SBML Model Report

Model name: "Moriya2011_CellCycle_FissionYeast"

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 Hisao Moriya[2] at January twelveth 2012 at 1:27 p. m. and last time modified at July eleventh 2012 at 6:10 p. m. Table 1 gives an overview of the quantities of all components of this model.

Table 1: Number of components in this model, which are described in the following sections.

Element	Quantity	Element	Quantity
compartment types	0	compartments	1
species types	0	species	49
events	0	constraints	0
reactions	51	function definitions	0
global parameters	118	unit definitions	5
rules	10	initial assignments	0

Model Notes

This model is from the article:
Overexpression limits of fission yeast cell-cycle regulators in vivo and in silico.
Moriya H, Chino A, Kapuy O, Csiksz-Nagy A, Novk B. Mol Syst Biol. 2011 Dec 6;7:556. 22146300 ,

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Abstract:
Cellular systems are generally robust against fluctuations of intracellular parameters such as gene expression level. However, little is known about expression limits of genes required to halt cellular systems. In this study, using the fission yeast Schizosaccharomyces pombe, we developed a genetic 'tug-of-war' (gTOW) method to assess the overexpression limit of certain genes. Using gTOW, we determined copy number limits for 31 cell-cycle regulators; the limits varied from 1 to >100. Comparison with orthologs of the budding yeast Saccharomyces cerevisiae suggested the presence of a conserved fragile core in the eukaryotic cell cycle. Robustness profiles of networks regulating cytokinesis in both yeasts (septation-initiation network (SIN) and mitotic exit network (MEN)) were quite different, probably reflecting differences in their physiologic functions. Fragility in the regulation of GTPase spg1 was due to dosage imbalance against GTPase-activating protein (GAP) byr4. Using the gTOW data, we modified a mathematical model and successfully reproduced the robustness of the S. pombe cell cycle with the model.

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

2 Unit Definitions

This is an overview of five unit definitions.

2.1 Unit `substance`

Name substance

Definition mol

2.2 Unit `volume`

Name volume

Definition l

2.3 Unit `area`

Name area

Definition m^2

2.4 Unit `length`

Name length

Definition m

2.5 Unit `time`

Name 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
`default`		0000290	3	1	litre	☑	

3.1 Compartment `default`

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

SBO:0000290 physical compartment

4 Species

This model contains 49 species. The boundary condition of 25 of these species is set to `true` so that these species' amount cannot be changed by any reaction. 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
s4	Vdrum	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s9	Vdcyc	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s46	sa4_degraded	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s47	Srw1	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s48	Slp1A	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s49	Puc1	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s50	IE	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s51	iIE	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s52	rum1+	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s55	cig2+	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s56	Cdc13	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s57	cdc13+	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s60	pCdc13	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s61	sa161_degraded	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s63	Cig2p	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s64	Pyp3	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s65	iSrw1	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s66	iSlp1	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s67	Cig2	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s70	iCdc10	default	mol	☐	☑
s71	Cdc10	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
s72	Mik1	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s73	mik1+	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s74	sa347_degraded	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s75	Cig1	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s76	cig1+	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s77	sa353_degraded	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s78	Clp1+	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s79	iWee1	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s80	Wee1	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s81	Clp1	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s82	iCdc25	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s83	Cdc25	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s84	Cdc18T	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s85	cdc18+	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s88	sa386_degraded	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s89	preRC	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s90	postRC	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s91	repldna	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s92	irepldna	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s93	sa370_degraded	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s94	sa44_degraded	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
s130	Vdc18	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s137	Cdc13p-Rum1	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s149	Cig2-Rum1	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s153	Cig2p-Rum1	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
s157	UDNA	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s161	Cdc13-Rum1	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
s166	Rum1	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟

5 Parameters

This model contains 118 global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ksc18_dash	ksc18'	0000009	0.075		☑
ksc18	ksc18	0000009	0.005		☑
kdc18	kdc18	0000356	0.001		☑
kdc18c13	kdc18c13	0000356	0.450		☑
kdc18cig	kdc18cig	0000356	1.000		☑
kdc18cig_dash	kdc18cig'	0000356	0.000		☑
krepl	krepl	0000009	2.000		☑
kini_dash	kini_dash	0000009	10.000		☑
kini_dash2	kini"	0000009	10.000		☑
kini_dash3	kini"'	0000009	0.000		☑
ko18	ko18	0000009	100.000		☑
ko18r	ko18r	0000009	1.000		☑
kori	kori	0000009	125.000		☑
kipre	kipre	0000261	1.000		☑
kipre_dash	kipre'	0000261	1.000		☑
Jipre	Jipre	0000261	0.010		☑
n	n	0000361	4.000		☑
k	k	0000009	0.100		☑
k_dash	k'	0000009	10.000		☑
kscyc	kscyc	0000009	0.030		☑
kdcyc	kdcyc	0000356	0.018		☑
kdcycsrw	kdcycsrw	0000356	1.000		☑
kdcycsrw_dash	kdcycsrw'	0000356	10^{-4}		☑
kdcycslp	kdcycslp	0000356	1.000		☑
kdcycslp_dash	kdcycslp'	0000356	$3 \cdot 10^{-4}$		☑
kasrw	kasrw	0000363	1.250		☑
kasrw_dash	kasrw'	0000363	30.000		☑
kisrw	kisrw	0000261	1.500		☑
kisrw_dash	kisrw'	0000261	40.000		☑
kisrw_dash2	kisrw"	0000261	1.000		☑
kisrw_dash3	kisrw"'	0000261	4.000		☑
kisrw_dash4	kisrw""	0000261	4.000		☑
Jasrw	Jasrw	0000363	0.010		☑
Jisrw	Jisrw	0000261	0.010		☑

Id	Name	SBO	Value	Unit	Constant
kaslp	kaslp	0000363	1.000		☑
kislp	kislp	0000261	0.200		☑
Jaslp	Jaslp	0000363	0.010		☑
Jislp	Jislp	0000261	0.010		☑
kaie	kaie	0000363	0.098		☑
kiie	kiie	0000261	0.040		☑
Jaie	Jaie	0000363	0.010		☑
Jiie	Jiie	0000261	0.010		☑
ksrum	ksrum	0000009	1.000		☑
kdrum	kdrum	0000356	0.400		☑
kdrumpuc	kdrumpuc	0000356	0.100		☑
kdrumci1	kdrumci1	0000356	1.000		☑
kdrumcig	kdrumcig	0000356	15.000		☑
kdrumcig_dash	kdrumcig_dash	0000356	10.000		☑
kdrumc13	kdrumc13	0000356	50.000		☑
kdrumc13_dash	kdrumc13’	0000356	5.000		☑
lp	lp	0000361	500.000		☑
lm	lm	0000361	100.000		☑
kscig_dash	kscig’	0000009	0.040		☑
kdcig	kdcig	0000356	0.020		☑
kdcig_dash	kdcig’	0000356	1.000		☑
kac10	kac10	0000363	0.125		☑
kic10	kic10	0000261	0.010		☑
kic10_dash	kic10’	0000261	3.000		☑
Jac10	Jac10	0000363	0.010		☑
Jic10	Jic10	0000261	0.010		☑
kwee_dash	kwee’	0000009	0.010		☑
kwee_dash2	kwee”	0000009	0.500		☑
Vawee_dash	Vawee’	0000363	0.240		☑
Vawee_dash2	Vawee”	0000363	1.000		☑
Viwee_dash	Viwee’	0000261	0.000		☑
Viwee_dash2	Viwee”	0000261	1.000		☑
Jawee	Jawee	0000363	0.040		☑
Jiwee	Jiwee	0000261	0.030		☑
k25_dash	k25’	0000009	0.010		☑
k25_dash2	k25”	0000009	1.000		☑
Va25_dash2	Va25”	0000363	1.000		☑
Vi25_dash2	Vi25”	0000261	1.000		☑
Vi25_dash	Vi25’	0000261	0.240		☑
Vi25	Vi25	0000261	0.300		☑

