SBML Model Report

Model name: "Pokhilko2010_CircClock"

May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 4 format. This model was created by the following two authors: Vijayalakshmi Chelliah[1] and Alexandra Pokhilko[2] at October 21st 2010 at 5:09 p. m. and last time modified at April eighth 2016 at 4:18 p. m. Table 1 provides 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	19
events	0	constraints	0
reactions	38	function definitions	38
global parameters	99	unit definitions	1
rules	2	initial assignments	0

Model Notes

This a model from the article:
Data assimilation constrains new connections and components in a complex, eukaryotic circadian clock model.
Pokhilko A, Hodge SK, Stratford K, Knox K, Edwards KD, Thomson AW, Mizuno T, Millar AJ. Mol Syst Biol.2010 Sep 21;6:416. 20865009,
Abstract:

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Circadian clocks generate 24-h rhythms that are entrained by the day/night cycle. Clock circuits include several light inputs and interlocked feedback loops, with complex dynamics. Multiple biological components can contribute to each part of the circuit in higher organisms. Mechanistic models with morning, evening and central feedback loops have provided a heuristic framework for the clock in plants, but were based on transcriptional control. Here, we model observed, post-transcriptional and post-translational regulation and constrain many parameter values based on experimental data. The model's feedback circuit is revised and now includes PSEUDO-RESPONSE REGULATOR 7 (PRR7) and ZEITLUPE. The revised model matches data in varying environments and mutants, and gains robustness to parameter variation. Our results suggest that the activation of important morning-expressed genes follows their release from a night inhibitor (NI). Experiments inspired by the new model support the predicted NI function and show that the PRR5 gene contributes to the NI. The multiple PRR genes of Arabidopsis uncouple events in the late night from light-driven responses in the day, increasing the flexibility of rhythmic regulation.

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 `substance`

Definition item

2.2 Unit `volume`

Notes Litre is the predefined SBML unit for `volume`.

Definition l

2.3 Unit `area`

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

Definition m^2

2.4 Unit `length`

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

Definition m

2.5 Unit `time`

Notes Second is the predefined SBML unit for `time`.

Definition s

3 Compartment

This model contains one compartment.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
`def`	def	0000290	3	1	litre	☑	

3.1 Compartment `def`

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

Name def

SBO:0000290 physical compartment

4 Species

This model contains 19 species. Section 9 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
cG	cG	def	item · l^{-1}	⊟	⊟
cG_m	cG_m	def	item · l^{-1}	⊟	⊟
cL	cL	def	item · l^{-1}	⊟	⊟
cL_m	cL_m	def	item · l^{-1}	⊟	⊟
cLm	cLm	def	item · l^{-1}	⊟	⊟
cNI	cNI	def	item · l^{-1}	⊟	⊟
cNI_m	cNI_m	def	item · l^{-1}	⊟	⊟
cP	cP	def	item · l^{-1}	⊟	⊟
cP7	cP7	def	item · l^{-1}	⊟	⊟
cP7_m	cP7_m	def	item · l^{-1}	⊟	⊟
cP9	cP9	def	item · l^{-1}	⊟	⊟
cP9_m	cP9_m	def	item · l^{-1}	⊟	⊟
cT	cT	def	item · l^{-1}	⊟	⊟
cT_m	cT_m	def	item · l^{-1}	⊟	⊟
cTm	cTm	def	item · l^{-1}	⊟	⊟
cY	cY	def	item · l^{-1}	⊟	⊟
cY_m	cY_m	def	item · l^{-1}	⊟	⊟
cZG	cZG	def	item · l^{-1}	⊟	⊟
cZTL	cZTL	def	item · l^{-1}	⊟	⊟

Produced by SBML2LaTeX

5 Parameters

This model contains 99 global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
n0	n0	0000009	0.400		☑
n1	n1	0000009	1.800		☑
n2	n2	0000009	0.700		☑
n3	n3	0000009	0.060		☑
n4	n4	0000009	0.000		☑
n5	n5	0000009	3.400		☑
n6	n6	0000009	1.250		☑
n7	n7	0000009	0.200		☑
n8	n8	0000009	0.420		☑
n9	n9	0000009	0.260		☑
n10	n10	0000009	0.180		☑
n11	n11	0000009	0.710		☑
n12	n12	0000009	2.300		☑
g1	g1	0000027	0.100		☑
g2	g2	0000027	0.280		☑
g3	g3	0000027	0.400		☑
g4	g4	0000027	0.910		☑
g5	g5	0000027	0.300		☑
g6	g6	0000027	0.300		☑
g7	g7	0000027	0.180		☑
g8	g8	0000027	0.140		☑
g9	g9	0000027	0.300		☑
g10	g10	0000027	0.700		☑
g11	g11	0000027	0.700		☑
g12	g12	0000027	0.500		☑
g13	g13	0000027	0.600		☑
g14	g14	0000027	0.170		☑
g15	g15	0000027	0.400		☑
g16	g16	0000027	0.200		☑
m1	m1	0000356	0.540		☑
m2	m2	0000356	0.240		☑
m3	m3	0000356	0.200		☑
m4	m4	0000356	0.200		☑
m5	m5	0000356	0.300		☑
m6	m6	0000356	0.250		☑
m7	m7	0000356	0.500		☑
m8	m8	0000356	0.100		☑

Id	Name	SBO	Value	Unit	Constant
m9	m9	0000356	1.000		☑
m10	m10	0000356	0.300		☑
m11	m11	0000356	1.000		☑
m12	m12	0000356	1.000		☑
m13	m13	0000356	0.320		☑
m14	m14	0000356	0.280		☑
m15	m15	0000356	0.310		☑
m16	m16	0000356	0.500		☑
m17	m17	0000356	0.300		☑
m18	m18	0000356	1.000		☑
m19	m19	0000356	0.200		☑
m20	m20	0000356	1.200		☑
m21	m21	0000356	0.200		☑
m22	m22	0000356	2.000		☑
m23	m23	0000356	1.000		☑
m24	m24	0000356	0.405		☑
m25	m25	0000356	0.280		☑
m26	m26	0000356	0.140		☑
a	a	0000191	2.000		☑
b	b	0000191	3.000		☑
c	c	0000191	3.000		☑
d	d	0000191	2.500		☑
e	e	0000191	2.000		☑
f	f	0000191	3.000		☑
h	h	0000191	2.000		☑
g	g	0000191	2.000		☑
i	i	0000191	3.000		☑
j	j	0000191	3.000		☑
k	k	0000191	3.000		☑
l	l	0000191	2.000		☑
m	m	0000191	2.000		☑
n	n	0000191	1.000		☑
o	o	0000191	2.000		☑
s	s	0000191	3.000		☑
p1	p1	0000009	0.400		☑
p2	p2	0000009	0.270		☑
p3	p3	0000009	0.100		☑
p4	p4	0000009	0.268		☑
p5	p5	0000009	1.000		☑
p6	p6	0000009	0.440		☑
p7	p7	0000009	0.300		☑
p8	p8	0000009	0.700		☑

Id	Name	SBO	Value	Unit	Constant
p9	p9	0000009	0.400		☑
p10	p10	0000009	0.360		☑
p11	p11	0000009	0.230		☑
p12	p12	0000009	30.000		☑
p13	p13	0000009	0.400		☑
p14	p14	0000009	0.450		☑
p15	p15	0000009	0.050		☑
q1	q1	0000009	0.800		☑
q2	q2	0000009	0.500		☑
q3	q3	0000009	2.900		☑
q4	q4	0000009	0.600		☑
dawn	dawn		0.000		☑
dusk	dusk		12.000		☑
dawn1	dawn1		0.000		☑
dusk1	dusk1		3.000		☑
dawn2	dawn2		9.000		☑
dusk2	dusk2		12.000		☑
L	L		0.500		⊟
D	D		0.500		⊟
parameter_1	quantity		0.500		⊟

6 Function definitions

This is an overview of 38 function definitions.

6.1 Function definition function_4_cT_degr

Name function_4_cT_degr

Arguments D, L, [cT], [cZG], [cZTL], vol (def), m6, m7, m8, p5

Mathematical Expression

$$\frac{(\mathrm{m6} \cdot \mathrm{L} + \mathrm{m7} \cdot \mathrm{D}) \cdot [\mathrm{cT}] \cdot (\mathrm{p5} \cdot [\mathrm{cZTL}] + [\mathrm{cZG}]) + \mathrm{m8} \cdot [\mathrm{cT}]}{\mathrm{vol}\,(\mathrm{def})} \tag{1}$$

6.2 Function definition function_4_cNI_m_degr

Name function_4_cNI_m_degr

Arguments [cNI_m], vol (def), m16

Mathematical Expression

$$\frac{\mathrm{m16} \cdot [\mathrm{cNI\_m}]}{\mathrm{vol}\,(\mathrm{def})} \tag{2}$$

6.3 Function definition function_4_cNI_m_trscr

Name function_4_cNI_m_trscr

Arguments [cLm], [cP7], vol (def), g12, g13, l, m, n10, n11

Mathematical Expression

$$\frac{\frac{\mathrm{n10} \cdot [\mathrm{cLm}]^{\mathrm{l}}}{[\mathrm{cLm}]^{\mathrm{l}} + \mathrm{g12}^{\mathrm{l}}} + \frac{\mathrm{n11} \cdot [\mathrm{cP7}]^{\mathrm{m}}}{[\mathrm{cP7}]^{\mathrm{m}} + \mathrm{g13}^{\mathrm{m}}}}{\mathrm{vol}\,(\mathrm{def})} \tag{3}$$

6.4 Function definition function_4_cY_trsl

Name function_4_cY_trsl

Arguments [cY_m], vol (def), p6

Mathematical Expression

$$\frac{\mathrm{p6} \cdot [\mathrm{cY\_m}]}{\mathrm{vol}\,(\mathrm{def})} \tag{4}$$

6.5 Function definition function_4_cP7_degr

Name function_4_cP7_degr

Arguments D, L, [cP7], vol (def), m15, m23

Mathematical Expression

$$\frac{(\mathrm{m15} \cdot \mathrm{L} + \mathrm{m23} \cdot \mathrm{D}) \cdot [\mathrm{cP7}]}{\mathrm{vol}\,(\mathrm{def})} \tag{5}$$

6.6 Function definition function_4_cT_trsl

Name function_4_cT_trsl

Arguments [cT_m], vol (def), p4

Mathematical Expression

$$\frac{\mathrm{p4} \cdot [\mathrm{cT\_m}]}{\mathrm{vol}\,(\mathrm{def})} \tag{6}$$

6.7 Function definition function_4_cY_m_trscr

Name function_4_cY_m_trscr

Arguments D, L, [cL], [cP], [cT], vol (def), g, g16, g7, n5, n6, q2, s

Mathematical Expression

$$\frac{\mathrm{L}\cdot \mathrm{q2}\cdot [\mathrm{cP}]+\frac{\frac{(\mathrm{n5}\cdot \mathrm{L}+\mathrm{n6}\cdot \mathrm{D})\cdot \mathrm{g7}^{\mathrm{s}}}{[\mathrm{cT}]^{\mathrm{s}}+\mathrm{g7}^{\mathrm{s}}}\cdot \mathrm{g16}^{\mathrm{g}}}{[\mathrm{cL}]^{\mathrm{g}}+\mathrm{g16}^{\mathrm{g}}}}{\mathrm{vol}\,(\mathrm{def})} \tag{7}$$

6.8 Function definition function_4_cT_m_trscr

Name function_4_cT_m_trscr

Arguments [cL], [cY], d, vol (def), e, g4, g5, n2, n3

Mathematical Expression

$$\frac{\frac{\left(\frac{\mathrm{n2}\cdot [\mathrm{cY}]^{\mathrm{d}}}{[\mathrm{cY}]^{\mathrm{d}}+\mathrm{g4}^{\mathrm{d}}}+\mathrm{n3}\right)\cdot \mathrm{g5}^{\mathrm{e}}}{[\mathrm{cL}]^{\mathrm{e}}+\mathrm{g5}^{\mathrm{e}}}}{\mathrm{vol}\,(\mathrm{def})} \tag{8}$$

