degradation	$cXc \longrightarrow \emptyset$	
22	R22	cXn degradation	$cXn \longrightarrow \emptyset$	
23	R23	cYm transcription	$\emptyset \xrightarrow{cTn, cLn, cPn} cYm$	
24	R24	cYm degradation	$cYm \longrightarrow \emptyset$	
25	R25	cYc synthesis	$\emptyset \xrightarrow{cYm} cYc$	
26	R26	cYc transport to nucleus	$cYc \longrightarrow cYn$	
27	R27	cYn transport to cytoplasm	$cYn \longrightarrow cYc$	
28	R28	cYc degradation	$cYc \longrightarrow \emptyset$	
29	R29	cYn degradation	$cYn \longrightarrow \emptyset$	
30	R30	cPn synthesis	$\emptyset \longrightarrow cPn$	
31	R31a	cPn degradation	$cPn \longrightarrow \emptyset$	
32	R31b	Light dependent cPn degradation	$cPn \longrightarrow \emptyset$	
33	R32	cP7m transcription	$\emptyset \xrightarrow{cLn} cP7m$	
34	R33	cP7m degradation	$cP7m \longrightarrow \emptyset$	
35	R34	cP7c synthesis	$\emptyset \xrightarrow{cP7m} cP7c$	
36	R35	cP7c transport to nucleus	$cP7c \longrightarrow cP7n$	
37	R36	cP7n transport to cytoplasm	$cP7n \longrightarrow cP7c$	
38	R37	cP7c degradation	$cP7c \longrightarrow \emptyset$	
39	R38	cP7n degradation	$cP7n \longrightarrow \emptyset$	
40	R39	cP9m transcription	$\emptyset \xrightarrow{cLn} cP9m$	
41	R40	cP9m degradation	$cP9m \longrightarrow \emptyset$	
42	R41	cP9c synthesis	$\emptyset \xrightarrow{cP9m} cP9c$	
43	R42	cP9c transport to nucleus	$cP9c \longrightarrow cP9n$	
44	R43	cP9n transport to cytoplasm	$cP9n \longrightarrow cP9c$	
45	R44	cP9c degradation	$cP9c \longrightarrow \emptyset$	
46	R45	cP9n degradation	$cP9n \longrightarrow \emptyset$	

7.1 Reaction R1

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

Name Light dependent cLm transcription

Reaction equation



Modifier

Table 6: Properties of each modifier.

Id	Name	SBO
cPn	cPn	

Product

Table 7: Properties of each product.

Id	Name	SBO
cLm	cLm	

Kinetic Law

Derived unit $(3600 \text{ s})^{-1} \cdot \text{nmol}$

$$v_1 = \text{vol}(\text{nucleus}) \cdot \text{ld} \cdot q_1 \cdot [cPn] \quad (4)$$

7.2 Reaction R2

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

Name Light independent cLm transcription

Reaction equation



Modifiers

Table 8: Properties of each modifier.

Id	Name	SBO
cXn	cXn	
cP7n	cP7n	
cP9n	cP9n	

Product

Table 9: Properties of each product.

Id	Name	SBO
cLm	cLm	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \text{vol}(\text{nucleus}) \cdot \frac{n1 \cdot [cXn]^a}{g1^a + [cXn]^a} \cdot \frac{g7^h}{g7^h + [cP7n]^h} \cdot \frac{g8^i}{g8^i + [cP9n]^i} \quad (6)$$

7.3 Reaction R3

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

Name cLm degradation

Reaction equation



Reactant

Table 10: Properties of each reactant.

Id	Name	SBO
cLm	cLm	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600 \text{ s})^{-1}$

$$v_3 = \frac{\text{vol}(\text{nucleus}) \cdot m1 \cdot [\text{cLm}]}{k1 + [\text{cLm}]} \quad (8)$$

7.4 Reaction R4

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

Name cLc synthesis

Reaction equation



Modifier

Table 11: Properties of each modifier.

Id	Name	SBO
cLm	cLm	

Product

Table 12: Properties of each product.

