SBML Model Report

Model name: “Chen2004 - Cell Cycle Regulation”

June 17, 2013

1 General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by the following three authors: Harish Dharuri[1], Katherine C Chen[2] and Lukas Endler[3] at May eighth 2006 at 11:05 a. m. and last time modified at June seventh 2013 at 10:59 a. 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	54
events	4	constraints	0
reactions	94	function definitions	5
global parameters	163	unit definitions	1
rules	35	initial assignments	0

Model Notes

Chen2004 - Cell Cycle Regulation

This is a hypothetical model of cell cycle that describes the molecular mechanism for regulating DNA synthesis, bud emergence, mitosis, and cell division in budding yeast.

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This model is described in the article:Integrative analysis of cell cycle control in budding yeast.Chen KC, Calzone L, Csikasz-Nagy A, Cross FR, Novak B, Tyson JJMol. Biol. Cell. [2004 Aug; Volume: 15 (Issue: 8)] Page info: 3841-62

Abstract:

The adaptive responses of a living cell to internal and external signals are controlled by networks of proteins whose interactions are so complex that the functional integration of the network cannot be comprehended by intuitive reasoning alone. Mathematical modeling, based on biochemical rate equations, provides a rigorous and reliable tool for unraveling the complexities of molecular regulatory networks. The budding yeast cell cycle is a challenging test case for this approach, because the control system is known in exquisite detail and its function is constrained by the phenotypic properties of >100 genetically engineered strains. We show that a mathematical model built on a consensus picture of this control system is largely successful in explaining the phenotypes of mutants described so far. A few inconsistencies between the model and experiments indicate aspects of the mechanism that require revision. In addition, the model allows one to frame and critique hypotheses about how the division cycle is regulated in wild-type and mutant cells, to predict the phenotypes of new mutant combinations, and to estimate the effective values of biochemical rate constants that are difficult to measure directly in vivo.

The model reproduces the time profiles of the different species in Figure 2 of the paper. The figure depicts the cycle of a daughter cell. Since the Mass Doubling Time (MDT) is 90 minutes, time t=90 from the model simulation will correspond to time t=0 in the paper. The model was successfully tested using MathSBML and SBML odeSolver.

To create a valid SBML file, a local parameter k=1 was added in the reaction 'Inactivation_274_CDC20'. Also, in order to annotate the protein and to have the interaction in the reaction graph to match figure 1 of the article, the reaction rate constants k_{mad2}, k_{bub2} and k_{lte1} are considered as species and renamed as MAD2, BUB2 and LTE1 in the model.

This model is hosted on BioModels Database and identified by: BIOMD0000000056 .

To cite BioModels Database, please use: BioModels Database: An enhanced, curated and annotated resource for published quantitative kinetic models .

2 Unit Definitions

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

2.1 Unit `time`

Name min

Definition 60 s

2.2 Unit substance

Notes Mole is the predefined SBML unit for substance.

Definition mol

2.3 Unit volume

Notes Litre is the predefined SBML unit for volume.

Definition l

2.4 Unit area

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

Definition m^2

2.5 Unit length

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

Definition m

3 Compartment

This model contains one compartment.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
cell	cell		3	1	litre	☑	

3.1 Compartment cell

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

Name cell

4 Species

This model contains 54 species. The boundary condition of four of these species is set to `true` so that these species' amount cannot be changed by any reaction. Section 10 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
BCK2	BCK2	cell	mol	☐	☐
BUB2	BUB2	cell	mol	☐	☐
BUD	BUD	cell	mol	☐	☐
C2	C2	cell	mol	☐	☐
C2P	C2P	cell	mol	☐	☐
C5	C5	cell	mol	☐	☐
C5P	C5P	cell	mol	☐	☐
CDC14	CDC14	cell	mol	☐	☐
CDC14T	CDC14T	cell	mol	☐	☐
CDC15	CDC15	cell	mol	☐	☐
CDC15i	CDC15i	cell	mol	☐	☑
CDC20	CDC20	cell	mol	☐	☐
CDC20i	CDC20i	cell	mol	☐	☐
CDC6	CDC6	cell	mol	☐	☐
CDC6P	CDC6P	cell	mol	☐	☐
CDC6T	CDC6T	cell	mol	☐	☐
CDH1	CDH1	cell	mol	☐	☐
CDH1i	CDH1i	cell	mol	☐	☐
CKIT	CKIT	cell	mol	☐	☐
CLB2	CLB2	cell	mol	☐	☐
CLB2T	CLB2T	cell	mol	☐	☐