6.9 Function definition function_4_cT_m_degr

Name function_4_cT_m_degr

Arguments [cT_m], vol (def), m5

Mathematical Expression

$$\frac{\mathrm{m5}\cdot [\mathrm{cT\_m}]}{\mathrm{vol}\,(\mathrm{def})} \tag{9}$$

6.10 Function definition function_4_cNI_trsl

Name function_4_cNI_trsl

Arguments [cNI_m], vol (def), p10

Mathematical Expression

$$\frac{\mathrm{p10}\cdot [\mathrm{cNI\_m}]}{\mathrm{vol}\,(\mathrm{def})} \tag{10}$$

6.11 Function definition function_4_cZTL_trsl

Name function_4_cZTL_trsl

Arguments vol (def), p14

Mathematical Expression

$$\frac{\mathrm{p14}}{\mathrm{vol}\,(\mathrm{def})} \tag{11}$$

6.12 Function definition function_4_cP7_m_degr

Name function_4_cP7_m_degr

Arguments [cP7_m], vol (def), m14

Mathematical Expression

$$\frac{\mathrm{m14} \cdot [\mathrm{cP7\_m}]}{\mathrm{vol}\,(\mathrm{def})} \tag{12}$$

6.13 Function definition function_4_cY_m_degr

Name function_4_cY_m_degr

Arguments [cY_m], vol (def), m9

Mathematical Expression

$$\frac{\mathrm{m9} \cdot [\mathrm{cY\_m}]}{\mathrm{vol}\,(\mathrm{def})} \tag{13}$$

6.14 Function definition function_4_cLm_degr

Name function_4_cLm_degr

Arguments [cLm], vol (def), m4

Mathematical Expression

$$\frac{\mathrm{m4} \cdot [\mathrm{cLm}]}{\mathrm{vol}\,(\mathrm{def})} \tag{14}$$

6.15 Function definition function_4_cL_modif

Name function_4_cL_modif

Arguments c, [cL], vol (def), g3, p3

Mathematical Expression

$$\frac{\frac{\mathrm{p3} \cdot [\mathrm{cL}]^{c}}{[\mathrm{cL}]^{c} + \mathrm{g3}^{c}}}{\mathrm{vol}\,(\mathrm{def})} \tag{15}$$

6.16 Function definition function_4_cL_degr

Name function_4_cL_degr

Arguments c, [cL], vol (def), g3, m3, p3

Mathematical Expression

$$\frac{\mathrm{m3} \cdot [\mathrm{cL}] + \frac{\mathrm{p3} \cdot [\mathrm{cL}]^{\mathrm{c}}}{[\mathrm{cL}]^{\mathrm{c}} + \mathrm{g3}^{\mathrm{c}}}}{\mathrm{vol}\,(\mathrm{def})} \tag{16}$$

6.17 Function definition function_4_cL_trsl

Name function_4_cL_trsl

Arguments D, L, [cL_m], vol (def), p1, p2

Mathematical Expression

$$\frac{[\mathrm{cL\_m}] \cdot (\mathrm{p1} \cdot \mathrm{L} + \mathrm{p2} \cdot \mathrm{D})}{\mathrm{vol}\,(\mathrm{def})} \tag{17}$$

6.18 Function definition function_4_cP9_m_degr

Name function_4_cP9_m_degr

Arguments [cP9_m], vol (def), m12

Mathematical Expression

$$\frac{\mathrm{m12} \cdot [\mathrm{cP9\_m}]}{\mathrm{vol}\,(\mathrm{def})} \tag{18}$$

6.19 Function definition function_4_cY_degr

Name function_4_cY_degr

Arguments [cY], vol (def), m10

Mathematical Expression

$$\frac{\mathrm{m10} \cdot [\mathrm{cY}]}{\mathrm{vol}\,(\mathrm{def})} \tag{19}$$

6.20 Function definition function_4_cP_degr

Name function_4_cP_degr

Arguments L, [cP], vol (def), m11

Mathematical Expression

$$\frac{\mathrm{m11} \cdot [\mathrm{cP}] \cdot \mathrm{L}}{\mathrm{vol}\,(\mathrm{def})} \tag{20}$$

6.21 Function definition function_4_cTm_degr

Name function_4_cTm_degr

Arguments D, L, [cTm], vol (def), m25, m26

Mathematical Expression

$$\frac{(\mathrm{m25} \cdot \mathrm{L} + \mathrm{m26} \cdot \mathrm{D}) \cdot [\mathrm{cTm}]}{\mathrm{vol}\,(\mathrm{def})} \tag{21}$$

6.22 Function definition function_4_cP_trsl

Name function_4_cP_trsl

Arguments D, [cP], vol (def), p7

Mathematical Expression

$$\frac{\mathrm{p7} \cdot \mathrm{D} \cdot (1 - [\mathrm{cP}])}{\mathrm{vol}\,(\mathrm{def})} \tag{22}$$

6.23 Function definition function_4_cG_cZTL_assoc

Name function_4_cG_cZTL_assoc

Arguments D, L, [cG], [cZG], [cZTL], vol (def), p12, p13

Mathematical Expression

$$\frac{\mathrm{p12} \cdot \mathrm{L} \cdot [\mathrm{cZTL}] \cdot [\mathrm{cG}] - \mathrm{p13} \cdot \mathrm{D} \cdot [\mathrm{cZG}]}{\mathrm{vol}\,(\mathrm{def})} \tag{23}$$

6.24 Function definition function_4_cG_m_trscr

Name function_4_cG_m_trscr

Arguments L, [cL], [cP], [cT], vol (def), g14, g15, n, n12, o, q4

Mathematical Expression

$$\frac{\mathrm{L} \cdot \mathrm{q4} \cdot [\mathrm{cP}] + \frac{\mathrm{n12} \cdot \mathrm{L} \cdot \mathrm{g15}^{\mathrm{o}}}{[\mathrm{cL}]^{\mathrm{o}} + \mathrm{g15}^{\mathrm{o}}} \cdot \mathrm{g14}^{\mathrm{n}}}{\mathrm{vol}\,(\mathrm{def})} \tag{24}$$

6.25 Function definition function_4_cG_degr

Name function_4_cG_degr

Arguments [cG], vol (def), m19

Mathematical Expression

$$\frac{\mathrm{m19} \cdot [\mathrm{cG}]}{\mathrm{vol}\,(\mathrm{def})} \tag{25}$$

6.26 Function definition function_4_cZG_degr

Name function_4_cZG_degr

Arguments [cZG], vol (def), m21

Mathematical Expression

$$\frac{\mathrm{m21} \cdot [\mathrm{cZG}]}{\mathrm{vol}\,(\mathrm{def})} \tag{26}$$

6.27 Function definition function_4_cL_m_trscr

Name function_4_cL_m_trscr

Arguments L, a, b, [cNI], [cP], [cP7], [cP9], [cTm], vol (def), g1, g2, n0, n1, q1

Mathematical Expression

$$\frac{\left(\mathrm{n0}\cdot \mathrm{L}+\mathrm{L}\cdot \mathrm{q1}\cdot [\mathrm{cP}]+\frac{\mathrm{n1}\cdot [\mathrm{cTm}]^{\mathrm{b}}}{[\mathrm{cTm}]^{\mathrm{b}}+\mathrm{g2}^{\mathrm{b}}}\right)\cdot \mathrm{g1}^{\mathrm{a}}}{([\mathrm{cP9}]+[\mathrm{cP7}]+[\mathrm{cNI}])^{\mathrm{a}}+\mathrm{g1}^{\mathrm{a}}} \over \mathrm{vol}\,(\mathrm{def}) \tag{27}$$

6.28 Function definition function_4_cL_m_degr

Name function_4_cL_m_degr

Arguments D, L, [cL_m], vol (def), m1, m2

Mathematical Expression

$$\frac{(\mathrm{m1} \cdot \mathrm{L} + \mathrm{m2} \cdot \mathrm{D}) \cdot [\mathrm{cL\_m}]}{\mathrm{vol}\,(\mathrm{def})} \tag{28}$$

6.29 Function definition function_4_cG_trsl

Name function_4_cG_trsl

Arguments [cG_m], vol (def), p11

Mathematical Expression

$$\frac{\mathrm{p11} \cdot [\mathrm{cG\_m}]}{\mathrm{vol}\,(\mathrm{def})} \tag{29}$$

6.30 Function definition function_4_cP9_m_trscr

Name function_4_cP9_m_trscr

Arguments L, [cL], [cP], [cT], vol (def), g8, g9, h, i, n4, n7, q3

Mathematical Expression

$$\frac{\mathrm{L} \cdot \mathrm{q3} \cdot [\mathrm{cP}] + \frac{\left(\mathrm{n4} \cdot \mathrm{L} + \frac{\mathrm{n7} \cdot [\mathrm{cL}]^{\mathrm{i}}}{[\mathrm{cL}]^{\mathrm{i}} + \mathrm{g9}^{\mathrm{i}}}\right) \cdot \mathrm{g8}^{\mathrm{h}}}{[\mathrm{cT}]^{\mathrm{h}} + \mathrm{g8}^{\mathrm{h}}}}{\mathrm{vol}\,(\mathrm{def})} \tag{30}$$

6.31 Function definition function_4_cP9_degr

Name function_4_cP9_degr

Arguments D, L, [cP9], vol (def), m13, m22

Mathematical Expression

$$\frac{(\mathrm{m13} \cdot \mathrm{L} + \mathrm{m22} \cdot \mathrm{D}) \cdot [\mathrm{cP9}]}{\mathrm{vol}\,(\mathrm{def})} \tag{31}$$

6.32 Function definition function_4_cP7_trsl

Name function_4_cP7_trsl

Arguments [cP7_m], vol (def), p9

Mathematical Expression

$$\frac{\mathrm{p9} \cdot [\mathrm{cP7\_m}]}{\mathrm{vol}\,(\mathrm{def})} \tag{32}$$

6.33 Function definition function_4_cP7_m_trscr

Name function_4_cP7_m_trscr

Arguments [cL], [cLm], [cP9], vol (def), g10, g11, j, k, n8, n9

Mathematical Expression

$$\frac{\frac{\mathrm{n8}\cdot([\mathrm{cLm}]+[\mathrm{cL}])^{\mathrm{j}}}{([\mathrm{cLm}]+[\mathrm{cL}])^{\mathrm{j}}+\mathrm{g10}^{\mathrm{j}}}+\frac{\mathrm{n9}\cdot[\mathrm{cP9}]^{\mathrm{k}}}{[\mathrm{cP9}]^{\mathrm{k}}+\mathrm{g11}^{\mathrm{k}}}}{\mathrm{vol}\,(\mathrm{def})} \tag{33}$$

6.34 Function definition function_4_cNI_degr

Name function_4_cNI_degr

Arguments D, L, [cNI], vol (def), m17, m24

Mathematical Expression

$$\frac{(\mathrm{m17}\cdot\mathrm{L}+\mathrm{m24}\cdot\mathrm{D})\cdot[\mathrm{cNI}]}{\mathrm{vol}\,(\mathrm{def})} \tag{34}$$

6.35 Function definition function_4_cG_m_degr

Name function_4_cG_m_degr

Arguments [cG_m], vol (def), m18

Mathematical Expression

$$\frac{\mathrm{m18}\cdot[\mathrm{cG\_m}]}{\mathrm{vol}\,(\mathrm{def})} \tag{35}$$

6.36 Function definition function_4_cP9_trsl

Name function_4_cP9_trsl

Arguments [cP9_m], vol (def), p8

Mathematical Expression

$$\frac{\mathrm{p8}\cdot[\mathrm{cP9\_m}]}{\mathrm{vol}\,(\mathrm{def})} \tag{36}$$

6.37 Function definition function_4_cZTL_degr

Name function_4_cZTL_degr

Arguments [cZTL], vol (def), m20

Mathematical Expression

$$\frac{\mathrm{m20} \cdot [\mathrm{cZTL}]}{\mathrm{vol}\,(\mathrm{def})} \tag{37}$$

6.38 Function definition function_4_cT_modif

Name function_4_cT_modif

Arguments [cT], vol (def), f, g6, p15

Mathematical Expression

$$\frac{\frac{\mathrm{p15} \cdot [\mathrm{cT}]^{\mathrm{f}}}{[\mathrm{cT}]^{\mathrm{f}} + \mathrm{g6}^{\mathrm{f}}}}{\mathrm{vol}\,(\mathrm{def})} \tag{38}$$

7 Rules

This is an overview of two rules.