Id	Name	SBO
cLc	cLc	

Kinetic Law

Derived unit $(3600 \text{ s})^{-1} \cdot \text{nmol}$

$$v_4 = \text{vol}(\text{cytoplasm}) \cdot p1 \cdot [\text{cLm}] \quad (10)$$

7.5 Reaction R5

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

Name cLc transport into nucleus

Reaction equation



Reactant

Table 13: Properties of each reactant.

Id	Name	SBO
cLc	cLc	

Product

Table 14: Properties of each product.

Id	Name	SBO
cLn	cLn	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

$$v_5 = \text{vol}(\text{cytoplasm}) \cdot r_1 \cdot [\text{cLc}] \tag{12}$$

7.6 Reaction R6

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

Name cLn transport into cytoplasm

Reaction equation



Reactant

Table 15: Properties of each reactant.

Id	Name	SBO
cLn	cLn	

Product

Table 16: Properties of each product.

Id	Name	SBO
cLc	cLc	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

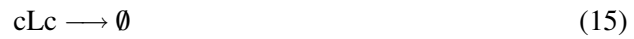
$$v_6 = \text{vol}(\text{nucleus}) \cdot r_2 \cdot [\text{cLn}] \quad (14)$$

7.7 Reaction R7

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

Name cLc degradation

Reaction equation



Reactant

Table 17: Properties of each reactant.

Id	Name	SBO
cLc	cLc	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600\text{ s})^{-1}$

$$v_7 = \frac{\text{vol}(\text{cytoplasm}) \cdot m_2 \cdot [\text{cLc}]}{k_2 + [\text{cLc}]} \quad (16)$$

7.8 Reaction R8

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

Name cLn degradation

Reaction equation



Reactant

Table 18: Properties of each reactant.

Id	Name	SBO
cLn	cLn	

Kinetic Law

Derived unit 9.999999999999998 · 10⁻¹⁰ mol · (3600 s)⁻¹

$$v_8 = \frac{\text{vol}(\text{nucleus}) \cdot m_3 \cdot [cLn]}{k_3 + [cLn]} \tag{18}$$

7.9 Reaction R9

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

Name cTm transcription

Reaction equation



Modifiers

Table 19: Properties of each modifier.

Id	Name	SBO
cYn	cYn	
cLn	cLn	

Product

Table 20: Properties of each product.

Id	Name	SBO
cTm	cTm	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \text{vol}(\text{nucleus}) \cdot \frac{n2 \cdot [cYn]^b}{g2^b + [cYn]^b} \cdot \frac{g3^c}{g3^c + [cLn]^c} \quad (20)$$

7.10 Reaction R10

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

Name cTm degradation

Reaction equation



Reactant

Table 21: Properties of each reactant.

Id	Name	SBO
cTm	cTm	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600 \text{ s})^{-1}$

$$v_{10} = \frac{\text{vol}(\text{nucleus}) \cdot m4 \cdot [cTm]}{k4 + [cTm]} \quad (22)$$

7.11 Reaction R11

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

Name cTc synthesis

Reaction equation



Modifier

Table 22: Properties of each modifier.

Id	Name	SBO
cTm	cTm	

Product

Table 23: Properties of each product.

Id	Name	SBO
cTc	cTc	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

$$v_{11} = \text{vol}(\text{cytoplasm}) \cdot p2 \cdot [\text{cTm}] \quad (24)$$

7.12 Reaction R12

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

Name cTc transport into nucleus

Reaction equation



Reactant

Table 24: Properties of each reactant.

Id	Name	SBO
cTc	cTc	

Product

Table 25: Properties of each product.

Id	Name	SBO
cTn	cTn	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

$$v_{12} = \text{vol}(\text{cytoplasm}) \cdot r3 \cdot [\text{cTc}] \quad (26)$$

7.13 Reaction R13

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

Name cTn transport into cytoplasm

Reaction equation



Reactant

Table 26: Properties of each reactant.

Id	Name	SBO
cTn	cTn	

Product

Table 27: Properties of each product.

Id	Name	SBO
cTc	cTc	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

$$v_{13} = \text{vol}(\text{nucleus}) \cdot r4 \cdot [\text{cTn}]$$

(28)

7.14 Reaction R14

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

Name cTc degradation

Reaction equation



Reactant

Table 28: Properties of each reactant.