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
CLB5	CLB5	cell	mol	☐	☐
CLB5T	CLB5T	cell	mol	☐	☐
CLN2	CLN2	cell	mol	☐	☐
CLN3	CLN3	cell	mol	☐	☐
ESP1	ESP1	cell	mol	☐	☐
F2	F2	cell	mol	☐	☐
F2P	F2P	cell	mol	☐	☐
F5	F5	cell	mol	☐	☐
F5P	F5P	cell	mol	☐	☐
IE	IE	cell	mol	☐	☑
IEP	IEP	cell	mol	☐	☐
LTE1	LTE1	cell	mol	☐	☐
MAD2	MAD2	cell	mol	☐	☐
MASS	MASS	cell	mol	☐	☐
MCM1	MCM1	cell	mol	☐	☐
NET1	NET1	cell	mol	☐	☐
NET1P	NET1P	cell	mol	☐	☐
NET1T	NET1T	cell	mol	☐	☐
ORI	ORI	cell	mol	☐	☐
PDS1	PDS1	cell	mol	☐	☐
PE	PE	cell	mol	☐	☑
PPX	PPX	cell	mol	☐	☐
RENT	RENT	cell	mol	☐	☐
RENTP	RENTP	cell	mol	☐	☐
SBF	SBF	cell	mol	☐	☐
SIC1	SIC1	cell	mol	☐	☐
SIC1P	SIC1P	cell	mol	☐	☐

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
SIC1T	SIC1T	cell	mol	☐	☐
SPN	SPN	cell	mol	☐	☐
SWI5	SWI5	cell	mol	☐	☐
SWI5P	SWI5P	cell	mol	☐	☐
TEM1GDP	TEM1GDP	cell	mol	☐	☑
TEM1GTP	TEM1GTP	cell	mol	☐	☐

5 Parameters

This model contains 163 global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
b0	b0		0.054		☑
bub2h	bub2h		1.000		☑
bub2l	bub2l		0.200		☐
C0	C0		0.400		☑
CDC15T	CDC15T		1.000		☐
Dn3	Dn3		1.000		☑
ebudb5	ebudb5		1.000		☑
ebudn2	ebudn2		0.250		☑
ebudn3	ebudn3		0.050		☑
ec1b2	ec1b2		0.450		☑
ec1b5	ec1b5		0.100		☑
ec1k2	ec1k2		0.030		☑
ec1n2	ec1n2		0.060		☑
ec1n3	ec1n3		0.300		☑
ef6b2	ef6b2		0.550		☑
ef6b5	ef6b5		0.100		☑
ef6k2	ef6k2		0.030		☑
ef6n2	ef6n2		0.060		☑
ef6n3	ef6n3		0.300		☑
eicdhb2	eicdhb2		1.200		☑
eicdhb5	eicdhb5		8.000		☑
eicdhn2	eicdhn2		0.400		☑
eicdhn3	eicdhn3		0.250		☑
eorib2	eorib2		0.450		☑
eorib5	eorib5		0.900		☑
esbfb5	esbfb5		2.000		☑
esbfn2	esbfn2		2.000		☑
esbfn3	esbfn3		10.000		☑
ESP1T	ESP1T		1.000		☐
IET	IET		1.000		☐
J20ppx	J20ppx		0.150		☑
Jacdh	Jacdh		0.030		☑
Jaiep	Jaiep		0.100		☑
Jamcm	Jamcm		0.100		☑
Jasbf	Jasbf		0.010		☑
Jatem	Jatem		0.100		☑
Jd2c1	Jd2c1		0.050		☑