7.1 Rule L

Rule L is an assignment rule for parameter L:

$$\mathrm{L} = 0.5 \cdot \left(1 + \tanh\left(\frac{\mathrm{t} - 24 \cdot \left\lfloor \frac{\mathrm{t}}{24} \right\rfloor}{0.5}\right) - \left(1 + \tanh\left(\frac{\mathrm{t} - 24 \cdot \left\lfloor \frac{\mathrm{t}}{24} \right\rfloor - 12}{0.5}\right)\right) + 1 + \tanh\left(\frac{\mathrm{t} - 24 \cdot \left\lfloor \frac{\mathrm{t}}{24} \right\rfloor - 24}{0.5}\right)\right) \tag{39}$$

7.2 Rule D

Rule D is an assignment rule for parameter D:

$$\mathrm{D} = 1 - \mathrm{L} \tag{40}$$

8 Reactions

This model contains 38 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

№	Id	Name	Reaction Equation	SBO
1	cL_m_trscr	cL_m_trscr	$\emptyset \xrightarrow{\text{cNI, cP, cP7, cP9, cTm}} \text{cL\_m}$	0000183
2	cL_m_degr	cL_m_degr	$\text{cL\_m} \longrightarrow \emptyset$	0000179
3	cL_trsl	cL_trsl	$\emptyset \xrightarrow{\text{cL\_m}} \text{cL}$	0000184
4	cL_degr	cL_degr	$\text{cL} \longrightarrow \emptyset$	0000179
5	cL_modif	cL_modif	$\emptyset \xrightarrow{\text{cL}} \text{cLm}$	0000176
6	cLm_degr	cLm_degr	$\text{cLm} \longrightarrow \emptyset$	0000179
7	cT_m_trscr	cT_m_trscr	$\emptyset \xrightarrow{\text{cL, cY}} \text{cT\_m}$	0000183
8	cT_m_degr	cT_m_degr	$\text{cT\_m} \longrightarrow \emptyset$	0000179
9	cT_trsl	cT_trsl	$\emptyset \xrightarrow{\text{cT\_m}} \text{cT}$	0000184
10	cT_degr	cT_degr	$\text{cT} \xrightarrow{\text{cZG, cZTL}} \emptyset$	0000179
11	cT_modif	cT_modif	$\emptyset \xrightarrow{\text{cT}} \text{cTm}$	0000176
12	cTm_degr	cTm_degr	$\text{cTm} \longrightarrow \emptyset$	0000179
13	cY_m_trscr	cY_m_trscr	$\emptyset \xrightarrow{\text{cL, cP, cT}} \text{cY\_m}$	0000183
14	cY_m_degr	cY_m_degr	$\text{cY\_m} \longrightarrow \emptyset$	0000179
15	cY_trsl	cY_trsl	$\emptyset \xrightarrow{\text{cY\_m}} \text{cY}$	0000184
16	cY_degr	cY_degr	$\text{cY} \longrightarrow \emptyset$	0000179
17	cP_trsl	cP_trsl	$\emptyset \longrightarrow \text{cP}$	0000184
18	cP_degr	cP_degr	$\text{cP} \longrightarrow \emptyset$	0000179
19	cP9_m_trscr	cP9_m_trscr	$\emptyset \xrightarrow{\text{cL, cP, cT}} \text{cP9\_m}$	0000183

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№	Id	Name	Reaction Equation	SBO
20	cP9_m_degr	cP9_m_degr	$\mathrm{cP9\_m} \longrightarrow \emptyset$	0000179
21	cP9_trsl	cP9_trsl	$\emptyset \xrightarrow{\mathrm{cP9\_m}} \mathrm{cP9}$	0000184
22	cP9_degr	cP9_degr	$\mathrm{cP9} \longrightarrow \emptyset$	0000179
23	cP7_m_trscr	cP7_m_trscr	$\emptyset \xrightarrow{\mathrm{cL,\ cLm,\ cP9}} \mathrm{cP7\_m}$	0000183
24	cP7_m_degr	cP7_m_degr	$\mathrm{cP7\_m} \longrightarrow \emptyset$	0000179
25	cP7_trsl	cP7_trsl	$\emptyset \xrightarrow{\mathrm{cP7\_m}} \mathrm{cP7}$	0000184
26	cP7_degr	cP7_degr	$\mathrm{cP7} \longrightarrow \emptyset$	0000179
27	cNI_m_trscr	cNI_m_trscr	$\emptyset \xrightarrow{\mathrm{cLm,\ cP7}} \mathrm{cNI\_m}$	0000183
28	cNI_m_degr	cNI_m_degr	$\mathrm{cNI\_m} \longrightarrow \emptyset$	0000179
29	cNI_trsl	cNI_trsl	$\emptyset \xrightarrow{\mathrm{cNI\_m}} \mathrm{cNI}$	0000184
30	cNI_degr	cNI_degr	$\mathrm{cNI} \longrightarrow \emptyset$	0000179
31	cG_m_trscr	cG_m_trscr	$\emptyset \xrightarrow{\mathrm{cL,\ cP,\ cT}} \mathrm{cG\_m}$	0000183
32	cG_m_degr	cG_m_degr	$\mathrm{cG\_m} \longrightarrow \emptyset$	0000179
33	cG_trsl	cG_trsl	$\emptyset \xrightarrow{\mathrm{cG\_m}} \mathrm{cG}$	0000184
34	cG_degr	cG_degr	$\mathrm{cG} \longrightarrow \emptyset$	0000179
35	cG_cZTL_assoc	cG_cZTL_assoc	$\mathrm{cG} + \mathrm{cZTL} \rightleftharpoons \mathrm{cZG}$	0000526
36	cZTL_trsl	cZTL_trsl	$\emptyset \longrightarrow \mathrm{cZTL}$	0000183
37	cZTL_degr	cZTL_degr	$\mathrm{cZTL} \longrightarrow \emptyset$	0000179
38	cZG_degr	cZG_degr	$\mathrm{cZG} \longrightarrow \emptyset$	0000179

Produced by SBML2LaTeX

8.1 Reaction cL_m_trscr

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

Name cL_m_trscr

SBO:0000183 transcription

Reaction equation

$$\emptyset \xrightarrow{\text{cNI, cP, cP7, cP9, cTm}} \text{cL\_m} \tag{41}$$

Modifiers

Table 6: Properties of each modifier.

Id	Name	SBO
cNI	cNI	
cP	cP	
cP7	cP7	
cP9	cP9	
cTm	cTm	

Product

Table 7: Properties of each product.

Id	Name	SBO
cL_m	cL_m	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \text{vol}(\text{def}) \cdot \text{function\_4\_cL\_m\_trscr}(\text{L}, \text{a}, \text{b}, [\text{cNI}], [\text{cP}], [\text{cP7}], [\text{cP9}], [\text{cTm}], \text{vol}(\text{def}), \text{g1}, \text{g2}, \text{n0}, \text{n1}, \text{q1}) \tag{42}$$

$$\begin{aligned} &\text{function\_4\_cL\_m\_trscr}(\text{L}, \text{a}, \text{b}, [\text{cNI}], [\text{cP}], [\text{cP7}], [\text{cP9}], [\text{cTm}], \text{vol}(\text{def}), \text{g1}, \text{g2}, \text{n0}, \text{n1}, \text{q1}) \\ &= \frac{\left(\text{n0}\cdot\text{L} + \text{L}\cdot\text{q1}\cdot[\text{cP}] + \frac{\text{n1}\cdot[\text{cTm}]^{\text{b}}}{[\text{cTm}]^{\text{b}} + \text{g2}^{\text{b}}}\right)\cdot \text{g1}^{\text{a}}}{([\text{cP9}] + [\text{cP7}] + [\text{cNI}])^{\text{a}} + \text{g1}^{\text{a}}} \\ &\quad \text{vol}(\text{def}) \end{aligned} \tag{43}$$

$$\begin{aligned}&\text{function\_4\_cL\_m\_trscr}\left(\text{L},\text{a},\text{b},[\text{cNI}],[\text{cP}],[\text{cP7}],[\text{cP9}],[\text{cTm}],\text{vol}\left(\text{def}\right),\text{g1},\text{g2},\text{n0},\text{n1},\text{q1}\right)\\&=\frac{\frac{\left(\text{n0}\cdot\text{L}+\text{L}\cdot\text{q1}\cdot[\text{cP}]+\frac{\text{n1}\cdot[\text{cTm}]^{\text{b}}}{[\text{cTm}]^{\text{b}}+\text{g2}^{\text{b}}}\right)\cdot\text{g1}^{\text{a}}}{([\text{cP9}]+[\text{cP7}]+[\text{cNI}])^{\text{a}}+\text{g1}^{\text{a}}}}{\text{vol}\left(\text{def}\right)}\end{aligned}\tag{44}$$

8.2 Reaction cL_m_degr

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

Name cL_m_degr

SBO:0000179 degradation

Reaction equation

$$\text{cL\_m}\longrightarrow\emptyset\tag{45}$$

Reactant

Table 8: Properties of each reactant.

Id	Name	SBO
cL_m	cL_m	

Kinetic Law

Derived unit contains undeclared units

$$v_2=\text{vol}\left(\text{def}\right)\cdot\text{function\_4\_cL\_m\_degr}\left(\text{D},\text{L},[\text{cL\_m}],\text{vol}\left(\text{def}\right),\text{m1},\text{m2}\right)\tag{46}$$

$$\text{function\_4\_cL\_m\_degr}\left(\text{D},\text{L},[\text{cL\_m}],\text{vol}\left(\text{def}\right),\text{m1},\text{m2}\right)=\frac{\left(\text{m1}\cdot\text{L}+\text{m2}\cdot\text{D}\right)\cdot[\text{cL\_m}]}{\text{vol}\left(\text{def}\right)}\tag{47}$$

$$\text{function\_4\_cL\_m\_degr}\left(\text{D},\text{L},[\text{cL\_m}],\text{vol}\left(\text{def}\right),\text{m1},\text{m2}\right)=\frac{\left(\text{m1}\cdot\text{L}+\text{m2}\cdot\text{D}\right)\cdot[\text{cL\_m}]}{\text{vol}\left(\text{def}\right)}\tag{48}$$

8.3 Reaction cL_trsl

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

Name cL_trsl

SBO:0000184 translation

Reaction equation

$$\emptyset \xrightarrow{\text{cL\_m}} \text{cL} \tag{49}$$

Modifier

Table 9: Properties of each modifier.

Id	Name	SBO
cL_m	cL_m	

Product

Table 10: Properties of each product.