Id	Name	SBO
cTc	cTc	

Kinetic Law

Derived unit $\text{nmol} \cdot (3600 \text{ s})^{-1}$

$$v_{14} = \text{vol}(\text{cytoplasm}) \cdot ((l_{\max} - l_d) \cdot m_5 + m_6) \cdot \frac{[cTc]}{k_5 + [cTc]} \quad (30)$$

7.15 Reaction R15

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

Name cTn degradation

Reaction equation



Reactant

Table 29: Properties of each reactant.

Id	Name	SBO
cTn	cTn	

Kinetic Law

Derived unit $\text{nmol} \cdot (3600 \text{ s})^{-1}$

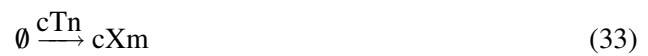
$$v_{15} = \text{vol}(\text{nucleus}) \cdot ((l_{\max} - l_d) \cdot m_7 + m_8) \cdot \frac{[cTn]}{k_6 + [cTn]} \quad (32)$$

7.16 Reaction R16

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

Name cXm transcription

Reaction equation



Modifier

Table 30: Properties of each modifier.

Id	Name	SBO
cTn	cTn	

Product

Table 31: Properties of each product.

Id	Name	SBO
cXm	cXm	

Kinetic Law

Derived unit contains undeclared units

$$v_{16} = \text{vol}(\text{nucleus}) \cdot \frac{n3 \cdot [\text{cTn}]^d}{g4^d + [\text{cTn}]^d} \quad (34)$$

7.17 Reaction R17

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

Name cXm degradation

Reaction equation



Reactant

Table 32: Properties of each reactant.

Id	Name	SBO
cXm	cXm	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600 \text{ s})^{-1}$

$$v_{17} = \text{vol}(\text{nucleus}) \cdot \frac{m9 \cdot [\text{cXm}]}{k7 + [\text{cXm}]} \quad (36)$$

7.18 Reaction R18

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

Name cXc synthesis

Reaction equation



Modifier

Table 33: Properties of each modifier.

Id	Name	SBO
cXm	cXm	

Product

Table 34: Properties of each product.

Id	Name	SBO
cXc	cXc	

Kinetic Law

Derived unit $(3600 \text{ s})^{-1} \cdot \text{nmol}$

$$v_{18} = \text{vol}(\text{cytoplasm}) \cdot p3 \cdot [\text{cXm}] \quad (38)$$

7.19 Reaction R19

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

Name cXc transport into nucleus

Reaction equation



Reactant

Table 35: Properties of each reactant.

Id	Name	SBO
cXc	cXc	

Product

Table 36: Properties of each product.

Id	Name	SBO
cXn	cXn	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

$$v_{19} = \text{vol}(\text{cytoplasm}) \cdot r5 \cdot [\text{cXc}] \quad (40)$$

7.20 Reaction R20

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

Name cXn transport into cytoplasm

Reaction equation



Reactant

Table 37: Properties of each reactant.

Id	Name	SBO
cXn	cXn	

Product

Table 38: Properties of each product.

Id	Name	SBO
cXc	cXc	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

$$v_{20} = \text{vol}(\text{nucleus}) \cdot r_6 \cdot [\text{cXn}] \quad (42)$$

7.21 Reaction R21

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

Name cXc degradation

Reaction equation



Reactant

Table 39: Properties of each reactant.

Id	Name	SBO
cXc	cXc	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600\text{ s})^{-1}$

$$v_{21} = \frac{\text{vol}(\text{cytoplasm}) \cdot m_{10} \cdot [\text{cXc}]}{k_8 + [\text{cXc}]} \quad (44)$$

7.22 Reaction R22

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

Name cXn degradation

Reaction equation



Reactant

Table 40: Properties of each reactant.

Id	Name	SBO
cXn	cXn	

Kinetic Law

Derived unit 9.999999999999998 · 10⁻¹⁰ mol · (3600 s)⁻¹

$$v_{22} = \frac{\text{vol}(\text{nucleus}) \cdot m11 \cdot [cXn]}{k9 + [cXn]} \tag{46}$$

7.23 Reaction R23

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

Name cYm transcription

Reaction equation



Modifiers

Table 41: Properties of each modifier.