Id	Name	SBO	Value	Unit	Constant
Jd2f6	Jd2f6		0.050		☑
Jicdh	Jicdh		0.030		☑
Jiiep	Jiiep		0.100		☑
Jimcm	Jimcm		0.100		☑
Jisbf	Jisbf		0.010		☑
Jitem	Jitem		0.100		☑
Jn3	Jn3		6.000		☑
Jpds	Jpds		0.040		☑
Jspn	Jspn		0.140		☑
ka15_p	ka15'		0.002		☑
ka15_p_p	ka15"		1.000		☑
ka15p	ka15p		0.001		☑
ka20_p	ka20'		0.050		☑
ka20_p_p	ka20"		0.200		☑
kacdh_p	kacdh'		0.010		☑
kacdh_p_p	kacdh"		0.800		☑
kaiep	kaiep		0.100		☑
kamcm	kamcm		1.000		☑
kasb2	kasb2		50.000		☑
kasb5	kasb5		50.000		☑
kasbf	kasbf		0.380		☑
kasesp	kasesp		50.000		☑
kasf2	kasf2		15.000		☑
kasf5	kasf5		0.010		☑
kasrent	kasrent		200.000		☑
kasrentp	kasrentp		1.000		☑
kaswi	kaswi		2.000		☑
kd14	kd14		0.100		☑
kd1c1	kd1c1		0.010		☑
kd1f6	kd1f6		0.010		☑
kd1pds_p	kd1pds'		0.010		☑
kd20	kd20		0.300		☑
kd2c1	kd2c1		1.000		☑
kd2f6	kd2f6		1.000		☑
kd2pds_p_p	kd2pds"		0.200		☑
kd3c1	kd3c1		1.000		☑
kd3f6	kd3f6		1.000		☑
kd3pds_p_p	kd3pds"		0.040		☑
kdb2_p	kdb2'		0.003		☑
kdb2_p_p	kdb2"		0.400		☑
kdb2p	kdb2p		0.150		☑
kdb5_p	kdb5'		0.010		☑

Id	Name	SBO	Value	Unit	Constant
kdb5_p_p	kdb5”		0.160		☑
kdbud	kdbud		0.060		☑
kdcdh	kdcdh		0.010		☑
kdib2	kdib2		0.050		☑
kdib5	kdib5		0.060		☑
kdiesp	kdiesp		0.500		☑
kdif2	kdif2		0.500		☑
kdif5	kdif5		0.010		☑
kdirent	kdirent		1.000		☑
kdirentp	kdirentp		2.000		☑
kdn2	kdn2		0.120		☑
kdnet	kdnet		0.030		☑
kdori	kdori		0.060		☑
kdppx_p	kdppx’		0.170		☑
kdppx_p_p	kdppx”		2.000		☑
kdspn	kdspn		0.060		☑
kdswi	kdswi		0.080		☑
KEZ	KEZ		0.300		☐
KEZ2	KEZ2		0.200		☐
ki15	ki15		0.500		☑
kicdh_p	kicdh’		0.001		☑
kicdh_p_p	kicdh”		0.080		☑
kiiep	kiiep		0.150		☑
kimcm	kimcm		0.150		☑
kisbf_p	kisbf’		0.600		☑
kisbf_p_p	kisbf”		8.000		☑
kiswi	kiswi		0.050		☑
kkpnet_p	kkpnet’		0.010		☑
kkpnet_p_p	kkpnet”		0.600		☑
kppc1	kppc1		4.000		☑
kppf6	kppf6		4.000		☑
kppnet_p	kppnet’		0.050		☑
kppnet_p_p	kppnet”		3.000		☑
ks14	ks14		0.200		☑
ks1pds_p_p	ks1pds”		0.030		☑
ks20_p	ks20’		0.006		☑
ks20_p_p	ks20”		0.600		☑
ks2pds_p_p	ks2pds”		0.055		☑
ksb2_p	ksb2’		0.001		☑
ksb2_p_p	ksb2”		0.040		☑
ksb5_p	ksb5’		$8 \cdot 10^{-4}$		☑
ksb5_p_p	ksb5”		0.005		☑