Id	Name	SBO
cL	cL	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \text{vol}(\text{def}) \cdot \text{function\_4\_cL\_trsl}(\text{D}, \text{L}, [\text{cL\_m}], \text{vol}(\text{def}), \text{p1}, \text{p2}) \tag{50}$$

$$\text{function\_4\_cL\_trsl}(\text{D}, \text{L}, [\text{cL\_m}], \text{vol}(\text{def}), \text{p1}, \text{p2}) = \frac{[\text{cL\_m}] \cdot (\text{p1} \cdot \text{L} + \text{p2} \cdot \text{D})}{\text{vol}(\text{def})} \tag{51}$$

$$\text{function\_4\_cL\_trsl}(\text{D}, \text{L}, [\text{cL\_m}], \text{vol}(\text{def}), \text{p1}, \text{p2}) = \frac{[\text{cL\_m}] \cdot (\text{p1} \cdot \text{L} + \text{p2} \cdot \text{D})}{\text{vol}(\text{def})} \tag{52}$$

8.4 Reaction cL_degr

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

Name cL_degr

SBO:0000179 degradation

Reaction equation

$$\text{cL} \longrightarrow \emptyset \tag{53}$$

Reactant

Table 11: Properties of each reactant.

Id	Name	SBO
cL	cL	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cL\_degr}\left(\mathrm{c}, [\mathrm{cL}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g3}, \mathrm{m3}, \mathrm{p3}\right) \tag{54}$$

$$\mathrm{function\_4\_cL\_degr}\left(\mathrm{c}, [\mathrm{cL}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g3}, \mathrm{m3}, \mathrm{p3}\right) = \frac{\mathrm{m3} \cdot [\mathrm{cL}] + \frac{\mathrm{p3} \cdot [\mathrm{cL}]^{\mathrm{c}}}{[\mathrm{cL}]^{\mathrm{c}} + \mathrm{g3}^{\mathrm{c}}}}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{55}$$

$$\mathrm{function\_4\_cL\_degr}\left(\mathrm{c}, [\mathrm{cL}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g3}, \mathrm{m3}, \mathrm{p3}\right) = \frac{\mathrm{m3} \cdot [\mathrm{cL}] + \frac{\mathrm{p3} \cdot [\mathrm{cL}]^{\mathrm{c}}}{[\mathrm{cL}]^{\mathrm{c}} + \mathrm{g3}^{\mathrm{c}}}}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{56}$$

8.5 Reaction cL_modif

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

Name cL_modif

SBO:0000176 biochemical reaction

Reaction equation

$$\emptyset \xrightarrow{\mathrm{cL}} \mathrm{cLm} \tag{57}$$

Modifier

Table 12: Properties of each modifier.

Id	Name	SBO
cL	cL	

Product

Table 13: Properties of each product.

Id	Name	SBO
cLm	cLm	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cL\_modif}\left(\mathrm{c}, [\mathrm{cL}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g3}, \mathrm{p3}\right) \tag{58}$$

$$\mathrm{function\_4\_cL\_modif}\left(\mathrm{c}, [\mathrm{cL}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g3}, \mathrm{p3}\right) = \frac{\frac{\mathrm{p3} \cdot [\mathrm{cL}]^{\mathrm{c}}}{[\mathrm{cL}]^{\mathrm{c}} + \mathrm{g3}^{\mathrm{c}}}}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{59}$$

$$\mathrm{function\_4\_cL\_modif}\left(\mathrm{c}, [\mathrm{cL}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g3}, \mathrm{p3}\right) = \frac{\frac{\mathrm{p3} \cdot [\mathrm{cL}]^{\mathrm{c}}}{[\mathrm{cL}]^{\mathrm{c}} + \mathrm{g3}^{\mathrm{c}}}}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{60}$$

8.6 Reaction cLm_degr

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

Name cLm_degr

SBO:0000179 degradation

Reaction equation

$$\mathrm{cLm} \longrightarrow \emptyset \tag{61}$$

Reactant

Table 14: Properties of each reactant.

Id	Name	SBO
cLm	cLm	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cLm\_degr}\left([\mathrm{cLm}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m4}\right) \tag{62}$$

$$\text{function\_4\_cLm\_degr}\left(\left[\text{cLm}\right], \text{vol}\left(\text{def}\right), \text{m4}\right) = \frac{\text{m4} \cdot \left[\text{cLm}\right]}{\text{vol}\left(\text{def}\right)} \tag{63}$$

$$\text{function\_4\_cLm\_degr}\left(\left[\text{cLm}\right], \text{vol}\left(\text{def}\right), \text{m4}\right) = \frac{\text{m4} \cdot \left[\text{cLm}\right]}{\text{vol}\left(\text{def}\right)} \tag{64}$$

8.7 Reaction `cT_m_trscr`

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

Name cT_m_trscr

SBO:0000183 transcription

Reaction equation

$$\emptyset \xrightarrow{\text{cL, cY}} \text{cT\_m} \tag{65}$$

Modifiers

Table 15: Properties of each modifier.

Id	Name	SBO
cL	cL	
cY	cY	

Product

Table 16: Properties of each product.

Id	Name	SBO
cT_m	cT_m	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \text{vol}\left(\text{def}\right) \cdot \text{function\_4\_cT\_m\_trscr}\left(\left[\text{cL}\right], \left[\text{cY}\right], \text{d}, \text{vol}\left(\text{def}\right), \text{e}, \text{g4}, \text{g5}, \text{n2}, \text{n3}\right) \tag{66}$$

$$\text{function\_4\_cT\_m\_trscr}\left(\left[\text{cL}\right], \left[\text{cY}\right], \text{d}, \text{vol}\left(\text{def}\right), \text{e}, \text{g4}, \text{g5}, \text{n2}, \text{n3}\right) = \frac{\left(\frac{\text{n2} \cdot \left[\text{cY}\right]^{\text{d}}}{\left[\text{cY}\right]^{\text{d}} + \text{g4}^{\text{d}}} + \text{n3}\right) \cdot \text{g5}^{\text{e}}}{\left[\text{cL}\right]^{\text{e}} + \text{g5}^{\text{e}}}}{\text{vol}\left(\text{def}\right)} \tag{67}$$

$$\text{function\_4\_cT\_m\_trscr}\left(\left[\text{cL}\right],\left[\text{cY}\right],\text{d},\text{vol}\left(\text{def}\right),\text{e},\text{g4},\text{g5},\text{n2},\text{n3}\right)=\frac{\left(\frac{\text{n2}\cdot\left[\text{cY}\right]^{\text{d}}}{\left[\text{cY}\right]^{\text{d}}+\text{g4}^{\text{d}}}+\text{n3}\right)\cdot\text{g5}^{\text{e}}}{\left[\text{cL}\right]^{\text{e}}+\text{g5}^{\text{e}}}}{\text{vol}\left(\text{def}\right)} \tag{68}$$

8.8 Reaction cT_m_degr

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

Name cT_m_degr

SBO:0000179 degradation

Reaction equation

$$\text{cT\_m}\longrightarrow\emptyset \tag{69}$$

Reactant

Table 17: Properties of each reactant.

Id	Name	SBO
cT_m	cT_m	

Kinetic Law

Derived unit contains undeclared units

$$v_8=\text{vol}\left(\text{def}\right)\cdot\text{function\_4\_cT\_m\_degr}\left(\left[\text{cT\_m}\right],\text{vol}\left(\text{def}\right),\text{m5}\right) \tag{70}$$

$$\text{function\_4\_cT\_m\_degr}\left(\left[\text{cT\_m}\right],\text{vol}\left(\text{def}\right),\text{m5}\right)=\frac{\text{m5}\cdot\left[\text{cT\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{71}$$

$$\text{function\_4\_cT\_m\_degr}\left(\left[\text{cT\_m}\right],\text{vol}\left(\text{def}\right),\text{m5}\right)=\frac{\text{m5}\cdot\left[\text{cT\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{72}$$

8.9 Reaction cT_trsl

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

Name cT_trsl

SBO:0000184 translation

Reaction equation

$$\emptyset \xrightarrow{\text{cT\_m}} \text{cT} \tag{73}$$

Modifier

Table 18: Properties of each modifier.

Id	Name	SBO
cT_m	cT_m	

Product

Table 19: Properties of each product.

Id	Name	SBO
cT	cT	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \text{vol}\left(\text{def}\right) \cdot \text{function\_4\_cT\_trsl}\left(\left[\text{cT\_m}\right], \text{vol}\left(\text{def}\right), \text{p4}\right) \tag{74}$$

$$\text{function\_4\_cT\_trsl}\left(\left[\text{cT\_m}\right], \text{vol}\left(\text{def}\right), \text{p4}\right) = \frac{\text{p4} \cdot \left[\text{cT\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{75}$$

$$\text{function\_4\_cT\_trsl}\left(\left[\text{cT\_m}\right], \text{vol}\left(\text{def}\right), \text{p4}\right) = \frac{\text{p4} \cdot \left[\text{cT\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{76}$$

8.10 Reaction cT_degr

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

Name cT_degr

SBO:0000179 degradation

Reaction equation

$$\text{cT} \xrightarrow{\text{cZG, cZTL}} \emptyset \tag{77}$$

Reactant

Table 20: Properties of each reactant.

Id	Name	SBO
cT	cT	

Modifiers

Table 21: Properties of each modifier.

Id	Name	SBO
cZG	cZG	
cZTL	cZTL	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cT\_degr}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cT}], [\mathrm{cZG}], [\mathrm{cZTL}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m6}, \mathrm{m7}, \mathrm{m8}, \mathrm{p5}\right) \tag{78}$$

$$\begin{aligned} &\mathrm{function\_4\_cT\_degr}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cT}], [\mathrm{cZG}], [\mathrm{cZTL}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m6}, \mathrm{m7}, \mathrm{m8}, \mathrm{p5}\right) \\ &= \frac{\left(\mathrm{m6} \cdot \mathrm{L} + \mathrm{m7} \cdot \mathrm{D}\right) \cdot [\mathrm{cT}] \cdot \left(\mathrm{p5} \cdot [\mathrm{cZTL}] + [\mathrm{cZG}]\right) + \mathrm{m8} \cdot [\mathrm{cT}]}{\mathrm{vol}\left(\mathrm{def}\right)} \end{aligned} \tag{79}$$

$$\begin{aligned} &\mathrm{function\_4\_cT\_degr}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cT}], [\mathrm{cZG}], [\mathrm{cZTL}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m6}, \mathrm{m7}, \mathrm{m8}, \mathrm{p5}\right) \\ &= \frac{\left(\mathrm{m6} \cdot \mathrm{L} + \mathrm{m7} \cdot \mathrm{D}\right) \cdot [\mathrm{cT}] \cdot \left(\mathrm{p5} \cdot [\mathrm{cZTL}] + [\mathrm{cZG}]\right) + \mathrm{m8} \cdot [\mathrm{cT}]}{\mathrm{vol}\left(\mathrm{def}\right)} \end{aligned} \tag{80}$$

8.11 Reaction cT_modif

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

Name cT_modif

SBO:0000176 biochemical reaction

Reaction equation

$$\emptyset \xrightarrow{\mathrm{cT}} \mathrm{cTm} \tag{81}$$

Modifier

Table 22: Properties of each modifier.

Id	Name	SBO
cT	cT	

Product

Table 23: Properties of each product.