Id	Name	SBO
cTn	cTn	
cLn	cLn	
cPn	cPn	

Product

Table 42: Properties of each product.

Id	Name	SBO
cYm	cYm	

Kinetic Law

Derived unit contains undeclared units

$$v_{23} = \text{vol}(\text{nucleus}) \cdot \left(\text{ld} \cdot q2 \cdot [\text{cPn}] + \frac{(\text{ld} \cdot n4 + n5) \cdot g5^e}{g5^e + [\text{cTn}]^e} \right) \cdot \frac{g6^f}{g6^f + [\text{cLn}]^f} \quad (48)$$

7.24 Reaction R24

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

Name cYm degradation

Reaction equation



Reactant

Table 43: Properties of each reactant.

Id	Name	SBO
cYm	cYm	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600 \text{ s})^{-1}$

$$v_{24} = \frac{\text{vol}(\text{nucleus}) \cdot m12 \cdot [\text{cYm}]}{k10 + [\text{cYm}]} \quad (50)$$

7.25 Reaction R25

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

Name cYc synthesis

Reaction equation



Modifier

Table 44: Properties of each modifier.

Id	Name	SBO
cYm	cYm	

Product

Table 45: Properties of each product.

Id	Name	SBO
cYc	cYc	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

$$v_{25} = \text{vol}(\text{cytoplasm}) \cdot p4 \cdot [\text{cYm}] \quad (52)$$

7.26 Reaction R26

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

Name cYc transport to nucleus

Reaction equation



Reactant

Table 46: Properties of each reactant.

Id	Name	SBO
cYc	cYc	

Product

Table 47: Properties of each product.

Id	Name	SBO
cYn	cYn	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

$$v_{26} = \text{vol}(\text{cytoplasm}) \cdot r7 \cdot [\text{cYc}] \quad (54)$$

7.27 Reaction R27

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

Name cYn transport to cytoplasm

Reaction equation



Reactant

Table 48: Properties of each reactant.

Id	Name	SBO
cYn	cYn	

Product

Table 49: Properties of each product.

Id	Name	SBO
cYc	cYc	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

$$v_{27} = \text{vol}(\text{nucleus}) \cdot r8 \cdot [\text{cYn}]$$

(56)

7.28 Reaction R28

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

Name cYc degradation

Reaction equation



Reactant

Table 50: Properties of each reactant.

Id	Name	SBO
cYc	cYc	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600 \text{ s})^{-1}$

$$v_{28} = \frac{\text{vol}(\text{cytoplasm}) \cdot m_{13} \cdot [\text{cYc}]}{k_{11} + [\text{cYc}]} \tag{58}$$

7.29 Reaction R29

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

Name cYn degradation

Reaction equation



Reactant

Table 51: Properties of each reactant.

Id	Name	SBO
cYn	cYn	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600 \text{ s})^{-1}$

$$v_{29} = \frac{\text{vol}(\text{nucleus}) \cdot m_{14} \cdot [\text{cYn}]}{k_{12} + [\text{cYn}]} \tag{60}$$

7.30 Reaction R30

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

Name cPn synthesis

Reaction equation



Product

Table 52: Properties of each product.

Id	Name	SBO
cPn	cPn	

Kinetic Law

Derived unit $\text{nmol} \cdot (3600 \text{ s})^{-1}$

$$v_{30} = \text{vol}(\text{nucleus}) \cdot (l_{\max} - l_d) \cdot p_5 \quad (62)$$

7.31 Reaction R31a

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

Name cPn degradation

Reaction equation



Reactant

Table 53: Properties of each reactant.

Id	Name	SBO
cPn	cPn	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600 \text{ s})^{-1}$

$$v_{31} = \frac{\text{vol}(\text{nucleus}) \cdot m_{15} \cdot [\text{cPn}]}{k_{13} + [\text{cPn}]} \quad (64)$$

7.32 Reaction R31b

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

Name Light dependent cPn degradation

Reaction equation



Reactant

Table 54: Properties of each reactant.