Id	Name	SBO	Value	Unit	Constant
Ja25	Ja25	0000363	0.030		☑
Ji25	Ji25	0000261	0.030		☑
lcp	lcp	0000361	3.000		☑
lcm	lcm	0000361	1.000		☑
kmik_dash	kmik'	0000009	0.010		☑
kmik_dash2	kmik"	0000009	4.000		☑
Vamik	Vamik	0000363	0.250		☑
Vimik	Vimik	0000261	0.750		☑
Vimik_dash	Vimik'	0000261	10.000		☑
Vimik_dash2	Vimik"	0000261	10.000		☑
Vimik_dash3	Vimik"'	0000261	0.250		☑
kpyp	kpyp	0000009	0.600		☑
ksflp	ksflp	0000009	0.002		☑
ksflp_dash	ksflp'	0000009	0.015		☑
kdflp	kdflp	0000356	0.100		☑
ksci1	ksci1	0000009	0.002		☑
kdci1	kdci1	0000356	0.100		☑
kdci1_dash	kdci1'	0000356	5.000		☑
kdci1_dash2	kdci1"	0000356	0.200		☑
k255	k255	0000009	0.100		☑
kpyp2	kpyp2	0000009	0.010		☑
kscig	kscig	0000009	0.002		☑
oriT	oriT	0000361	1.000		☑
BB	BB		0.000		☐
chrom	chrom		0.000		☐
UDNA	UDNA		0.000		☐
kmik	kmik	0000009	0.000		☐
Vdrum	Vdrum		0.000		☐
Vdcyc	Vdcyc		0.000		☐
Vdc18	Vdc18		0.000		☐
k25	k25		0.000		☐
Vamik_dash	Vamik'	0000363	0.750		☑
preRC	preRC		0.000		☐
Rad3	Rad3	0000361	1.000		☑
beta	beta	0000361	10.000		☑
Puc1	Puc1	0000196	1.000		☑
Srw1T	Srw1T	0000196	1.000		☑
Slp1T	Slp1T	0000196	1.000		☑
Cdc10T	Cdc10T	0000196	1.000		☑
Cdc25T	Cdc25T	0000196	1.000		☑
Wee1T	Wee1T	0000196	1.000		☑
kaie_dash	kaie'	0000363	0.050		☑

Id	Name	SBO	Value	Unit	Constant
Cdc18	Cdc18		0.000		⊟
kwee	kwee		0.000		⊟

6 Rules

This is an overview of ten rules.

6.1 Rule BB

Rule BB is an assignment rule for parameter BB:

$$\mathrm{BB} = \mathrm{oriT} + [\mathrm{s84}] + \frac{\mathrm{ko18r} + \mathrm{Vdc18}}{\mathrm{ko18}} \tag{1}$$

6.2 Rule kwee

Rule kwee is an assignment rule for parameter kwee:

$$\mathrm{kwee} = \mathrm{kwee\_dash} \cdot \mathrm{Wee1T} + (\mathrm{kwee\_dash2} - \mathrm{kwee\_dash}) \cdot [\mathrm{s80}] \tag{2}$$

6.3 Rule Vdrum

Rule Vdrum is an assignment rule for parameter Vdrum:

$$\begin{aligned}\mathrm{Vdrum} = {} & \mathrm{kdrum} + \mathrm{kdrumpuc} \cdot \mathrm{Puc1} + \mathrm{kdrumci1} \cdot [\mathrm{s75}] + \mathrm{kdrumcig} \cdot [\mathrm{s67}] \\ & + \mathrm{kdrumcig\_dash} \cdot [\mathrm{s63}] + \mathrm{kdrumc13} \cdot [\mathrm{s56}] + \mathrm{kdrumc13\_dash} \cdot [\mathrm{s60}]\end{aligned} \tag{3}$$

6.4 Rule Vdcyc

Rule Vdcyc is an assignment rule for parameter Vdcyc:

$$\begin{aligned}\mathrm{Vdcyc} = {} & \mathrm{kdcyc} + \mathrm{kdcycsrw} \cdot [\mathrm{s47}] + \mathrm{kdcycsrw\_dash} \cdot \mathrm{Srw1T} \\ & + \mathrm{kdcycslp} \cdot [\mathrm{s48}] + \mathrm{kdcycslp\_dash} \cdot \mathrm{Slp1T}\end{aligned} \tag{4}$$

6.5 Rule Vdc18

Rule Vdc18 is an assignment rule for parameter Vdc18:

$$\mathrm{Vdc18} = \mathrm{kdc18} + \mathrm{kdc18c13} \cdot [\mathrm{s56}] + \mathrm{kdc18cig} \cdot [\mathrm{s67}] + \mathrm{kdc18cig\_dash} \cdot [\mathrm{s63}] \tag{5}$$

6.6 Rule k25

Rule k25 is an assignment rule for parameter k25:

$$\mathrm{k25} = \mathrm{k25\_dash} \cdot \mathrm{Cdc25T} + (\mathrm{k25\_dash2} - \mathrm{k25\_dash}) \cdot [\mathrm{s83}] \tag{6}$$

6.7 Rule chrom

Rule chrom is an assignment rule for parameter chrom:

$$\text{chrom} = \frac{2 \cdot \text{oriT} \cdot [\text{s84}]}{\text{BB} + \sqrt{2}} \tag{7}$$

6.8 Rule preRC

Rule preRC is an assignment rule for parameter preRC:

$$\text{preRC} = \frac{(\text{oriT} - [\text{s90}] - [\text{s91}]) \cdot \text{Cdc18}}{\frac{\text{ko18r+Vdc18}}{\text{ko18}} + \text{Cdc18}} \tag{8}$$

6.9 Rule Cdc18

Rule Cdc18 is an assignment rule for parameter Cdc18:

$$\text{Cdc18} = [\text{s84}] - \text{chrom} \tag{9}$$

6.10 Rule UDNA

Rule UDNA is an assignment rule for parameter UDNA:

$$\text{UDNA} = \text{Rad3} \cdot \left(\text{k} \cdot [\text{s84}] + \frac{\text{k\_dash} \cdot [\text{s90}] \cdot \text{Cdc18}}{\frac{\text{ko18r+Vdc18}}{\text{ko18}} + \text{Cdc18}} \right) \tag{10}$$

7 Reactions

This model contains 51 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	re3		$s65 \xrightarrow{s48} s47$	0000344
2	re4		$s47 \xrightarrow{s56,\ s49,\ s75,\ s67} s65$	0000344
3	re5		$s51 \xrightarrow{s75,\ s56} s50$	0000344
4	re6		$s50 \longrightarrow s51$	0000344
5	re7		$s66 \xrightarrow{s50} s48$	0000344
6	re8		$s48 \longrightarrow s66$	0000344
7	re12	Cdc13_Synthesis	$s57 \longrightarrow s56$	0000393
8	re14	Trim_Dissociation_Rum1degradation	$s137 \xrightarrow{s4} s60 + s61$	0000180
9	re15		$s161 \xrightarrow{s9} s166 + s46$	0000180
10	re16	Trim_Dissociation_Rum1degradation	$s161 \xrightarrow{s4} s56 + s61$	0000180
11	re17		$s137 \xrightarrow{s9} s166 + s46$	0000180
12	re18	Cdc13_Dephosphorylation	$s137 \xrightarrow{s64,\ s83} s161$	0000330
13	re19	Cdc13_Synthesis	$s55 \xrightarrow{s71} s67$	0000393
14	re20	Cdc13_Phosphorylation	$s67 \xrightarrow{s72} s63$	0000216
15	re21	Cdc13_Dephosphorylation	$s63 \xrightarrow{s64,\ s83,\ s157} s67$	0000330
16	re22	Rum1+Cdc13_association	$s166 + s67 \rightleftharpoons s149$	0000526
17	re23		$s149 \xrightarrow{s48} s166 + s94$	0000180
18	re24	Rum1+Cdc13_association	$s166 + s63 \rightleftharpoons s153$	0000526