Id	Name	SBO
cTm	cTm	

Kinetic Law

Derived unit contains undeclared units

$$v_{11} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cT\_modif}\left(\left[\mathrm{cT}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{f}, \mathrm{g6}, \mathrm{p15}\right) \tag{82}$$

$$\mathrm{function\_4\_cT\_modif}\left(\left[\mathrm{cT}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{f}, \mathrm{g6}, \mathrm{p15}\right) = \frac{\frac{\mathrm{p15} \cdot \left[\mathrm{cT}\right]^{\mathrm{f}}}{\left[\mathrm{cT}\right]^{\mathrm{f}} + \mathrm{g6}^{\mathrm{f}}}}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{83}$$

$$\mathrm{function\_4\_cT\_modif}\left(\left[\mathrm{cT}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{f}, \mathrm{g6}, \mathrm{p15}\right) = \frac{\frac{\mathrm{p15} \cdot \left[\mathrm{cT}\right]^{\mathrm{f}}}{\left[\mathrm{cT}\right]^{\mathrm{f}} + \mathrm{g6}^{\mathrm{f}}}}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{84}$$

8.12 Reaction cTm_degr

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

Name cTm_degr

SBO:0000179 degradation

Reaction equation

$$\mathrm{cTm} \longrightarrow \emptyset \tag{85}$$

Reactant

Table 24: Properties of each reactant.

Id	Name	SBO
cTm	cTm	

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cTm\_degr}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cTm}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m25}, \mathrm{m26}\right) \tag{86}$$

$$\mathrm{function\_4\_cTm\_degr}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cTm}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m25}, \mathrm{m26}\right) = \frac{\left(\mathrm{m25} \cdot \mathrm{L} + \mathrm{m26} \cdot \mathrm{D}\right) \cdot [\mathrm{cTm}]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{87}$$

$$\mathrm{function\_4\_cTm\_degr}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cTm}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m25}, \mathrm{m26}\right) = \frac{\left(\mathrm{m25} \cdot \mathrm{L} + \mathrm{m26} \cdot \mathrm{D}\right) \cdot [\mathrm{cTm}]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{88}$$

8.13 Reaction cY_m_trscr

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

Name cY_m_trscr

SBO:0000183 transcription

Reaction equation

$$\emptyset \xrightarrow{\mathrm{cL},\ \mathrm{cP},\ \mathrm{cT}} \mathrm{cY\_m} \tag{89}$$

Modifiers

Table 25: Properties of each modifier.

Id	Name	SBO
cL	cL	
cP	cP	
cT	cT	

Product

Table 26: Properties of each product.

Id	Name	SBO
cY_m	cY_m	

Kinetic Law

Derived unit contains undeclared units

$$v_{13} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cY\_m\_trscr}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cL}], [\mathrm{cP}], [\mathrm{cT}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g}, \mathrm{g16}, \mathrm{g7}, \mathrm{n5}, \mathrm{n6}, \mathrm{q2}, \mathrm{s}\right) \tag{90}$$

$$\begin{aligned} &\mathrm{function\_4\_cY\_m\_trscr}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cL}], [\mathrm{cP}], [\mathrm{cT}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g}, \mathrm{g16}, \mathrm{g7}, \mathrm{n5}, \mathrm{n6}, \mathrm{q2}, \mathrm{s}\right) \\ &= \frac{\mathrm{L} \cdot \mathrm{q2} \cdot [\mathrm{cP}] + \frac{\frac{(\mathrm{n5} \cdot \mathrm{L} + \mathrm{n6} \cdot \mathrm{D}) \cdot \mathrm{g7}^{\mathrm{s}}}{[\mathrm{cT}]^{\mathrm{s}} + \mathrm{g7}^{\mathrm{s}}} \cdot \mathrm{g16}^{\mathrm{g}}}{[\mathrm{cL}]^{\mathrm{g}} + \mathrm{g16}^{\mathrm{g}}}}{\mathrm{vol}\left(\mathrm{def}\right)} \end{aligned} \tag{91}$$

$$\begin{aligned} &\mathrm{function\_4\_cY\_m\_trscr}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cL}], [\mathrm{cP}], [\mathrm{cT}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g}, \mathrm{g16}, \mathrm{g7}, \mathrm{n5}, \mathrm{n6}, \mathrm{q2}, \mathrm{s}\right) \\ &= \frac{\mathrm{L} \cdot \mathrm{q2} \cdot [\mathrm{cP}] + \frac{\frac{(\mathrm{n5} \cdot \mathrm{L} + \mathrm{n6} \cdot \mathrm{D}) \cdot \mathrm{g7}^{\mathrm{s}}}{[\mathrm{cT}]^{\mathrm{s}} + \mathrm{g7}^{\mathrm{s}}} \cdot \mathrm{g16}^{\mathrm{g}}}{[\mathrm{cL}]^{\mathrm{g}} + \mathrm{g16}^{\mathrm{g}}}}{\mathrm{vol}\left(\mathrm{def}\right)} \end{aligned} \tag{92}$$

8.14 Reaction cY_m_degr

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

Name cY_m_degr

SBO:0000179 degradation

Reaction equation

$$\mathrm{cY\_m} \longrightarrow \emptyset \tag{93}$$

Reactant

Table 27: Properties of each reactant.

Id	Name	SBO
cY_m	cY_m	

Kinetic Law

Derived unit contains undeclared units

$$v_{14} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cY\_m\_degr}\left(\left[\mathrm{cY\_m}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m9}\right) \tag{94}$$

$$\mathrm{function\_4\_cY\_m\_degr}\left(\left[\mathrm{cY\_m}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m9}\right) = \frac{\mathrm{m9} \cdot \left[\mathrm{cY\_m}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{95}$$

$$\mathrm{function\_4\_cY\_m\_degr}\left(\left[\mathrm{cY\_m}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m9}\right) = \frac{\mathrm{m9} \cdot \left[\mathrm{cY\_m}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{96}$$

8.15 Reaction `cY_trsl`

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

Name cY_trsl

SBO:0000184 translation

Reaction equation

$$\emptyset \xrightarrow{\mathrm{cY\_m}} \mathrm{cY} \tag{97}$$

Modifier

Table 28: Properties of each modifier.

Id	Name	SBO
`cY_m`	cY_m	

Product

Table 29: Properties of each product.

Id	Name	SBO
`cY`	cY	

Kinetic Law

Derived unit contains undeclared units

$$v_{15} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cY\_trsl}\left(\left[\mathrm{cY\_m}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{p6}\right) \tag{98}$$

$$\text{function\_4\_cY\_trsl}\left(\left[\text{cY\_m}\right], \text{vol}\left(\text{def}\right), \text{p6}\right) = \frac{\text{p6} \cdot \left[\text{cY\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{99}$$

$$\text{function\_4\_cY\_trsl}\left(\left[\text{cY\_m}\right], \text{vol}\left(\text{def}\right), \text{p6}\right) = \frac{\text{p6} \cdot \left[\text{cY\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{100}$$

8.16 Reaction cY_degr

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

Name cY_degr

SBO:0000179 degradation

Reaction equation

$$\text{cY} \longrightarrow \emptyset \tag{101}$$

Reactant

Table 30: Properties of each reactant.

Id	Name	SBO
cY	cY	

Kinetic Law

Derived unit contains undeclared units

$$v_{16} = \text{vol}\left(\text{def}\right) \cdot \text{function\_4\_cY\_degr}\left(\left[\text{cY}\right], \text{vol}\left(\text{def}\right), \text{m10}\right) \tag{102}$$

$$\text{function\_4\_cY\_degr}\left(\left[\text{cY}\right], \text{vol}\left(\text{def}\right), \text{m10}\right) = \frac{\text{m10} \cdot \left[\text{cY}\right]}{\text{vol}\left(\text{def}\right)} \tag{103}$$

$$\text{function\_4\_cY\_degr}\left(\left[\text{cY}\right], \text{vol}\left(\text{def}\right), \text{m10}\right) = \frac{\text{m10} \cdot \left[\text{cY}\right]}{\text{vol}\left(\text{def}\right)} \tag{104}$$

8.17 Reaction cP_trsl

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

Name cP_trsl

SBO:0000184 translation

Reaction equation

$$\emptyset \longrightarrow \mathrm{cP} \tag{105}$$

Product

Table 31: Properties of each product.

Id	Name	SBO
cP	cP	

Kinetic Law

Derived unit contains undeclared units

$$v_{17} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cP\_trsl}\left(\mathrm{D}, [\mathrm{cP}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{p7}\right) \tag{106}$$

$$\mathrm{function\_4\_cP\_trsl}\left(\mathrm{D}, [\mathrm{cP}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{p7}\right) = \frac{\mathrm{p7} \cdot \mathrm{D} \cdot (1 - [\mathrm{cP}])}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{107}$$

$$\mathrm{function\_4\_cP\_trsl}\left(\mathrm{D}, [\mathrm{cP}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{p7}\right) = \frac{\mathrm{p7} \cdot \mathrm{D} \cdot (1 - [\mathrm{cP}])}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{108}$$

8.18 Reaction cP_degr

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

Name cP_degr

SBO:0000179 degradation

Reaction equation

$$\mathrm{cP} \longrightarrow \emptyset \tag{109}$$

Reactant

Table 32: Properties of each reactant.

Id	Name	SBO
cP	cP	

Kinetic Law

Derived unit contains undeclared units

$$v_{18} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cP\_degr}\left(\mathrm{L}, [\mathrm{cP}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m11}\right) \tag{110}$$

$$\mathrm{function\_4\_cP\_degr}\left(\mathrm{L}, [\mathrm{cP}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m11}\right) = \frac{\mathrm{m11} \cdot [\mathrm{cP}] \cdot \mathrm{L}}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{111}$$

$$\mathrm{function\_4\_cP\_degr}\left(\mathrm{L}, [\mathrm{cP}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m11}\right) = \frac{\mathrm{m11} \cdot [\mathrm{cP}] \cdot \mathrm{L}}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{112}$$

8.19 Reaction cP9_m_trscr

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

Name cP9_m_trscr

SBO:0000183 transcription

Reaction equation

$$\emptyset \xrightarrow{\mathrm{cL},\ \mathrm{cP},\ \mathrm{cT}} \mathrm{cP9\_m} \tag{113}$$

Modifiers

Table 33: Properties of each modifier.

Id	Name	SBO
cL	cL	
cP	cP	
cT	cT	

Product

Table 34: Properties of each product.

Id	Name	SBO
cP9_m	cP9_m	

Kinetic Law

Derived unit contains undeclared units

$$v_{19} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cP9\_m\_trscr}\left(\mathrm{L}, [\mathrm{cL}], [\mathrm{cP}], [\mathrm{cT}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g8}, \mathrm{g9}, \mathrm{h}, \mathrm{i}, \mathrm{n4}, \mathrm{n7}, \mathrm{q3}\right) \tag{114}$$

$$\begin{aligned} &\mathrm{function\_4\_cP9\_m\_trscr}\left(\mathrm{L}, [\mathrm{cL}], [\mathrm{cP}], [\mathrm{cT}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g8}, \mathrm{g9}, \mathrm{h}, \mathrm{i}, \mathrm{n4}, \mathrm{n7}, \mathrm{q3}\right) \\ &= \frac{\mathrm{L} \cdot \mathrm{q3} \cdot [\mathrm{cP}] + \frac{\left(\mathrm{n4} \cdot \mathrm{L} + \frac{\mathrm{n7} \cdot [\mathrm{cL}]^{\mathrm{i}}}{[\mathrm{cL}]^{\mathrm{i}} + \mathrm{g9}^{\mathrm{i}}}\right) \cdot \mathrm{g8}^{\mathrm{h}}}{[\mathrm{cT}]^{\mathrm{h}} + \mathrm{g8}^{\mathrm{h}}}}{\mathrm{vol}\left(\mathrm{def}\right)} \end{aligned} \tag{115}$$

$$\begin{aligned} &\mathrm{function\_4\_cP9\_m\_trscr}\left(\mathrm{L}, [\mathrm{cL}], [\mathrm{cP}], [\mathrm{cT}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g8}, \mathrm{g9}, \mathrm{h}, \mathrm{i}, \mathrm{n4}, \mathrm{n7}, \mathrm{q3}\right) \\ &= \frac{\mathrm{L} \cdot \mathrm{q3} \cdot [\mathrm{cP}] + \frac{\left(\mathrm{n4} \cdot \mathrm{L} + \frac{\mathrm{n7} \cdot [\mathrm{cL}]^{\mathrm{i}}}{[\mathrm{cL}]^{\mathrm{i}} + \mathrm{g9}^{\mathrm{i}}}\right) \cdot \mathrm{g8}^{\mathrm{h}}}{[\mathrm{cT}]^{\mathrm{h}} + \mathrm{g8}^{\mathrm{h}}}}{\mathrm{vol}\left(\mathrm{def}\right)} \end{aligned} \tag{116}$$

8.20 Reaction `cP9_m_degr`

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

Name cP9_m_degr

SBO:0000179 degradation

Reaction equation

$$\mathrm{cP9\_m} \longrightarrow \emptyset \tag{117}$$

Reactant

Table 35: Properties of each reactant.