Id	Name	SBO
cPn	cPn	

Kinetic Law

Derived unit $(3600 \text{ s})^{-1} \cdot \text{nmol}$

$$v_{32} = \text{vol}(\text{nucleus}) \cdot q_3 \cdot \text{ld} \cdot [\text{cPn}] \quad (66)$$

7.33 Reaction R32

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

Name cP7m transcription

Reaction equation



Modifier

Table 55: Properties of each modifier.

Id	Name	SBO
cLn	cLn	

Product

Table 56: Properties of each product.

Id	Name	SBO
cP7m	cP7m	

Kinetic Law

Derived unit contains undeclared units

$$v_{33} = \frac{\text{vol}(\text{nucleus}) \cdot n6 \cdot [\text{cLn}]^j}{g9^j + [\text{cLn}]^j} \quad (68)$$

7.34 Reaction R33

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

Name cP7m degradation

Reaction equation



Reactant

Table 57: Properties of each reactant.

Id	Name	SBO
cP7m	cP7m	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600 \text{ s})^{-1}$

$$v_{34} = \frac{\text{vol}(\text{nucleus}) \cdot m16 \cdot [\text{cP7m}]}{k14 + [\text{cP7m}]} \quad (70)$$

7.35 Reaction R34

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

Name cP7c synthesis

Reaction equation



Modifier

Table 58: Properties of each modifier.

Id	Name	SBO
cP7m	cP7m	

Product

Table 59: Properties of each product.

Id	Name	SBO
cP7c	cP7c	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

$$v_{35} = \text{vol}(\text{cytoplasm}) \cdot p_6 \cdot [\text{cP7m}] \quad (72)$$

7.36 Reaction R35

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

Name cP7c transport to nucleus

Reaction equation



Reactant

Table 60: Properties of each reactant.

Id	Name	SBO
cP7c	cP7c	

Product

Table 61: Properties of each product.

Id	Name	SBO
cP7n	cP7n	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

$$v_{36} = \text{vol}(\text{cytoplasm}) \cdot r_9 \cdot [\text{cP7c}] \quad (74)$$

7.37 Reaction R36

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

Name cP7n transport to cytoplasm

Reaction equation



Reactant

Table 62: Properties of each reactant.

Id	Name	SBO
cP7n	cP7n	

Product

Table 63: Properties of each product.

Id	Name	SBO
cP7c	cP7c	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

$$v_{37} = \text{vol}(\text{nucleus}) \cdot r_{10} \cdot [\text{cP7n}] \quad (76)$$

7.38 Reaction R37

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

Name cP7c degradation

Reaction equation



Reactant

Table 64: Properties of each reactant.

Id	Name	SBO
cP7c	cP7c	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600 \text{ s})^{-1}$

$$v_{38} = \frac{\text{vol}(\text{cytoplasm}) \cdot m17 \cdot [cP7c]}{k15 + [cP7c]}$$
 (78)

7.39 Reaction R38

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

Name cP7n degradation

Reaction equation



Reactant

Table 65: Properties of each reactant.

Id	Name	SBO
cP7n	cP7n	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600 \text{ s})^{-1}$

$$v_{39} = \frac{\text{vol}(\text{nucleus}) \cdot m18 \cdot [cP7n]}{k16 + [cP7n]}$$
 (80)

7.40 Reaction R39

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

Name cP9m transcription

Reaction equation



Modifier

Table 66: Properties of each modifier.

Id	Name	SBO
cLn	cLn	

Product

Table 67: Properties of each product.

Id	Name	SBO
cP9m	cP9m	

Kinetic Law

Derived unit contains undeclared units

$$v_{40} = \frac{\text{vol}(\text{nucleus}) \cdot n7 \cdot [\text{cLn}]^k}{g10^k + [\text{cLn}]^k} \quad (82)$$

7.41 Reaction R40

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

Name cP9m degradation

Reaction equation



Reactant

Table 68: Properties of each reactant.

Id	Name	SBO
cP9m	cP9m	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600 \text{ s})^{-1}$

$$v_{41} = \frac{\text{vol}(\text{nucleus}) \cdot m_{19} \cdot [\text{cP9m}]}{k_{17} + [\text{cP9m}]} \tag{84}$$

7.42 Reaction R41

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

Name cP9c synthesis

Reaction equation



Modifier

Table 69: Properties of each modifier.