№	Id	Name	Reaction Equation	SBO
19	re25		$s153 \xrightarrow{s48} s166 + s94$	0000180
20	re27	Cdc13_Dephosphorylation	$s153 \xrightarrow{s64,\ s83} s149$	0000330
21	re28		$s67 \xrightarrow{s48} s94$	0000179
22	re29		$s153 \xrightarrow{s4} s63$	0000180
23	re30		$s149 \xrightarrow{s4} s67 + s61$	0000180
24	re31		$s63 \xrightarrow{s48} s94$	0000179
25	re32		$s71 \xrightarrow{s67} s70$	0000344
26	re33		$s70 \longrightarrow s71$	0000344
27	re34		$s73 \xrightarrow{s71} s72$	0000344
28	re35		$s72 \xrightarrow{s67,\ s56,\ s60} s74$	0000179
29	re36		$s76 \longrightarrow s75$	0000344
30	re37		$s75 \xrightarrow{s48,\ s47} s77$	0000179
31	re38		$s78 \xrightarrow{s48} s81$	0000344
32	re39		$s79 \xrightarrow{s81} s80$	0000344
33	re40		$s80 \xrightarrow{s56} s79$	0000344
34	re41		$s60 \xrightarrow{s9} s46$	0000179
35	re42		$s56 \xrightarrow{s9} s46$	0000179
36	re43		$s161 \xrightarrow{s80,\ s72} s137$	0000216
37	re44		$s149 \xrightarrow{s72} s153$	0000216
38	re45		$s82 \xrightarrow{s56} s83$	0000344
39	re46		$s83 \xrightarrow{s81,\ s157} s82$	0000344

№	Id	Name	Reaction Equation	SBO
40	re47		$s85 \xrightarrow{s71} s84$	0000344
41	re48		$s84 \xrightarrow{s130} s88$	0000179
42	re53		$s81 \longrightarrow s93$	0000179
43	re54		$s56 + s166 \rightleftharpoons s161$	0000526
44	re56		$s60 \xrightarrow{s83,\ s64} s56$	0000330
45	re57		$s56 \xrightarrow{s80,\ s72} s60$	0000216
46	re58		$s166 + s60 \rightleftharpoons s137$	0000526
47	re60		$s166 \xrightarrow{s4} s61$	0000179
48	re62		$s52 \longrightarrow s166$	0000344
49	re66		$s89 \xrightarrow{s67,\ s56,\ s63} s90$	0000344
50	re67		$s91 \xrightarrow{s67,\ s56,\ s63} s92$	0000204
51	re68		$s90 \longrightarrow s91$	0000204

7.1 Reaction re3

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

SBO:0000344 molecular interaction

Reaction equation

$$\mathrm{s65} \xrightarrow{\mathrm{s48}} \mathrm{s47} \tag{11}$$

Reactant

Table 6: Properties of each reactant.

Id	Name	SBO
s65	iSrw1	

Modifier

Table 7: Properties of each modifier.

Id	Name	SBO
s48	Slp1A	

Product

Table 8: Properties of each product.

Id	Name	SBO
s47	Srw1	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \frac{(\mathrm{kasrw} + \mathrm{kasrw\_dash} \cdot [\mathrm{s48}]) \cdot (\mathrm{Srw1T} - [\mathrm{s47}])}{\mathrm{Jasrw} + (\mathrm{Srw1T} - [\mathrm{s47}])} \tag{12}$$

7.2 Reaction re4

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s47} \xrightarrow{\text{s56, s49, s75, s67}} \text{s65} \tag{13}$$

Reactant

Table 9: Properties of each reactant.

Id	Name	SBO
s47	Srw1	

Modifiers

Table 10: Properties of each modifier.

Id	Name	SBO
s56	Cdc13	
s49	Puc1	
s75	Cig1	
s67	Cig2	

Product

Table 11: Properties of each product.

Id	Name	SBO
s65	iSrw1	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \frac{(\text{kisrw} + \text{kisrw\_dash} \cdot [\text{s67}] + \text{kisrw\_dash2} \cdot [\text{s56}] + \text{kisrw\_dash3} \cdot \text{Puc1} + \text{kisrw\_dash4} \cdot [\text{s75}]) \cdot [\text{s47}]}{\text{Jisrw} + [\text{s47}]} \tag{14}$$

7.3 Reaction re5

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s51} \xrightarrow{\text{s75, s56}} \text{s50} \tag{15}$$

Reactant

Table 12: Properties of each reactant.

Id	Name	SBO
s51	iIE	

Modifiers

Table 13: Properties of each modifier.

Id	Name	SBO
s75	Cig1	
s56	Cdc13	

Product

Table 14: Properties of each product.

Id	Name	SBO
s50	IE	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \frac{(\text{kaie} \cdot [\text{s56}] + \text{kaie\_dash} \cdot [\text{s75}]) \cdot (1 - [\text{s50}])}{\text{Jaie} + (1 - [\text{s50}])} \tag{16}$$

7.4 Reaction re6

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s50} \longrightarrow \text{s51} \tag{17}$$

Reactant

Table 15: Properties of each reactant.

Id	Name	SBO
s50	IE	

Product

Table 16: Properties of each product.

Id	Name	SBO
s51	iIE	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \frac{\text{kiie} \cdot [\text{s50}]}{\text{Jiie} + [\text{s50}]} \tag{18}$$

7.5 Reaction re7

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s66} \xrightarrow{\text{s50}} \text{s48} \tag{19}$$

Reactant

Table 17: Properties of each reactant.

Id	Name	SBO
s66	iSlp1	

Modifier

Table 18: Properties of each modifier.

Id	Name	SBO
s50	IE	

Product

Table 19: Properties of each product.

Id	Name	SBO
s48	Slp1A	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \frac{\text{kaslp} \cdot [\text{s50}] \cdot (\text{Slp1T} - [\text{s48}])}{\text{Jaslp} + (\text{Slp1T} - [\text{s48}])} \tag{20}$$

7.6 Reaction re8

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s48} \longrightarrow \text{s66} \tag{21}$$

Reactant

Table 20: Properties of each reactant.

Id	Name	SBO
s48	Slp1A	

Product

Table 21: Properties of each product.

Id	Name	SBO
s66	iSlp1	

Id	Name	SBO

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \frac{\text{kislp} \cdot [\text{s48}]}{\text{Jislp} + [\text{s48}]} \tag{22}$$

7.7 Reaction `re12`

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

Name Cdc13_Synthesis

SBO:0000393 production

Reaction equation

$$\text{s57} \longrightarrow \text{s56} \tag{23}$$

Reactant

Table 22: Properties of each reactant.

Id	Name	SBO
`s57`	cdc13+	

Product

Table 23: Properties of each product.

Id	Name	SBO
`s56`	Cdc13	

Kinetic Law

Derived unit not available

$$v_7 = \text{kscyc} \tag{24}$$

7.8 Reaction `re14`

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

Name Trim_Dissociation_Rum1degradation

SBO:0000180 dissociation

Reaction equation

$$\mathrm{s137} \xrightarrow{\mathrm{s4}} \mathrm{s60} + \mathrm{s61} \tag{25}$$

Reactant

Table 24: Properties of each reactant.

Id	Name	SBO
s137	Cdc13p-Rum1	

Modifier

Table 25: Properties of each modifier.

Id	Name	SBO
s4	Vdrum	

Products

Table 26: Properties of each product.

Id	Name	SBO
s60	pCdc13	
s61	sa161_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_8 = \mathrm{Vdrum} \cdot [\mathrm{s137}] \tag{26}$$

7.9 Reaction re15

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

SBO:0000180 dissociation

Reaction equation

$$\mathrm{s161} \xrightarrow{\mathrm{s9}} \mathrm{s166} + \mathrm{s46} \tag{27}$$

Reactant

Table 27: Properties of each reactant.

Id	Name	SBO
s161	Cdc13-Rum1	

Modifier

Table 28: Properties of each modifier.

Id	Name	SBO
s9	Vdcyc	

Products

Table 29: Properties of each product.