Id	Name	SBO
`cP9_m`	cP9_m	

Kinetic Law

Derived unit contains undeclared units

$$v_{20} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cP9\_m\_degr}\left([\mathrm{cP9\_m}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m12}\right) \tag{118}$$

$$\text{function\_4\_cP9\_m\_degr}\left(\left[\text{cP9\_m}\right], \text{vol}\left(\text{def}\right), \text{m12}\right) = \frac{\text{m12} \cdot \left[\text{cP9\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{119}$$

$$\text{function\_4\_cP9\_m\_degr}\left(\left[\text{cP9\_m}\right], \text{vol}\left(\text{def}\right), \text{m12}\right) = \frac{\text{m12} \cdot \left[\text{cP9\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{120}$$

8.21 Reaction `cP9_trsl`

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

Name cP9_trsl

SBO:0000184 translation

Reaction equation

$$\emptyset \xrightarrow{\text{cP9\_m}} \text{cP9} \tag{121}$$

Modifier

Table 36: Properties of each modifier.

Id	Name	SBO
`cP9_m`	cP9_m	

Product

Table 37: Properties of each product.

Id	Name	SBO
`cP9`	cP9	

Kinetic Law

Derived unit contains undeclared units

$$v_{21} = \text{vol}\left(\text{def}\right) \cdot \text{function\_4\_cP9\_trsl}\left(\left[\text{cP9\_m}\right], \text{vol}\left(\text{def}\right), \text{p8}\right) \tag{122}$$

$$\text{function\_4\_cP9\_trsl}\left(\left[\text{cP9\_m}\right], \text{vol}\left(\text{def}\right), \text{p8}\right) = \frac{\text{p8} \cdot \left[\text{cP9\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{123}$$

$$\text{function\_4\_cP9\_trsl}\left(\left[\text{cP9\_m}\right], \text{vol}\left(\text{def}\right), \text{p8}\right) = \frac{\text{p8} \cdot \left[\text{cP9\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{124}$$

8.22 Reaction cP9_degr

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

Name cP9_degr

SBO:0000179 degradation

Reaction equation

$$\mathrm{cP9} \longrightarrow \emptyset \tag{125}$$

Reactant

Table 38: Properties of each reactant.

Id	Name	SBO
cP9	cP9	

Kinetic Law

Derived unit contains undeclared units

$$v_{22} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cP9\_degr}\left(\mathrm{D}, \mathrm{L}, \left[\mathrm{cP9}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m13}, \mathrm{m22}\right) \tag{126}$$

$$\mathrm{function\_4\_cP9\_degr}\left(\mathrm{D}, \mathrm{L}, \left[\mathrm{cP9}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m13}, \mathrm{m22}\right) = \frac{\left(\mathrm{m13} \cdot \mathrm{L} + \mathrm{m22} \cdot \mathrm{D}\right) \cdot \left[\mathrm{cP9}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{127}$$

$$\mathrm{function\_4\_cP9\_degr}\left(\mathrm{D}, \mathrm{L}, \left[\mathrm{cP9}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m13}, \mathrm{m22}\right) = \frac{\left(\mathrm{m13} \cdot \mathrm{L} + \mathrm{m22} \cdot \mathrm{D}\right) \cdot \left[\mathrm{cP9}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{128}$$

8.23 Reaction cP7_m_trscr

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

Name cP7_m_trscr

SBO:0000183 transcription

Reaction equation

$$\emptyset \xrightarrow{\mathrm{cL},\ \mathrm{cLm},\ \mathrm{cP9}} \mathrm{cP7\_m} \tag{129}$$

Modifiers

Table 39: Properties of each modifier.

Id	Name	SBO
cL	cL	
cLm	cLm	
cP9	cP9	

Product

Table 40: Properties of each product.

Id	Name	SBO
cP7_m	cP7_m	

Kinetic Law

Derived unit contains undeclared units

$$v_{23} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cP7\_m\_trscr}\left(\left[\mathrm{cL}\right], \left[\mathrm{cLm}\right], \left[\mathrm{cP9}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g10}, \mathrm{g11}, \mathrm{j}, \mathrm{k}, \mathrm{n8}, \mathrm{n9}\right) \tag{130}$$

$$\mathrm{function\_4\_cP7\_m\_trscr}\left(\left[\mathrm{cL}\right], \left[\mathrm{cLm}\right], \left[\mathrm{cP9}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g10}, \mathrm{g11}, \mathrm{j}, \mathrm{k}, \mathrm{n8}, \mathrm{n9}\right) = \frac{\frac{\mathrm{n8} \cdot \left(\left[\mathrm{cLm}\right] + \left[\mathrm{cL}\right]\right)^{\mathrm{j}}}{\left(\left[\mathrm{cLm}\right] + \left[\mathrm{cL}\right]\right)^{\mathrm{j}} + \mathrm{g10}^{\mathrm{j}}} + \frac{\mathrm{n9} \cdot \left[\mathrm{cP9}\right]^{\mathrm{k}}}{\left[\mathrm{cP9}\right]^{\mathrm{k}} + \mathrm{g11}^{\mathrm{k}}}}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{131}$$

$$\mathrm{function\_4\_cP7\_m\_trscr}\left(\left[\mathrm{cL}\right], \left[\mathrm{cLm}\right], \left[\mathrm{cP9}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g10}, \mathrm{g11}, \mathrm{j}, \mathrm{k}, \mathrm{n8}, \mathrm{n9}\right) = \frac{\frac{\mathrm{n8} \cdot \left(\left[\mathrm{cLm}\right] + \left[\mathrm{cL}\right]\right)^{\mathrm{j}}}{\left(\left[\mathrm{cLm}\right] + \left[\mathrm{cL}\right]\right)^{\mathrm{j}} + \mathrm{g10}^{\mathrm{j}}} + \frac{\mathrm{n9} \cdot \left[\mathrm{cP9}\right]^{\mathrm{k}}}{\left[\mathrm{cP9}\right]^{\mathrm{k}} + \mathrm{g11}^{\mathrm{k}}}}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{132}$$

8.24 Reaction cP7_m_degr

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

Name cP7_m_degr

SBO:0000179 degradation

Reaction equation

$$\mathrm{cP7\_m} \longrightarrow \emptyset \tag{133}$$

Reactant

Table 41: Properties of each reactant.

Id	Name	SBO
cP7_m	cP7_m	

Kinetic Law

Derived unit contains undeclared units

$$v_{24} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cP7\_m\_degr}\left(\left[\mathrm{cP7\_m}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m14}\right) \tag{134}$$

$$\mathrm{function\_4\_cP7\_m\_degr}\left(\left[\mathrm{cP7\_m}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m14}\right) = \frac{\mathrm{m14} \cdot \left[\mathrm{cP7\_m}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{135}$$

$$\mathrm{function\_4\_cP7\_m\_degr}\left(\left[\mathrm{cP7\_m}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m14}\right) = \frac{\mathrm{m14} \cdot \left[\mathrm{cP7\_m}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{136}$$

8.25 Reaction cP7_trsl

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

Name cP7_trsl

SBO:0000184 translation

Reaction equation

$$\emptyset \xrightarrow{\mathrm{cP7\_m}} \mathrm{cP7} \tag{137}$$

Modifier

Table 42: Properties of each modifier.

Id	Name	SBO
cP7_m	cP7_m	

Product

Table 43: Properties of each product.

Id	Name	SBO
cP7	cP7	

Id	Name	SBO

Kinetic Law

Derived unit contains undeclared units

$$v_{25} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cP7\_trsl}\left(\left[\mathrm{cP7\_m}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{p9}\right) \tag{138}$$

$$\mathrm{function\_4\_cP7\_trsl}\left(\left[\mathrm{cP7\_m}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{p9}\right) = \frac{\mathrm{p9} \cdot \left[\mathrm{cP7\_m}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{139}$$

$$\mathrm{function\_4\_cP7\_trsl}\left(\left[\mathrm{cP7\_m}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{p9}\right) = \frac{\mathrm{p9} \cdot \left[\mathrm{cP7\_m}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{140}$$

8.26 Reaction cP7_degr

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

Name cP7_degr

SBO:0000179 degradation

Reaction equation

$$\mathrm{cP7} \longrightarrow \emptyset \tag{141}$$

Reactant

Table 44: Properties of each reactant.

Id	Name	SBO
cP7	cP7	

Kinetic Law

Derived unit contains undeclared units

$$v_{26} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cP7\_degr}\left(\mathrm{D}, \mathrm{L}, \left[\mathrm{cP7}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m15}, \mathrm{m23}\right) \tag{142}$$

$$\mathrm{function\_4\_cP7\_degr}\left(\mathrm{D}, \mathrm{L}, \left[\mathrm{cP7}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m15}, \mathrm{m23}\right) = \frac{\left(\mathrm{m15} \cdot \mathrm{L} + \mathrm{m23} \cdot \mathrm{D}\right) \cdot \left[\mathrm{cP7}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{143}$$

$$\mathrm{function\_4\_cP7\_degr}\left(\mathrm{D}, \mathrm{L}, \left[\mathrm{cP7}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m15}, \mathrm{m23}\right) = \frac{\left(\mathrm{m15} \cdot \mathrm{L} + \mathrm{m23} \cdot \mathrm{D}\right) \cdot \left[\mathrm{cP7}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{144}$$

8.27 Reaction cNI_m_trscr

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

Name cNI_m_trscr

SBO:0000183 transcription

Reaction equation

$$\emptyset \xrightarrow{\text{cLm, cP7}} \text{cNI\_m} \tag{145}$$

Modifiers

Table 45: Properties of each modifier.

Id	Name	SBO
cLm	cLm	
cP7	cP7	

Product

Table 46: Properties of each product.

Id	Name	SBO
cNI_m	cNI_m	

Kinetic Law

Derived unit contains undeclared units

$$v_{27} = \text{vol}\left(\text{def}\right) \cdot \text{function\_4\_cNI\_m\_trscr}\left(\left[\text{cLm}\right], \left[\text{cP7}\right], \text{vol}\left(\text{def}\right), \text{g12}, \text{g13}, \text{l}, \text{m}, \text{n10}, \text{n11}\right) \tag{146}$$

$$\begin{aligned} &\text{function\_4\_cNI\_m\_trscr}\left(\left[\text{cLm}\right], \left[\text{cP7}\right], \text{vol}\left(\text{def}\right), \text{g12}, \text{g13}, \text{l}, \text{m}, \text{n10}, \text{n11}\right) \\ &= \frac{\frac{\text{n10} \cdot \left[\text{cLm}\right]^{\text{l}}}{\left[\text{cLm}\right]^{\text{l}} + \text{g12}^{\text{l}}} + \frac{\text{n11} \cdot \left[\text{cP7}\right]^{\text{m}}}{\left[\text{cP7}\right]^{\text{m}} + \text{g13}^{\text{m}}}}{\text{vol}\left(\text{def}\right)} \end{aligned} \tag{147}$$

$$\begin{aligned} &\text{function\_4\_cNI\_m\_trscr}\left(\left[\text{cLm}\right], \left[\text{cP7}\right], \text{vol}\left(\text{def}\right), \text{g12}, \text{g13}, \text{l}, \text{m}, \text{n10}, \text{n11}\right) \\ &= \frac{\frac{\text{n10} \cdot \left[\text{cLm}\right]^{\text{l}}}{\left[\text{cLm}\right]^{\text{l}} + \text{g12}^{\text{l}}} + \frac{\text{n11} \cdot \left[\text{cP7}\right]^{\text{m}}}{\left[\text{cP7}\right]^{\text{m}} + \text{g13}^{\text{m}}}}{\text{vol}\left(\text{def}\right)} \end{aligned} \tag{148}$$

8.28 Reaction cNI_m_degr

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

Name cNI_m_degr

SBO:0000179 degradation

Reaction equation

$$\text{cNI\_m} \longrightarrow \emptyset \tag{149}$$

Reactant

Table 47: Properties of each reactant.