Id	Name	SBO
cP9m	cP9m	

Product

Table 70: Properties of each product.

Id	Name	SBO
cP9c	cP9c	

Kinetic Law

Derived unit $(3600 \text{ s})^{-1} \cdot \text{nmol}$

$$v_{42} = \text{vol}(\text{cytoplasm}) \cdot p_7 \cdot [\text{cP9m}] \tag{86}$$

7.43 Reaction R42

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

Name cP9c transport to nucleus

Reaction equation



Reactant

Table 71: Properties of each reactant.

Id	Name	SBO
cP9c	cP9c	

Product

Table 72: Properties of each product.

Id	Name	SBO
cP9n	cP9n	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

$$v_{43} = \text{vol}(\text{cytoplasm}) \cdot r11 \cdot [\text{cP9c}]$$

(88)

7.44 Reaction R43

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

Name cP9n transport to cytoplasm

Reaction equation



Reactant

Table 73: Properties of each reactant.

Id	Name	SBO
cP9n	cP9n	

Product

Table 74: Properties of each product.

Id	Name	SBO
cP9c	cP9c	

Kinetic Law

Derived unit $(3600\text{ s})^{-1} \cdot \text{nmol}$

$$v_{44} = \text{vol}(\text{nucleus}) \cdot r_{12} \cdot [\text{cP9n}] \tag{90}$$

7.45 Reaction R44

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

Name cP9c degradation

Reaction equation



Reactant

Table 75: Properties of each reactant.

Id	Name	SBO
cP9c	cP9c	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600\text{ s})^{-1}$

$$v_{45} = \frac{\text{vol}(\text{cytoplasm}) \cdot m_{20} \cdot [\text{cP9c}]}{k_{18} + [\text{cP9c}]} \tag{92}$$

7.46 Reaction R45

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

Name cP9n degradation

Reaction equation



Reactant

Table 76: Properties of each reactant.

Id	Name	SBO
cP9n	cP9n	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10} \text{ mol} \cdot (3600 \text{ s})^{-1}$

$$v_{46} = \frac{\text{vol}(\text{nucleus}) \cdot m_{21} \cdot [\text{cP9n}]}{k_{19} + [\text{cP9n}]} \quad (94)$$

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.

8.1 Species cLc

Name cLc

Initial concentration $6.7846 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in four reactions (as a reactant in R5, R7 and as a product in R4, R6).

$$\frac{d}{dt} \text{cLc} = v_4 + v_6 - v_5 - v_7 \quad (95)$$

8.2 Species cLm

Name cLm

Initial concentration $0.8539 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in four reactions (as a reactant in [R3](#) and as a product in [R1](#), [R2](#) and as a modifier in [R4](#)).

$$\frac{d}{dt}c_{Lm} = v_1 + v_2 - v_3 \quad (96)$$

8.3 Species c_{Ln}

Name c_{Ln}

Initial concentration $6.8104 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in seven reactions (as a reactant in [R6](#), [R8](#) and as a product in [R5](#) and as a modifier in [R9](#), [R23](#), [R32](#), [R39](#)).

$$\frac{d}{dt}c_{Ln} = v_5 - v_6 - v_8 \quad (97)$$

8.4 Species c_{P7c}

Name c_{P7c}

Initial concentration $20.0554 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in four reactions (as a reactant in [R35](#), [R37](#) and as a product in [R34](#), [R36](#)).

$$\frac{d}{dt}c_{P7c} = v_{35} + v_{37} - v_{36} - v_{38} \quad (98)$$

8.5 Species c_{P7m}

Name c_{P7m}

Initial concentration $4.28 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in [R33](#) and as a product in [R32](#) and as a modifier in [R34](#)).

$$\frac{d}{dt}c_{P7m} = v_{33} - v_{34} \quad (99)$$

8.6 Species c_{P7n}

Name c_{P7n}

Initial concentration $2.091 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in four reactions (as a reactant in [R36](#), [R38](#) and as a product in [R35](#) and as a modifier in [R2](#)).