Id	Name	SBO
s166	Rum1	
s46	sa4_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \mathrm{Vdcyc} \cdot [\mathrm{s161}] \tag{28}$$

7.10 Reaction re16

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

Name Trim_Dissociation_Rum1degradation

SBO:0000180 dissociation

Reaction equation

$$\mathrm{s161} \xrightarrow{\mathrm{s4}} \mathrm{s56} + \mathrm{s61} \tag{29}$$

Reactant

Table 30: Properties of each reactant.

Id	Name	SBO
s161	Cdc13-Rum1	

Modifier

Table 31: Properties of each modifier.

Id	Name	SBO
s4	Vdrum	

Products

Table 32: Properties of each product.

Id	Name	SBO
s56	Cdc13	
s61	sa161_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \text{Vdrum} \cdot [\text{s161}] \tag{30}$$

7.11 Reaction re17

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

SBO:0000180 dissociation

Reaction equation

$$\text{s137} \xrightarrow{\text{s9}} \text{s166} + \text{s46} \tag{31}$$

Reactant

Table 33: Properties of each reactant.

Id	Name	SBO
s137	Cdc13p-Rum1	

Modifier

Table 34: Properties of each modifier.

Id	Name	SBO
s9	Vdcyc	

Products

Table 35: Properties of each product.

Id	Name	SBO
s166	Rum1	
s46	sa4_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_{11} = \text{Vdcyc} \cdot [\text{s137}] \tag{32}$$

7.12 Reaction re18

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

Name Cdc13_Dephosphorylation

SBO:0000330 dephosphorylation

Reaction equation

$$\text{s137} \xrightarrow{\text{s64, s83}} \text{s161} \tag{33}$$

Reactant

Table 36: Properties of each reactant.

Id	Name	SBO
s137	Cdc13p-Rum1	

Modifiers

Table 37: Properties of each modifier.

Id	Name	SBO
s64	Pyp3	
s83	Cdc25	

Product

Table 38: Properties of each product.

Id	Name	SBO
s161	Cdc13-Rum1	

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = (\mathrm{kpyp2} + \mathrm{k25}) \cdot [\mathrm{s137}] \tag{34}$$

7.13 Reaction re19

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

Name Cdc13_Synthesis

SBO:0000393 production

Reaction equation

$$\mathrm{s55} \xrightarrow{\mathrm{s71}} \mathrm{s67} \tag{35}$$

Reactant

Table 39: Properties of each reactant.

Id	Name	SBO
s55	cig2+	

Modifier

Table 40: Properties of each modifier.

Id	Name	SBO
s71	Cdc10	

Product

Table 41: Properties of each product.

Id	Name	SBO
s67	Cig2	

Kinetic Law

Derived unit contains undeclared units

$$v_{13} = \text{kscig} \cdot \text{Cdc10T} + \text{kscig\_dash} \cdot [\text{s71}] \tag{36}$$

7.14 Reaction re20

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

Name Cdc13_Phosphorylation

SBO:0000216 phosphorylation

Reaction equation

$$\text{s67} \xrightarrow{\text{s72}} \text{s63} \tag{37}$$

Reactant

Table 42: Properties of each reactant.

Id	Name	SBO
s67	Cig2	

Modifier

Table 43: Properties of each modifier.

Id	Name	SBO
s72	Mik1	

Product

Table 44: Properties of each product.

Id	Name	SBO
s63	Cig2p	

Kinetic Law

Derived unit contains undeclared units

$$v_{14} = \text{kmik\_dash2} \cdot [\text{s72}] \cdot [\text{s67}] \tag{38}$$

7.15 Reaction re21

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

Name Cdc13_Dephosphorylation

SBO:0000330 dephosphorylation

Reaction equation

$$\text{s63} \xrightarrow{\text{s64, s83, s157}} \text{s67} \tag{39}$$

Reactant

Table 45: Properties of each reactant.

Id	Name	SBO
s63	Cig2p	

Modifiers

Table 46: Properties of each modifier.

Id	Name	SBO
s64	Pyp3	
s83	Cdc25	
s157	UDNA	

Product

Table 47: Properties of each product.

Id	Name	SBO
s67	Cig2	

Kinetic Law

Derived unit contains undeclared units

$$v_{15} = \mathrm{k25} \cdot \mathrm{k255} \cdot [\mathrm{s63}] + \frac{\mathrm{kpyp} \cdot [\mathrm{s63}]}{1 + \mathrm{beta} \cdot \mathrm{UDNA}} \tag{40}$$

7.16 Reaction re22

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

Name Rum1+Cdc13_association

SBO:0000526 protein complex formation

Reaction equation

$$\mathrm{s166} + \mathrm{s67} \rightleftharpoons \mathrm{s149} \tag{41}$$

Reactants

Table 48: Properties of each reactant.

Id	Name	SBO
s166	Rum1	
s67	Cig2	

Product

Table 49: Properties of each product.

Id	Name	SBO
s149	Cig2-Rum1	

Kinetic Law

Derived unit contains undeclared units

$$v_{16} = \mathrm{lcp} \cdot [\mathrm{s67}] \cdot [\mathrm{s166}] - \mathrm{lcm} \cdot [\mathrm{s149}] \tag{42}$$

7.17 Reaction re23

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

SBO:0000180 dissociation

Reaction equation

$$\mathrm{s149} \xrightarrow{\mathrm{s48}} \mathrm{s166} + \mathrm{s94} \tag{43}$$

Reactant

Table 50: Properties of each reactant.

Id	Name	SBO
s149	Cig2-Rum1	

Modifier

Table 51: Properties of each modifier.

Id	Name	SBO
s48	Slp1A	

Products

Table 52: Properties of each product.

Id	Name	SBO
s166	Rum1	
s94	sa44_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_{17} = (\text{kdcig} + \text{kdcig\_dash} \cdot [\text{s48}]) \cdot [\text{s149}] \tag{44}$$

7.18 Reaction re24

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

Name Rum1+Cdc13_association

SBO:0000526 protein complex formation

Reaction equation

$$\text{s166} + \text{s63} \rightleftharpoons \text{s153} \tag{45}$$

Reactants

Table 53: Properties of each reactant.

Id	Name	SBO
s166	Rum1	
s63	Cig2p	

Product

Table 54: Properties of each product.

Id	Name	SBO
s153	Cig2p-Rum1	

Kinetic Law

Derived unit contains undeclared units

$$v_{18} = \text{lcp} \cdot [\text{s63}] \cdot [\text{s166}] - \text{lcm} \cdot [\text{s153}] \tag{46}$$

7.19 Reaction re25

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

SBO:0000180 dissociation

Reaction equation

$$\text{s153} \xrightarrow{\text{s48}} \text{s166} + \text{s94} \tag{47}$$

Reactant

Table 55: Properties of each reactant.

Id	Name	SBO
s153	Cig2p-Rum1	

Modifier

Table 56: Properties of each modifier.

Id	Name	SBO
s48	Slp1A	

Products

Table 57: Properties of each product.

Id	Name	SBO
s166	Rum1	

Id	Name	SBO
s94	sa44_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_{19} = (\text{kdcig} + \text{kdcig\_dash} \cdot [\text{s48}]) \cdot [\text{s153}] \tag{48}$$

7.20 Reaction re27

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

Name Cdc13_Dephosphorylation

SBO:0000330 dephosphorylation

Reaction equation

$$\text{s153} \xrightarrow{\text{s64, s83}} \text{s149} \tag{49}$$

Reactant

Table 58: Properties of each reactant.

Id	Name	SBO
s153	Cig2p-Rum1	

Modifiers

Table 59: Properties of each modifier.

Id	Name	SBO
s64	Pyp3	
s83	Cdc25	

Product

Table 60: Properties of each product.