Id	Name	SBO
cNI_m	cNI_m	

Kinetic Law

Derived unit contains undeclared units

$$v_{28} = \text{vol}\left(\text{def}\right) \cdot \text{function\_4\_cNI\_m\_degr}\left(\left[\text{cNI\_m}\right], \text{vol}\left(\text{def}\right), \text{m16}\right) \tag{150}$$

$$\text{function\_4\_cNI\_m\_degr}\left(\left[\text{cNI\_m}\right], \text{vol}\left(\text{def}\right), \text{m16}\right) = \frac{\text{m16} \cdot \left[\text{cNI\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{151}$$

$$\text{function\_4\_cNI\_m\_degr}\left(\left[\text{cNI\_m}\right], \text{vol}\left(\text{def}\right), \text{m16}\right) = \frac{\text{m16} \cdot \left[\text{cNI\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{152}$$

8.29 Reaction cNI_trsl

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

Name cNI_trsl

SBO:0000184 translation

Reaction equation

$$\emptyset \xrightarrow{\text{cNI\_m}} \text{cNI} \tag{153}$$

Modifier

Table 48: Properties of each modifier.

Id	Name	SBO
cNI_m	cNI_m	

Product

Table 49: Properties of each product.

Id	Name	SBO
cNI	cNI	

Kinetic Law

Derived unit contains undeclared units

$$v_{29} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cNI\_trsl}\left(\left[\mathrm{cNI\_m}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{p10}\right) \tag{154}$$

$$\mathrm{function\_4\_cNI\_trsl}\left(\left[\mathrm{cNI\_m}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{p10}\right) = \frac{\mathrm{p10} \cdot \left[\mathrm{cNI\_m}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{155}$$

$$\mathrm{function\_4\_cNI\_trsl}\left(\left[\mathrm{cNI\_m}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{p10}\right) = \frac{\mathrm{p10} \cdot \left[\mathrm{cNI\_m}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{156}$$

8.30 Reaction cNI_degr

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

Name cNI_degr

SBO:0000179 degradation

Reaction equation

$$\mathrm{cNI} \longrightarrow \emptyset \tag{157}$$

Reactant

Table 50: Properties of each reactant.

Id	Name	SBO
cNI	cNI	

Kinetic Law

Derived unit contains undeclared units

$$v_{30} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cNI\_degr}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cNI}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m17}, \mathrm{m24}\right) \tag{158}$$

$$\mathrm{function\_4\_cNI\_degr}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cNI}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m17}, \mathrm{m24}\right) = \frac{\left(\mathrm{m17} \cdot \mathrm{L} + \mathrm{m24} \cdot \mathrm{D}\right) \cdot [\mathrm{cNI}]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{159}$$

$$\mathrm{function\_4\_cNI\_degr}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cNI}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m17}, \mathrm{m24}\right) = \frac{\left(\mathrm{m17} \cdot \mathrm{L} + \mathrm{m24} \cdot \mathrm{D}\right) \cdot [\mathrm{cNI}]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{160}$$

8.31 Reaction `cG_m_trscr`

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

Name cG_m_trscr

SBO:0000183 transcription

Reaction equation

$$\emptyset \xrightarrow{\mathrm{cL},\ \mathrm{cP},\ \mathrm{cT}} \mathrm{cG\_m} \tag{161}$$

Modifiers

Table 51: Properties of each modifier.

Id	Name	SBO
cL	cL	
cP	cP	
cT	cT	

Product

Table 52: Properties of each product.

Id	Name	SBO
cG_m	cG_m	

Kinetic Law

Derived unit contains undeclared units

$$v_{31} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cG\_m\_trscr}\left(\mathrm{L}, [\mathrm{cL}], [\mathrm{cP}], [\mathrm{cT}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g14}, \mathrm{g15}, \mathrm{n}, \mathrm{n12}, \mathrm{o}, \mathrm{q4}\right) \tag{162}$$

$$\begin{aligned} &\mathrm{function\_4\_cG\_m\_trscr}\left(\mathrm{L}, [\mathrm{cL}], [\mathrm{cP}], [\mathrm{cT}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g14}, \mathrm{g15}, \mathrm{n}, \mathrm{n12}, \mathrm{o}, \mathrm{q4}\right) \\ &= \frac{\mathrm{L} \cdot \mathrm{q4} \cdot [\mathrm{cP}] + \frac{\mathrm{n12} \cdot \mathrm{L} \cdot \mathrm{g15}^{\mathrm{o}}}{[\mathrm{cL}]^{\mathrm{o}} + \mathrm{g15}^{\mathrm{o}}} \cdot \mathrm{g14}^{\mathrm{n}}}{\mathrm{vol}\left(\mathrm{def}\right)} \end{aligned} \tag{163}$$

$$\begin{aligned} &\mathrm{function\_4\_cG\_m\_trscr}\left(\mathrm{L}, [\mathrm{cL}], [\mathrm{cP}], [\mathrm{cT}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{g14}, \mathrm{g15}, \mathrm{n}, \mathrm{n12}, \mathrm{o}, \mathrm{q4}\right) \\ &= \frac{\mathrm{L} \cdot \mathrm{q4} \cdot [\mathrm{cP}] + \frac{\mathrm{n12} \cdot \mathrm{L} \cdot \mathrm{g15}^{\mathrm{o}}}{[\mathrm{cL}]^{\mathrm{o}} + \mathrm{g15}^{\mathrm{o}}} \cdot \mathrm{g14}^{\mathrm{n}}}{\mathrm{vol}\left(\mathrm{def}\right)} \end{aligned} \tag{164}$$

8.32 Reaction cG_m_degr

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

Name cG_m_degr

SBO:0000179 degradation

Reaction equation

$$\mathrm{cG\_m} \longrightarrow \emptyset \tag{165}$$

Reactant

Table 53: Properties of each reactant.

Id	Name	SBO
cG_m	cG_m	

Kinetic Law

Derived unit contains undeclared units

$$v_{32} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cG\_m\_degr}\left([\mathrm{cG\_m}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m18}\right) \tag{166}$$

$$\mathrm{function\_4\_cG\_m\_degr}\left([\mathrm{cG\_m}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m18}\right) = \frac{\mathrm{m18} \cdot [\mathrm{cG\_m}]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{167}$$

$$\text{function\_4\_cG\_m\_degr}\left(\left[\text{cG\_m}\right], \text{vol}\left(\text{def}\right), \text{m18}\right) = \frac{\text{m18} \cdot \left[\text{cG\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{168}$$

8.33 Reaction cG_trsl

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

Name cG_trsl

SBO:0000184 translation

Reaction equation

$$\emptyset \xrightarrow{\text{cG\_m}} \text{cG} \tag{169}$$

Modifier

Table 54: Properties of each modifier.

Id	Name	SBO
cG_m	cG_m	

Product

Table 55: Properties of each product.

Id	Name	SBO
cG	cG	

Kinetic Law

Derived unit contains undeclared units

$$v_{33} = \text{vol}\left(\text{def}\right) \cdot \text{function\_4\_cG\_trsl}\left(\left[\text{cG\_m}\right], \text{vol}\left(\text{def}\right), \text{p11}\right) \tag{170}$$

$$\text{function\_4\_cG\_trsl}\left(\left[\text{cG\_m}\right], \text{vol}\left(\text{def}\right), \text{p11}\right) = \frac{\text{p11} \cdot \left[\text{cG\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{171}$$

$$\text{function\_4\_cG\_trsl}\left(\left[\text{cG\_m}\right], \text{vol}\left(\text{def}\right), \text{p11}\right) = \frac{\text{p11} \cdot \left[\text{cG\_m}\right]}{\text{vol}\left(\text{def}\right)} \tag{172}$$

8.34 Reaction cG_degr

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

Name cG_degr

SBO:0000179 degradation

Reaction equation

$$\mathrm{cG} \longrightarrow \emptyset \tag{173}$$

Reactant

Table 56: Properties of each reactant.

Id	Name	SBO
cG	cG	

Kinetic Law

Derived unit contains undeclared units

$$v_{34} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cG\_degr}\left(\left[\mathrm{cG}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m19}\right) \tag{174}$$

$$\mathrm{function\_4\_cG\_degr}\left(\left[\mathrm{cG}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m19}\right) = \frac{\mathrm{m19} \cdot \left[\mathrm{cG}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{175}$$

$$\mathrm{function\_4\_cG\_degr}\left(\left[\mathrm{cG}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m19}\right) = \frac{\mathrm{m19} \cdot \left[\mathrm{cG}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{176}$$

8.35 Reaction cG_cZTL_assoc

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

Name cG_cZTL_assoc

SBO:0000526 protein complex formation

Reaction equation

$$\mathrm{cG} + \mathrm{cZTL} \rightleftharpoons \mathrm{cZG} \tag{177}$$

Reactants

Table 57: Properties of each reactant.

Id	Name	SBO
cG	cG	
cZTL	cZTL	

Product

Table 58: Properties of each product.

Id	Name	SBO
cZG	cZG	

Kinetic Law

Derived unit contains undeclared units

$$v_{35} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cG\_cZTL\_assoc}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cG}], [\mathrm{cZG}], [\mathrm{cZTL}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{p12}, \mathrm{p13}\right) \tag{178}$$

$$\mathrm{function\_4\_cG\_cZTL\_assoc}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cG}], [\mathrm{cZG}], [\mathrm{cZTL}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{p12}, \mathrm{p13}\right) = \frac{\mathrm{p12} \cdot \mathrm{L} \cdot [\mathrm{cZTL}] \cdot [\mathrm{cG}] - \mathrm{p13} \cdot \mathrm{D} \cdot [\mathrm{cZG}]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{179}$$

$$\mathrm{function\_4\_cG\_cZTL\_assoc}\left(\mathrm{D}, \mathrm{L}, [\mathrm{cG}], [\mathrm{cZG}], [\mathrm{cZTL}], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{p12}, \mathrm{p13}\right) = \frac{\mathrm{p12} \cdot \mathrm{L} \cdot [\mathrm{cZTL}] \cdot [\mathrm{cG}] - \mathrm{p13} \cdot \mathrm{D} \cdot [\mathrm{cZG}]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{180}$$

8.36 Reaction cZTL_trsl

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

Name cZTL_trsl

SBO:0000183 transcription

Reaction equation

$$\emptyset \longrightarrow \mathrm{cZTL} \tag{181}$$

Product

Table 59: Properties of each product.