$$\frac{d}{dt}c_{P7n} = v_{36} - v_{37} - v_{39} \quad (100)$$

8.7 Species cP9c

Name cP9c

Initial concentration 6.0091 nmol · l⁻¹

This species takes part in four reactions (as a reactant in [R42](#), [R44](#) and as a product in [R41](#), [R43](#)).

$$\frac{d}{dt}cP9c = v_{42} + v_{44} - v_{43} - v_{45} \quad (101)$$

8.8 Species cP9m

Name cP9m

Initial concentration 1.1006 nmol · l⁻¹

This species takes part in three reactions (as a reactant in [R40](#) and as a product in [R39](#) and as a modifier in [R41](#)).

$$\frac{d}{dt}cP9m = v_{40} - v_{41} \quad (102)$$

8.9 Species cP9n

Name cP9n

Initial concentration 3.7528 nmol · l⁻¹

This species takes part in four reactions (as a reactant in [R43](#), [R45](#) and as a product in [R42](#) and as a modifier in [R2](#)).

$$\frac{d}{dt}cP9n = v_{43} - v_{44} - v_{46} \quad (103)$$

8.10 Species cPn

Name cPn

Initial concentration 0 nmol · l⁻¹

This species takes part in five reactions (as a reactant in [R31a](#), [R31b](#) and as a product in [R30](#) and as a modifier in [R1](#), [R23](#)).

$$\frac{d}{dt}cPn = v_{30} - v_{31} - v_{32} \quad (104)$$

8.11 Species c_{Tc}

Name c_{Tc}

Initial concentration $0.1724 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in four reactions (as a reactant in [R12](#), [R14](#) and as a product in [R11](#), [R13](#)).

$$\frac{d}{dt}c_{Tc} = v_{11} + v_{13} - v_{12} - v_{14} \quad (105)$$

8.12 Species c_{Tm}

Name c_{Tm}

Initial concentration $0.3717 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in [R10](#) and as a product in [R9](#) and as a modifier in [R11](#)).

$$\frac{d}{dt}c_{Tm} = v_9 - v_{10} \quad (106)$$

8.13 Species c_{Tn}

Name c_{Tn}

Initial concentration $8.0398 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in five reactions (as a reactant in [R13](#), [R15](#) and as a product in [R12](#) and as a modifier in [R16](#), [R23](#)).

$$\frac{d}{dt}c_{Tn} = v_{12} - v_{13} - v_{15} \quad (107)$$

8.14 Species c_{Xc}

Name c_{Xc}

Initial concentration $13.0372 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in four reactions (as a reactant in [R19](#), [R21](#) and as a product in [R18](#), [R20](#)).

$$\frac{d}{dt}c_{Xc} = v_{18} + v_{20} - v_{19} - v_{21} \quad (108)$$

8.15 Species cX_m

Name cX_m

Initial concentration $8.487 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in [R17](#) and as a product in [R16](#) and as a modifier in [R18](#)).

$$\frac{d}{dt}cX_m = v_{16} - v_{17} \quad (109)$$

8.16 Species cX_n

Name cX_n

Initial concentration $31.8995 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in four reactions (as a reactant in [R20](#), [R22](#) and as a product in [R19](#) and as a modifier in [R2](#)).

$$\frac{d}{dt}cX_n = v_{19} - v_{20} - v_{22} \quad (110)$$

8.17 Species cY_c

Name cY_c

Initial concentration $7.075 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in four reactions (as a reactant in [R26](#), [R28](#) and as a product in [R25](#), [R27](#)).

$$\frac{d}{dt}cY_c = v_{25} + v_{27} - v_{26} - v_{28} \quad (111)$$

8.18 Species cY_m

Name cY_m

Initial concentration $0.1937 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in [R24](#) and as a product in [R23](#) and as a modifier in [R25](#)).

$$\frac{d}{dt}cY_m = v_{23} - v_{24} \quad (112)$$

8.19 Species cYn

Name cYn

Initial concentration $1.07 \text{ nmol} \cdot \text{l}^{-1}$

This species takes part in four reactions (as a reactant in R27, R29 and as a product in R26 and as a modifier in R9).

$$\frac{d}{dt}cYn = v_{26} - v_{27} - v_{29} \quad (113)$$

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