Id	Name	SBO
s149	Cig2-Rum1	

Id	Name	SBO

Kinetic Law

Derived unit contains undeclared units

$$v_{20} = \text{k25} \cdot \text{k255} \cdot [\text{s153}] + \frac{\text{kpyp} \cdot [\text{s153}]}{1 + \text{beta} \cdot \text{UDNA}} \tag{50}$$

7.21 Reaction re28

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

SBO:0000179 degradation

Reaction equation

$$\text{s67} \xrightarrow{\text{s48}} \text{s94} \tag{51}$$

Reactant

Table 61: Properties of each reactant.

Id	Name	SBO
s67	Cig2	

Modifier

Table 62: Properties of each modifier.

Id	Name	SBO
s48	Slp1A	

Product

Table 63: Properties of each product.

Id	Name	SBO
s94	sa44_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_{21} = (\text{kdcig} + \text{kdcig\_dash} \cdot [\text{s48}]) \cdot [\text{s67}] \tag{52}$$

7.22 Reaction `re29`

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

SBO:0000180 dissociation

Reaction equation

$$\text{s153} \xrightarrow{\text{s4}} \text{s63} \tag{53}$$

Reactant

Table 64: Properties of each reactant.

Id	Name	SBO
`s153`	Cig2p-Rum1	

Modifier

Table 65: Properties of each modifier.

Id	Name	SBO
`s4`	Vdrum	

Product

Table 66: Properties of each product.

Id	Name	SBO
`s63`	Cig2p	

Kinetic Law

Derived unit contains undeclared units

$$v_{22} = \text{Vdrum} \cdot [\text{s153}] \tag{54}$$

7.23 Reaction re30

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

SBO:0000180 dissociation

Reaction equation

$$\text{s149} \xrightarrow{\text{s4}} \text{s67} + \text{s61} \tag{55}$$

Reactant

Table 67: Properties of each reactant.

Id	Name	SBO
s149	Cig2-Rum1	

Modifier

Table 68: Properties of each modifier.

Id	Name	SBO
s4	Vdrum	

Products

Table 69: Properties of each product.

Id	Name	SBO
s67	Cig2	
s61	sa161_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_{23} = \text{Vdrum} \cdot [\text{s149}] \tag{56}$$

7.24 Reaction re31

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

SBO:0000179 degradation

Reaction equation

$$\text{s63} \xrightarrow{\text{s48}} \text{s94} \tag{57}$$

Reactant

Table 70: Properties of each reactant.

Id	Name	SBO
s63	Cig2p	

Modifier

Table 71: Properties of each modifier.

Id	Name	SBO
s48	Slp1A	

Product

Table 72: Properties of each product.

Id	Name	SBO
s94	sa44_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_{24} = (\text{kdcig} + \text{kdcig\_dash} \cdot [\text{s48}]) \cdot [\text{s63}] \tag{58}$$

7.25 Reaction re32

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s71} \xrightarrow{\text{s67}} \text{s70} \tag{59}$$

Reactant

Table 73: Properties of each reactant.

Id	Name	SBO
s71	Cdc10	

Modifier

Table 74: Properties of each modifier.

Id	Name	SBO
s67	Cig2	

Product

Table 75: Properties of each product.

Id	Name	SBO
s70	iCdc10	

Kinetic Law

Derived unit contains undeclared units

$$v_{25} = \frac{(\text{kic10} + \text{kic10\_dash} \cdot [\text{s67}]) \cdot [\text{s71}]}{\text{Jic10} + [\text{s71}]} \tag{60}$$

7.26 Reaction re33

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s70} \longrightarrow \text{s71} \tag{61}$$

Reactant

Table 76: Properties of each reactant.

Id	Name	SBO
s70	iCdc10	

Product

Table 77: Properties of each product.

Id	Name	SBO
s71	Cdc10	

Kinetic Law

Derived unit contains undeclared units

$$v_{26} = \frac{\text{kac10} \cdot (\text{Cdc10T} - [\text{s71}])}{\text{Jac10} + (\text{Cdc10T} - [\text{s71}])} \tag{62}$$

7.27 Reaction re34

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s73} \xrightarrow{\text{s71}} \text{s72} \tag{63}$$

Reactant

Table 78: Properties of each reactant.

Id	Name	SBO
s73	mik1+	

Modifier

Table 79: Properties of each modifier.

Id	Name	SBO
s71	Cdc10	

Product

Table 80: Properties of each product.

Id	Name	SBO
s72	Mik1	

Kinetic Law

Derived unit contains undeclared units

$$v_{27} = \text{Vamik} \cdot \text{Cdc10T} + \text{Vamik\_dash} \cdot [\text{s71}] \tag{64}$$

7.28 Reaction re35

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

SBO:0000179 degradation

Reaction equation

$$\text{s72} \xrightarrow{\text{s67, s56, s60}} \text{s74} \tag{65}$$

Reactant

Table 81: Properties of each reactant.

Id	Name	SBO
s72	Mik1	

Modifiers

Table 82: Properties of each modifier.

Id	Name	SBO
s67	Cig2	
s56	Cdc13	
s60	pCdc13	

Product

Table 83: Properties of each product.

Id	Name	SBO
s74	sa347_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_{28} = (\text{Vimik} + \text{Vimik\_dash} \cdot [\text{s67}] + \text{Vimik\_dash2} \cdot [\text{s56}] + \text{Vimik\_dash3} \cdot [\text{s60}]) \cdot [\text{s72}] \quad (66)$$

7.29 Reaction re36

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s76} \longrightarrow \text{s75} \quad (67)$$

Reactant

Table 84: Properties of each reactant.

Id	Name	SBO
s76	cig1+	

Product

Table 85: Properties of each product.

Id	Name	SBO
s75	Cig1	

Kinetic Law

Derived unit not available

$$v_{29} = \text{ksci1} \quad (68)$$

7.30 Reaction re37

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

SBO:0000179 degradation

Reaction equation

$$\text{s75} \xrightarrow{\text{s48, s47}} \text{s77} \tag{69}$$

Reactant

Table 86: Properties of each reactant.

Id	Name	SBO
s75	Cig1	

Modifiers

Table 87: Properties of each modifier.

Id	Name	SBO
s48	Slp1A	
s47	Srw1	

Product

Table 88: Properties of each product.

Id	Name	SBO
s77	sa353_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_{30} = (\text{kdci1} + \text{kdci1\_dash} \cdot [\text{s48}] + \text{kdci1\_dash2} \cdot [\text{s47}]) \cdot [\text{s75}] \tag{70}$$

7.31 Reaction re38

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s78} \xrightarrow{\text{s48}} \text{s81} \tag{71}$$

Reactant

Table 89: Properties of each reactant.

Id	Name	SBO
s78	Clp1+	

Modifier

Table 90: Properties of each modifier.

Id	Name	SBO
s48	Slp1A	

Product

Table 91: Properties of each product.

Id	Name	SBO
s81	Clp1	

Kinetic Law

Derived unit contains undeclared units

$$v_{31} = \text{ksflp} + \text{ksflp\_dash} \cdot [\text{s48}] \tag{72}$$

7.32 Reaction re39

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s79} \xrightarrow{\text{s81}} \text{s80} \tag{73}$$

Reactant

Table 92: Properties of each reactant.

Id	Name	SBO
s79	iWee1	

Modifier

Table 93: Properties of each modifier.

Id	Name	SBO
s81	Clp1	

Product

Table 94: Properties of each product.

Id	Name	SBO
s80	Wee1	

Kinetic Law

Derived unit contains undeclared units

$$v_{32} = \frac{(\text{Vawee\_dash} + \text{Vawee\_dash2} \cdot [\text{s81}]) \cdot (\text{Wee1T} - [\text{s80}])}{\text{Jawee} + (\text{Wee1T} - [\text{s80}])} \tag{74}$$

7.33 Reaction re40

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s80} \xrightarrow{\text{s56}} \text{s79} \tag{75}$$

Reactant

Table 95: Properties of each reactant.

Id	Name	SBO
s80	Wee1	

Modifier

Table 96: Properties of each modifier.

Id	Name	SBO
s56	Cdc13	

Product

Table 97: Properties of each product.