Id	Name	SBO
cZTL	cZTL	

Kinetic Law

Derived unit contains undeclared units

$$v_{36} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cZTL\_trsl}\left(\mathrm{vol}\left(\mathrm{def}\right), \mathrm{p14}\right) \tag{182}$$

$$\mathrm{function\_4\_cZTL\_trsl}\left(\mathrm{vol}\left(\mathrm{def}\right), \mathrm{p14}\right) = \frac{\mathrm{p14}}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{183}$$

$$\mathrm{function\_4\_cZTL\_trsl}\left(\mathrm{vol}\left(\mathrm{def}\right), \mathrm{p14}\right) = \frac{\mathrm{p14}}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{184}$$

8.37 Reaction cZTL_degr

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

Name cZTL_degr

SBO:0000179 degradation

Reaction equation

$$\mathrm{cZTL} \longrightarrow \emptyset \tag{185}$$

Reactant

Table 60: Properties of each reactant.

Id	Name	SBO
cZTL	cZTL	

Kinetic Law

Derived unit contains undeclared units

$$v_{37} = \mathrm{vol}\left(\mathrm{def}\right) \cdot \mathrm{function\_4\_cZTL\_degr}\left(\left[\mathrm{cZTL}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m20}\right) \tag{186}$$

$$\mathrm{function\_4\_cZTL\_degr}\left(\left[\mathrm{cZTL}\right], \mathrm{vol}\left(\mathrm{def}\right), \mathrm{m20}\right) = \frac{\mathrm{m20} \cdot \left[\mathrm{cZTL}\right]}{\mathrm{vol}\left(\mathrm{def}\right)} \tag{187}$$

$$\text{function\_4\_cZTL\_degr}\left([\text{cZTL}], \text{vol}\left(\text{def}\right), \text{m20}\right) = \frac{\text{m20} \cdot [\text{cZTL}]}{\text{vol}\left(\text{def}\right)} \tag{188}$$

8.38 Reaction cZG_degr

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

Name cZG_degr

SBO:0000179 degradation

Reaction equation

$$\text{cZG} \longrightarrow \emptyset \tag{189}$$

Reactant

Table 61: Properties of each reactant.

Id	Name	SBO
cZG	cZG	

Kinetic Law

Derived unit contains undeclared units

$$v_{38} = \text{vol}\left(\text{def}\right) \cdot \text{function\_4\_cZG\_degr}\left([\text{cZG}], \text{vol}\left(\text{def}\right), \text{m21}\right) \tag{190}$$

$$\text{function\_4\_cZG\_degr}\left([\text{cZG}], \text{vol}\left(\text{def}\right), \text{m21}\right) = \frac{\text{m21} \cdot [\text{cZG}]}{\text{vol}\left(\text{def}\right)} \tag{191}$$

$$\text{function\_4\_cZG\_degr}\left([\text{cZG}], \text{vol}\left(\text{def}\right), \text{m21}\right) = \frac{\text{m21} \cdot [\text{cZG}]}{\text{vol}\left(\text{def}\right)} \tag{192}$$

9 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.

9.1 Species cG

Name cG

SBO:0000245 macromolecule

Initial concentration $0.0238\ \text{item} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in cG_degr, cG_cZTL_assoc and as a product in cG_trsl).

$$\frac{\text{d}}{\text{d}t}\text{cG} = v_{33} - v_{34} - v_{35} \tag{193}$$

9.2 Species cG_m

Name cG_m

SBO:0000278 messenger RNA

Initial concentration $0.119\ \text{item} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in cG_m_degr and as a product in cG_m_trscr and as a modifier in cG_trsl).

$$\frac{\text{d}}{\text{d}t}\text{cG\_m} = v_{31} - v_{32} \tag{194}$$

9.3 Species cL

Name cL

SBO:0000245 macromolecule

Initial concentration $0.416\ \text{item} \cdot \text{l}^{-1}$

This species takes part in eight reactions (as a reactant in cL_degr and as a product in cL_trsl and as a modifier in cL_modif, cT_m_trscr, cY_m_trscr, cP9_m_trscr, cP7_m_trscr, cG_m_trscr).

$$\frac{\text{d}}{\text{d}t}\text{cL} = v_{3} - v_{4} \tag{195}$$

9.4 Species cL_m

Name cL_m

SBO:0000278 messenger RNA

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

This species takes part in three reactions (as a reactant in cL_m_degr and as a product in cL_m_trscr and as a modifier in cL_trsl).

$$\frac{\text{d}}{\text{d}t}\text{cL\_m} = v_1 - v_2 \tag{196}$$

9.5 Species cLm

Name cLm

SBO:0000245 macromolecule

Initial concentration $0.054\ \text{item} \cdot \text{l}^{-1}$

This species takes part in four reactions (as a reactant in cLm_degr and as a product in cL_modif and as a modifier in cP7_m_trscr, cNI_m_trscr).

$$\frac{\text{d}}{\text{d}t}\text{cLm} = v_5 - v_6 \tag{197}$$

9.6 Species cNI

Name cNI

SBO:0000020 inhibitor

Initial concentration $0.044\ \text{item} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in cNI_degr and as a product in cNI_trsl and as a modifier in cL_m_trscr).

$$\frac{\text{d}}{\text{d}t}\text{cNI} = v_{29} - v_{30} \tag{198}$$

9.7 Species cNI_m

Name cNI_m

SBO:0000278 messenger RNA

Initial concentration $0.0065\ \text{item} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in cNI_m_degr and as a product in cNI_m_trscr and as a modifier in cNI_trsl).

$$\frac{\text{d}}{\text{d}t}\text{cNI\_m} = v_{27} - v_{28} \tag{199}$$

9.8 Species cP

Name cP

SBO:0000245 macromolecule

Initial concentration $0.825\ \text{item} \cdot \text{l}^{-1}$

This species takes part in six reactions (as a reactant in cP_degr and as a product in cP_trsl and as a modifier in cL_m_trscr, cY_m_trscr, cP9_m_trscr, cG_m_trscr).

$$\frac{\text{d}}{\text{d}t}\text{cP} = v_{17} - v_{18} \tag{200}$$

9.9 Species cP7

Name cP7

SBO:0000245 macromolecule

Initial concentration $0.019\ \text{item} \cdot \text{l}^{-1}$

This species takes part in four reactions (as a reactant in cP7_degr and as a product in cP7_trsl and as a modifier in cL_m_trscr, cNI_m_trscr).

$$\frac{\text{d}}{\text{d}t}\text{cP7} = v_{25} - v_{26} \tag{201}$$

9.10 Species cP7_m

Name cP7_m

SBO:0000278 messenger RNA

Initial concentration $0.075\ \text{item} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in cP7_m_degr and as a product in cP7_m_trscr and as a modifier in cP7_trsl).

$$\frac{\text{d}}{\text{d}t}\text{cP7\_m} = v_{23} - v_{24} \tag{202}$$

9.11 Species cP9

Name cP9

SBO:0000245 macromolecule

Initial concentration $0.056\ \text{item} \cdot \text{l}^{-1}$

This species takes part in four reactions (as a reactant in cP9_degr and as a product in cP9_trsl and as a modifier in cL_m_trscr, cP7_m_trscr).

$$\frac{\text{d}}{\text{d}t}\text{cP9} = v_{21} - v_{22} \tag{203}$$

9.12 Species cP9_m

Name cP9_m

SBO:0000278 messenger RNA

Initial concentration $0.35\ \text{item} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in cP9_m_degr and as a product in cP9_m_trscr and as a modifier in cP9_trsl).

$$\frac{\text{d}}{\text{d}t}\text{cP9\_m} = v_{19} - v_{20} \tag{204}$$

9.13 Species cT

Name cT

SBO:0000245 macromolecule

Initial concentration $0.393\ \text{item} \cdot \text{l}^{-1}$

This species takes part in six reactions (as a reactant in cT_degr and as a product in cT_trsl and as a modifier in cT_modif, cY_m_trscr, cP9_m_trscr, cG_m_trscr).

$$\frac{\text{d}}{\text{d}t}\text{cT} = v_{9} - v_{10} \tag{205}$$

9.14 Species cT_m

Name cT_m

SBO:0000278 messenger RNA

Initial concentration $0.25\ \text{item} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in cT_m_degr and as a product in cT_m_trscr and as a modifier in cT_trsl).

$$\frac{\text{d}}{\text{d}t}\text{cT\_m} = v_{7} - v_{8} \tag{206}$$

9.15 Species cTm

Name cTm

SBO:0000245 macromolecule

Initial concentration $0.24\ \text{item} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in cTm_degr and as a product in cT_modif and as a modifier in cL_m_trscr).

$$\frac{\text{d}}{\text{d}t}\text{cTm} = v_{11} - v_{12} \tag{207}$$

9.16 Species cY

Name cY

SBO:0000245 macromolecule

Initial concentration $0.1\ \text{item} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in cY_degr and as a product in cY_trsl and as a modifier in cT_m_trscr).

$$\frac{\text{d}}{\text{d}t}\text{cY} = v_{15} - v_{16} \tag{208}$$

9.17 Species cY_m

Name cY_m

SBO:0000278 messenger RNA

Initial concentration $0.093\ \text{item} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in cY_m_degr and as a product in cY_m_trscr and as a modifier in cY_trsl).

$$\frac{\text{d}}{\text{d}t}\text{cY\_m} = v_{13} - v_{14} \tag{209}$$

9.18 Species cZG

Name cZG

SBO:0000296 macromolecular complex

Initial concentration $0.0774\ \text{item} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in cZG_degr and as a product in cG_cZTL_assoc and as a modifier in cT_degr).

$$\frac{\text{d}}{\text{d}t}\text{cZG} = v_{35} - v_{38} \tag{210}$$

9.19 Species cZTL

Name cZTL

SBO:0000245 macromolecule

Initial concentration $0.323\ \text{item} \cdot \text{l}^{-1}$

This species takes part in four reactions (as a reactant in cG_cZTL_assoc, cZTL_degr and as a product in cZTL_trsl and as a modifier in cT_degr).

$$\frac{\text{d}}{\text{d}t}\text{cZTL} = v_{36} - v_{35} - v_{37} \tag{211}$$

A Glossary of Systems Biology Ontology Terms

SBO:0000009 kinetic constant: Numerical parameter that quantifies the velocity of a chemical reaction

SBO:0000020 inhibitor: Substance that decreases the probability of a chemical reaction without itself being consumed or transformed by the reaction

SBO:0000027 Michaelis constant: Substrate concentration at which the velocity of reaction is half its maximum. Michaelis constant is an experimental parameter. According to the underlying molecular mechanism it can be interpreted differently in terms of microscopic constants

SBO:0000176 biochemical reaction: An event involving one or more chemical entities that modifies the electrochemical structure of at least one of the participants.

SBO:0000179 degradation: Complete disappearance of a physical entity

SBO:0000183 transcription: Process through which a DNA sequence is copied to produce a complementary RNA

SBO:0000184 translation: Process in which a polypeptide chain is produced from a messenger RNA

SBO:0000191 Hill constant: Empirical constant created by Archibald Vivian Hill to describe the cooperative binding of oxygen on hemoglobine (Hill (1910). The possible effects of the aggregation of the molecules of haemoglobin on its dissociation curves. J Physiol 40: iv-vii). Different from a microscopic dissociation constant, it has the dimension of concentration to the power of the Hill coefficient

SBO:0000245 macromolecule: Molecular entity mainly built-up by the repetition of pseudo-identical units. CHEBI:3383

SBO:0000278 messenger RNA: A messenger RNA is a ribonucleic acid synthesized during the transcription of a gene, and that carries the information to encode one or several proteins

SBO:0000290 physical compartment: Specific location of space, that can be bounded or not. A physical compartment can have 1, 2 or 3 dimensions

SBO:0000296 macromolecular complex: Non-covalent complex of one or more macromolecules and zero or more simple chemicals

SBO:0000356 decay constant: Kinetic constant characterising a mono-exponential decay. It is the inverse of the mean lifetime of the continuant being decayed. Its unit is“per tim”.

SBO:0000526 protein complex formation: The process by which two or more proteins interact non-covalently to form a protein complex (SBO:0000297)

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