Id	Name	SBO
s79	iWee1	

Kinetic Law

Derived unit contains undeclared units

$$v_{33} = \frac{(\text{Viwee\_dash} + \text{Viwee\_dash2} \cdot [\text{s56}]) \cdot [\text{s80}]}{\text{Jiwee} + [\text{s80}]} \tag{76}$$

7.34 Reaction re41

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

SBO:0000179 degradation

Reaction equation

$$\text{s60} \xrightarrow{\text{s9}} \text{s46} \tag{77}$$

Reactant

Table 98: Properties of each reactant.

Id	Name	SBO
s60	pCdc13	

Modifier

Table 99: Properties of each modifier.

Id	Name	SBO
s9	Vdcyc	

Product

Table 100: Properties of each product.

Id	Name	SBO
s46	sa4_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_{34} = \text{Vdcyc} \cdot [\text{s60}] \tag{78}$$

7.35 Reaction re42

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

SBO:0000179 degradation

Reaction equation

$$\text{s56} \xrightarrow{\text{s9}} \text{s46} \tag{79}$$

Reactant

Table 101: Properties of each reactant.

Id	Name	SBO
s56	Cdc13	

Modifier

Table 102: Properties of each modifier.

Id	Name	SBO
s9	Vdcyc	

Product

Table 103: Properties of each product.

Id	Name	SBO
s46	sa4_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_{35} = \text{Vdcyc} \cdot [\text{s56}] \tag{80}$$

7.36 Reaction re43

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

SBO:0000216 phosphorylation

Reaction equation

$$\text{s161} \xrightarrow{\text{s80, s72}} \text{s137} \tag{81}$$

Reactant

Table 104: Properties of each reactant.

Id	Name	SBO
s161	Cdc13-Rum1	

Modifiers

Table 105: Properties of each modifier.

Id	Name	SBO
s80	Wee1	
s72	Mik1	

Product

Table 106: Properties of each product.

Id	Name	SBO
s137	Cdc13p-Rum1	

Kinetic Law

Derived unit contains undeclared units

$$v_{36} = (\text{kmik\_dash} \cdot [\text{s72}] + \text{kwee}) \cdot [\text{s161}] \tag{82}$$

7.37 Reaction re44

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

SBO:0000216 phosphorylation

Reaction equation

$$\text{s149} \xrightarrow{\text{s72}} \text{s153} \tag{83}$$

Reactant

Table 107: Properties of each reactant.

Id	Name	SBO
s149	Cig2-Rum1	

Modifier

Table 108: Properties of each modifier.

Id	Name	SBO
s72	Mik1	

Product

Table 109: Properties of each product.

Id	Name	SBO
s153	Cig2p-Rum1	

Kinetic Law

Derived unit contains undeclared units

$$v_{37} = \text{kmik\_dash2} \cdot [\text{s72}] \cdot [\text{s149}] \tag{84}$$

7.38 Reaction `re45`

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s82} \xrightarrow{\text{s56}} \text{s83} \tag{85}$$

Reactant

Table 110: Properties of each reactant.

Id	Name	SBO
`s82`	iCdc25	

Modifier

Table 111: Properties of each modifier.

Id	Name	SBO
`s56`	Cdc13	

Product

Table 112: Properties of each product.

Id	Name	SBO
`s83`	Cdc25	

Kinetic Law

Derived unit contains undeclared units

$$v_{38} = \frac{\text{Va25\_dash2} \cdot [\text{s56}] \cdot (\text{Cdc25T} - [\text{s83}])}{\text{Ja25} + (\text{Cdc25T} - [\text{s83}])} \tag{86}$$

7.39 Reaction re46

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s83} \xrightarrow{\text{s81, s157}} \text{s82} \tag{87}$$

Reactant

Table 113: Properties of each reactant.

Id	Name	SBO
s83	Cdc25	

Modifiers

Table 114: Properties of each modifier.

Id	Name	SBO
s81	Clp1	
s157	UDNA	

Product

Table 115: Properties of each product.

Id	Name	SBO
s82	iCdc25	

Kinetic Law

Derived unit contains undeclared units

$$v_{39} = \frac{(\text{Vi25\_dash} + \text{Vi25\_dash2} \cdot [\text{s81}] + \text{Vi25} \cdot \text{UDNA}) \cdot [\text{s83}]}{\text{Ji25} + [\text{s83}]} \tag{88}$$

7.40 Reaction re47

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s85} \xrightarrow{\text{s71}} \text{s84} \tag{89}$$

Reactant

Table 116: Properties of each reactant.

Id	Name	SBO
s85	cdc18+	

Modifier

Table 117: Properties of each modifier.

Id	Name	SBO
s71	Cdc10	

Product

Table 118: Properties of each product.

Id	Name	SBO
s84	Cdc18T	

Kinetic Law

Derived unit contains undeclared units

$$v_{40} = \text{ksc18} \cdot (\text{Cdc10T} - [\text{s71}] + [\text{s71}]) + \text{ksc18\_dash} \cdot [\text{s71}] \tag{90}$$

7.41 Reaction re48

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

SBO:0000179 degradation

Reaction equation

$$\text{s84} \xrightarrow{\text{s130}} \text{s88} \tag{91}$$

Reactant

Table 119: Properties of each reactant.

Id	Name	SBO
s84	Cdc18T	

Modifier

Table 120: Properties of each modifier.

Id	Name	SBO
s130	Vdc18	

Product

Table 121: Properties of each product.

Id	Name	SBO
s88	sa386_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_{41} = \text{Vdc18} \cdot [\text{s84}] \tag{92}$$

7.42 Reaction re53

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

SBO:0000179 degradation

Reaction equation

$$\text{s81} \longrightarrow \text{s93} \tag{93}$$

Reactant

Table 122: Properties of each reactant.

Id	Name	SBO
s81	Clp1	

Product

Table 123: Properties of each product.

Id	Name	SBO
s93	sa370_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_{42} = \text{kdflp} \cdot [\text{s81}] \tag{94}$$

7.43 Reaction re54

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

SBO:0000526 protein complex formation

Reaction equation

$$\text{s56} + \text{s166} \rightleftharpoons \text{s161} \tag{95}$$

Reactants

Table 124: Properties of each reactant.

Id	Name	SBO
s56	Cdc13	
s166	Rum1	

Product

Table 125: Properties of each product.

Id	Name	SBO
s161	Cdc13-Rum1	

Kinetic Law

Derived unit contains undeclared units

$$v_{43} = \text{lp} \cdot [\text{s56}] \cdot [\text{s166}] - \text{lm} \cdot [\text{s161}] \tag{96}$$

7.44 Reaction re56

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

SBO:0000330 dephosphorylation

Reaction equation

$$\text{s60} \xrightarrow{\text{s83, s64}} \text{s56} \tag{97}$$

Reactant

Table 126: Properties of each reactant.

Id	Name	SBO
s60	pCdc13	

Modifiers

Table 127: Properties of each modifier.

Id	Name	SBO
s83	Cdc25	
s64	Pyp3	

Product

Table 128: Properties of each product.

Id	Name	SBO
s56	Cdc13	

Kinetic Law

Derived unit contains undeclared units

$$v_{44} = (\text{kpyp2} + \text{k25}) \cdot [\text{s60}] \tag{98}$$

7.45 Reaction re57

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

SBO:0000216 phosphorylation

Reaction equation

$$\text{s56} \xrightarrow{\text{s80, s72}} \text{s60} \tag{99}$$

Reactant

Table 129: Properties of each reactant.

Id	Name	SBO
s56	Cdc13	

Modifiers

Table 130: Properties of each modifier.

Id	Name	SBO
s80	Wee1	
s72	Mik1	

Product

Table 131: Properties of each product.

Id	Name	SBO
s60	pCdc13	

Kinetic Law

Derived unit contains undeclared units

$$v_{45} = (\text{kmik\_dash} \cdot [\text{s72}] + \text{kwee}) \cdot [\text{s56}] \tag{100}$$

7.46 Reaction re58

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

SBO:0000526 protein complex formation

Reaction equation

$$\text{s166} + \text{s60} \rightleftharpoons \text{s137} \tag{101}$$

Reactants

Table 132: Properties of each reactant.

Id	Name	SBO
s166	Rum1	
s60	pCdc13	

Product

Table 133: Properties of each product.

Id	Name	SBO
s137	Cdc13p-Rum1	

Kinetic Law

Derived unit contains undeclared units

$$v_{46} = \mathrm{lp} \cdot [\mathrm{s60}] \cdot [\mathrm{s166}] - \mathrm{lm} \cdot [\mathrm{s137}] \tag{102}$$

7.47 Reaction re60

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

SBO:0000179 degradation

Reaction equation

$$\mathrm{s166} \xrightarrow{\mathrm{s4}} \mathrm{s61} \tag{103}$$

Reactant

Table 134: Properties of each reactant.

Id	Name	SBO
s166	Rum1	

Modifier

Table 135: Properties of each modifier.

Id	Name	SBO
s4	Vdrum	

Product

Table 136: Properties of each product.

Id	Name	SBO
s61	sa161_degraded	

Kinetic Law

Derived unit contains undeclared units

$$v_{47} = \text{Vdrum} \cdot [\text{s166}] \tag{104}$$

7.48 Reaction re62

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s52} \longrightarrow \text{s166} \tag{105}$$

Reactant

Table 137: Properties of each reactant.

Id	Name	SBO
s52	rum1+	

Product

Table 138: Properties of each product.

Id	Name	SBO
s166	Rum1	

Kinetic Law

Derived unit not available

$$v_{48} = \text{ksrum} \tag{106}$$

7.49 Reaction re66

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

SBO:0000344 molecular interaction

Reaction equation

$$\text{s89} \xrightarrow{\text{s67, s56, s63}} \text{s90} \tag{107}$$

Reactant

Table 139: Properties of each reactant.

Id	Name	SBO
s89	preRC	

Modifiers

Table 140: Properties of each modifier.

Id	Name	SBO
s67	Cig2	
s56	Cdc13	
s63	Cig2p	

Product

Table 141: Properties of each product.

Id	Name	SBO
s90	postRC	

Kinetic Law

Derived unit contains undeclared units

$$v_{49} = (\text{kini\_dash} \cdot [\text{s56}] + \text{kini\_dash2} \cdot [\text{s67}] + \text{kini\_dash3} \cdot [\text{s63}]) \cdot \text{preRC} \tag{108}$$

7.50 Reaction re67

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

SBO:0000204 dna replication

Reaction equation

$$\text{s91} \xrightarrow{\text{s67, s56, s63}} \text{s92} \tag{109}$$

Reactant

Table 142: Properties of each reactant.

Id	Name	SBO
s91	repldna	

Modifiers

Table 143: Properties of each modifier.

Id	Name	SBO
s67	Cig2	
s56	Cdc13	
s63	Cig2p	

Product

Table 144: Properties of each product.

Id	Name	SBO
s92	irepldna	

Kinetic Law

Derived unit contains undeclared units

$$v_{50} = \frac{\text{kori}}{1 + \left(\frac{\text{kipre} \cdot [\text{s56}] + \text{kipre\_dash} \cdot [\text{s67}]}{\text{Jipre}}\right)^{\text{n}}} \cdot [\text{s91}] \tag{110}$$

7.51 Reaction re68

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

SBO:0000204 dna replication

Reaction equation

$$\text{s90} \longrightarrow \text{s91} \tag{111}$$

Reactant

Table 145: Properties of each reactant.

Id	Name	SBO
s90	postRC	

Product

Table 146: Properties of each product.

Id	Name	SBO
s91	repldna	

Kinetic Law

Derived unit contains undeclared units

$$v_{51} = \text{krepl} \cdot [\text{s90}] \tag{112}$$

8 Derived Rate Equations

When interpreted as an ordinary differential equation framework, this model implies the following set of equations for the rates of change of each species.

Identifiers for kinetic laws highlighted in gray cannot be verified to evaluate to units of SBML substance per time. As a result, some SBML interpreters may not be able to verify the consistency of the units on quantities in the model. Please check if

- parameters without an unit definition are involved or
- volume correction is necessary because the hasOnlySubstanceUnits flag may be set to false and spacialDimensions> 0 for certain species.

8.1 Species s4

Name Vdrum

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in five reactions (as a modifier in re14, re16, re29, re30, re60), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s4} = 0 \tag{113}$$

8.2 Species s9

Name Vdcyc

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in four reactions (as a modifier in re15, re17, re41, re42), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s9} = 0 \tag{114}$$

8.3 Species s46

Name sa4_degraded

SBO:0000291 empty set

Initial amount 0 mol

Charge 0

This species takes part in four reactions (as a product in re15, re17, re41, re42), which do not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s46} = 0 \tag{115}$$

8.4 Species s47

Name Srw1

SBO:0000252 polypeptide chain

Initial amount 0.00239076 mol

Charge 0

This species takes part in three reactions (as a reactant in re4 and as a product in re3 and as a modifier in re37).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s47} = v_1 - v_2 \tag{116}$$

8.5 Species s48

Name Slp1A

SBO:0000252 polypeptide chain

Initial amount $6.33821 \cdot 10^{-5}$ mol

Charge 0

This species takes part in nine reactions (as a reactant in re8 and as a product in re7 and as a modifier in re3, re23, re25, re28, re31, re37, re38).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s48} = v_5 - v_6 \tag{117}$$

8.6 Species s49

Name Puc1

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a modifier in re4).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s49} = 0 \tag{118}$$

8.7 Species s50

Name IE

SBO:0000014 enzyme

Initial amount 0.00127807 mol

Charge 0

This species takes part in three reactions (as a reactant in re6 and as a product in re5 and as a modifier in re7).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s50} = v_3 - v_4 \tag{119}$$

8.8 Species s51

Name iIE

SBO:0000014 enzyme

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a reactant in re5 and as a product in re6), which do not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s51} = 0 \tag{120}$$

8.9 Species s52

Name rum1+

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a reactant in re62), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s52} = 0 \tag{121}$$

8.10 Species s55

Name cig2+

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a reactant in re19), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s55} = 0 \tag{122}$$

8.11 Species s56

Name Cdc13

SBO:0000252 polypeptide chain

Initial amount 0.0439902 mol

Charge 0

This species takes part in 13 reactions (as a reactant in re42, re54, re57 and as a product in re12, re16, re56 and as a modifier in re4, re5, re35, re40, re45, re66, re67).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s56} = v_7 + v_{10} + v_{44} - v_{35} - v_{43} - v_{45} \tag{123}$$

8.12 Species s57

Name cdc13+

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a reactant in re12), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s57} = 0 \tag{124}$$

8.13 Species s60

Name pCdc13

SBO:0000252 polypeptide chain

Initial amount 0.1147007 mol

Charge 0

This species takes part in six reactions (as a reactant in re41, re56, re58 and as a product in re14, re57 and as a modifier in re35).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s60} = v_8 + v_{45} - v_{34} - v_{44} - v_{46} \tag{125}$$

8.14 Species s61

Name sa161_degraded

SBO:0000291 empty set

Initial amount 0 mol

Charge 0

This species takes part in four reactions (as a product in re14, re16, re30, re60), which do not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s61} = 0 \tag{126}$$

8.15 Species s63

Name Cig2p

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in seven reactions (as a reactant in re21, re24, re31 and as a product in re20, re29 and as a modifier in re66, re67).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s63} = v_{14} + v_{22} - v_{15} - v_{18} - v_{24} \tag{127}$$

8.16 Species s64

Name Pyp3

SBO:0000252 polypeptide chain

Initial amount 0 mol

This species takes part in four reactions (as a modifier in re18, re21, re27, re56).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s64} = 0 \tag{128}$$

8.17 Species s65

Name iSrw1

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a reactant in re3 and as a product in re4), which do not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s65} = 0 \tag{129}$$

8.18 Species s66

Name iSlp1

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a reactant in re7 and as a product in re8), which do not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s66} = 0 \tag{130}$$

8.19 Species s67

Name Cig2

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in eleven reactions (as a reactant in re20, re22, re28 and as a product in re19, re21, re30 and as a modifier in re4, re32, re35, re66, re67).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s67} = v_{13} + v_{15} + v_{23} - v_{14} - v_{16} - v_{21} \tag{131}$$

8.20 Species s70

Name iCdc10

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a reactant in re33 and as a product in re32), which do not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s70} = 0 \tag{132}$$

8.21 Species s71

Name Cdc10

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in five reactions (as a reactant in re32 and as a product in re33 and as a modifier in re19, re34, re47).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s71} = v_{26} - v_{25} \tag{133}$$

8.22 Species s72

Name Mik1

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in six reactions (as a reactant in re35 and as a product in re34 and as a modifier in re20, re43, re44, re57).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s72} = v_{27} - v_{28} \tag{134}$$

8.23 Species s73

Name mik1+

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a reactant in re34), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s73} = 0 \tag{135}$$

8.24 Species s74

Name sa347_degraded

SBO:0000291 empty set

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a product in re35), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s74} = 0 \tag{136}$$

8.25 Species s75

Name Cig1

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in four reactions (as a reactant in re37 and as a product in re36 and as a modifier in re4, re5).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s75} = v_{29} - v_{30} \tag{137}$$

8.26 Species s76

Name cig1+

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a reactant in re36), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s76} = 0 \tag{138}$$

8.27 Species s77

Name sa353_degraded

SBO:0000291 empty set

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a product in re37), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s77} = 0 \tag{139}$$

8.28 Species s78

Name Clp1+

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a reactant in re38), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s78} = 0 \tag{140}$$

8.29 Species s79

Name iWee1

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a reactant in re39 and as a product in re40), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s79} = 0 \tag{141}$$

8.30 Species s80

Name Wee1

SBO:0000252 polypeptide chain

Initial amount 0 mol

This species takes part in four reactions (as a reactant in re40 and as a product in re39 and as a modifier in re43, re57).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s80} = v_{32} - v_{33} \tag{142}$$

8.31 Species s81

Name Clp1

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in four reactions (as a reactant in re53 and as a product in re38 and as a modifier in re39, re46).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s81} = v_{31} - v_{42} \tag{143}$$

8.32 Species s82

Name iCdc25

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a reactant in re45 and as a product in re46), which do not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s82} = 0 \tag{144}$$

8.33 Species s83

Name Cdc25

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in six reactions (as a reactant in re46 and as a product in re45 and as a modifier in re18, re21, re27, re56).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s83} = v_{38} - v_{39} \tag{145}$$

8.34 Species s84

Name Cdc18T

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a reactant in re48 and as a product in re47).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s84} = v_{40} - v_{41} \tag{146}$$

8.35 Species s85

Name cdc18+

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a reactant in re47), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s85} = 0 \tag{147}$$

8.36 Species s88

Name sa386_degraded

SBO:0000291 empty set

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a product in re48), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s88} = 0 \tag{148}$$

8.37 Species s89

Name preRC

SBO:0000297 protein complex

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a reactant in re66), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s89} = 0 \tag{149}$$

8.38 Species s90

Name postRC

SBO:0000297 protein complex

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a reactant in re68 and as a product in re66).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s90} = v_{49} - v_{51} \tag{150}$$

8.39 Species s91

Name repldna

SBO:0000251 deoxyribonucleic acid

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a reactant in re67 and as a product in re68).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s91} = v_{51} - v_{50} \tag{151}$$

8.40 Species s92

Name irepldna

SBO:0000251 deoxyribonucleic acid

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a product in re67), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s92} = 0 \tag{152}$$

8.41 Species s93

Name sa370_degraded

SBO:0000291 empty set

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a product in re53), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s93} = 0 \tag{153}$$

8.42 Species s94

Name sa44_degraded

SBO:0000291 empty set

Initial amount 0 mol

Charge 0

This species takes part in four reactions (as a product in re23, re25, re28, re31), which do not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s94} = 0 \tag{154}$$

8.43 Species s130

Name Vdc18

SBO:0000252 polypeptide chain

Initial amount 0 mol

This species takes part in one reaction (as a modifier in re48).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s130} = 0 \tag{155}$$

8.44 Species s137

Name Cdc13p-Rum1

SBO:0000297 protein complex

Initial amount 0.0432273 mol

Charge 0

This species takes part in five reactions (as a reactant in re14, re17, re18 and as a product in re43, re58).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s137} = v_{36} + v_{46} - v_{8} - v_{11} - v_{12} \tag{156}$$

8.45 Species s149

Name Cig2-Rum1

SBO:0000297 protein complex

Initial amount 0 mol

Charge 0

This species takes part in five reactions (as a reactant in re23, re30, re44 and as a product in re22, re27).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s149} = v_{16} + v_{20} - v_{17} - v_{23} - v_{37} \tag{157}$$

8.46 Species s153

Name Cig2p-Rum1

SBO:0000297 protein complex

Initial amount 0 mol

This species takes part in five reactions (as a reactant in re25, re27, re29 and as a product in re24, re44).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s153} = v_{18} + v_{37} - v_{19} - v_{20} - v_{22} \tag{158}$$

8.47 Species s157

Name UDNA

SBO:0000251 deoxyribonucleic acid

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a modifier in re21, re46), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s157} = 0 \tag{159}$$

8.48 Species s161

Name Cdc13-Rum1

SBO:0000297 protein complex

Initial amount 0.0165018 mol

Charge 0

This species takes part in five reactions (as a reactant in re15, re16, re43 and as a product in re18, re54).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s161} = v_{12} + v_{43} - v_{9} - v_{10} - v_{36} \tag{160}$$

8.49 Species s166

Name Rum1

SBO:0000252 polypeptide chain

Initial amount 0 mol

Charge 0

This species takes part in ten reactions (as a reactant in re22, re24, re54, re58, re60 and as a product in re15, re17, re23, re25, re62).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s166} = v_9 + v_{11} + v_{17} + v_{19} + v_{48} - v_{16} - v_{18} - v_{43} - v_{46} - v_{47} \quad (161)$$

A Glossary of Systems Biology Ontology Terms

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

SBO:0000014 enzyme: A protein that catalyzes a chemical reaction. The word comes from en “a” or“i”) and simo “leave” or“yeas”)

SBO:0000179 degradation: Complete disappearance of a physical entity

SBO:0000180 dissociation: Transformation of a non-covalent complex that results in the formation of several independent biochemical entitie

SBO:0000196 concentration of an entity pool: The amount of an entity per unit of volume.

SBO:0000204 dna replication: Process in which a DNA duplex is transformed into two identical DNA duplexes

SBO:0000216 phosphorylation: Addition of a phosphate group (-H2PO4) to a chemical entity

SBO:0000251 deoxyribonucleic acid: Polymer composed of nucleotides containing deoxyribose and linked by phosphodiester bonds. CHEBI:16991

SBO:0000252 polypeptide chain: Naturally occurring macromolecule formed by the repetition of amino-acid residues linked by peptidic bonds. A polypeptide chain is synthesized by the ribosome. CHEBI:1654

SBO:0000261 inhibitory constant: Dissociation constant of a compound from a target of which it inhibits the function.

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:0000291 empty set: Entity defined by the absence of any actual object. An empty set is often used to represent the source of a creation process or the result of a degradation process.

SBO:0000297 protein complex: Macromolecular complex containing one or more polypeptide chains possibly associated with simple chemicals. CHEBI:3608

SBO:0000330 dephosphorylation: Removal of a phosphate group (-H2PO4) from a chemical entity.

SBO:0000344 molecular interaction: Relationship between molecular entities, based on contacts, direct or indirect.

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:0000361 amount of an entity pool: A numerical measure of the quantity, or of some property, of the entities that constitute the entity pool.

SBO:0000363 activation constant: Dissociation constant of a potentiator (activator) from a target (e.g. an enzyme) of which it activates the function

SBO:0000393 production: Generation of a material or conceptual entity.

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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