Id	Name	SBO	Value	Unit	Constant
ksbud	ksbud		0.200		☑
ksc1_p	ksc1'		0.012		☑
ksc1_p_p	ksc1"		0.120		☑
kscdh	kscdh		0.010		☑
ksf6_p	ksf6'		0.024		☑
ksf6_p_p	ksf6"		0.120		☑
ksf6_p_p_p	ksf6"'		0.004		☑
ksn2_p	ksn2'		0.000		☑
ksn2_p_p	ksn2"		0.150		☑
ksnet	ksnet		0.084		☑
ksori	ksori		2.000		☑
kspds_p	kspds'		0.000		☑
ksppx	ksppx		0.100		☑
ksspn	ksspn		0.100		☑
ksswi_p	ksswi'		0.005		☑
ksswi_p_p	ksswi"		0.080		☑
lte1h	lte1h		1.000		☐
lte1l	lte1l		0.100		☐
mad2h	mad2h		8.000		☑
mad2l	mad2l		0.010		☐
mdt	mdt		90.000		☑
TEM1T	TEM1T		1.000		☐
D	D		0.000		☐
mu	mu		0.000		☐
Vdb5	Vdb5		0.000		☐
Vdb2	Vdb2		0.000		☐
Vasbf	Vasbf		0.000		☐
Visbf	Visbf		0.000		☐
Vkpc1	Vkpc1		0.000		☐
Vkpf6	Vkpf6		0.000		☐
Vacdh	Vacdh		0.000		☐
Vicdh	Vicdh		0.000		☐
Vppnet	Vppnet		0.000		☐
Vkpnet	Vkpnet		0.000		☐
Vdppx	Vdppx		0.000		☐
Vdpds	Vdpds		0.000		☐
Vaiep	Vaiep		0.000		☐
Vd2c1	Vd2c1		0.000		☐
Vd2f6	Vd2f6		0.000		☐
Vppc1	Vppc1		0.000		☐
Vppf6	Vppf6		0.000		☐
F	F		0.000		☐

Id	Name	SBO	Value	Unit	Constant

6 Function definitions

This is an overview of five function definitions.

6.1 Function definition BB_218

Name BB

Arguments A1, A2, A3, A4

Mathematical Expression

$$\mathrm{A2} - \mathrm{A1} + \mathrm{A3} \cdot \mathrm{A2} + \mathrm{A4} \cdot \mathrm{A1} \tag{1}$$

6.2 Function definition GK_219

Name GK

Arguments A1, A2, A3, A4

Mathematical Expression

$$\frac{2 \cdot \mathrm{A4} \cdot \mathrm{A1}}{\mathrm{A2} - \mathrm{A1} + \mathrm{A3} \cdot \mathrm{A2} + \mathrm{A4} \cdot \mathrm{A1} + \sqrt{(\mathrm{A2} - \mathrm{A1} + \mathrm{A3} \cdot \mathrm{A2} + \mathrm{A4} \cdot \mathrm{A1})^2 - 4 \cdot (\mathrm{A2} - \mathrm{A1}) \cdot \mathrm{A4} \cdot \mathrm{A1}}} \tag{2}$$

6.3 Function definition MichaelisMenten_220

Name Michaelis-Menten

Arguments M1, J1, k1, S1

Mathematical Expression

$$\frac{\mathrm{k1} \cdot \mathrm{S1} \cdot \mathrm{M1}}{\mathrm{J1} + \mathrm{S1}} \tag{3}$$

6.4 Function definition Mass_Action_2_221

Name Mass_Action_2

Arguments k1, S1, S2

Mathematical Expression

$$\mathrm{k1} \cdot \mathrm{S1} \cdot \mathrm{S2} \tag{4}$$

6.5 Function definition Mass_Action_1_222

Name Mass_Action_1

Arguments k1, S1

Mathematical Expression

$$\mathrm{k1} \cdot \mathrm{S1} \tag{5}$$

7 Rules

This is an overview of 35 rules.

7.1 Rule BCK2

Rule BCK2 is an assignment rule for species BCK2:

$$[\mathrm{BCK2}] = \mathrm{b0} \cdot \mathrm{MASS} \tag{6}$$

7.2 Rule Visbf

Rule Visbf is an assignment rule for parameter Visbf:

$$\mathrm{Visbf} = \mathrm{kisbf\_p} + \mathrm{kisbf\_p\_p} \cdot \mathrm{CLB2} \tag{7}$$

7.3 Rule CLN3

Rule CLN3 is an assignment rule for species CLN3:

$$[\mathrm{CLN3}] = \frac{\mathrm{C0} \cdot \mathrm{Dn3} \cdot \mathrm{MASS}}{\mathrm{Jn3} + \mathrm{Dn3} \cdot \mathrm{MASS}} \tag{8}$$

7.4 Rule Vppc1

Rule Vppc1 is an assignment rule for parameter Vppc1:

$$\mathrm{Vppc1} = \mathrm{kppc1} \cdot \mathrm{CDC14} \tag{9}$$

7.5 Rule Vppf6

Rule Vppf6 is an assignment rule for parameter Vppf6:

$$\mathrm{Vppf6} = \mathrm{kppf6} \cdot \mathrm{CDC14} \tag{10}$$

7.6 Rule Vaiep

Rule Vaiep is an assignment rule for parameter Vaiep:

$$\mathrm{Vaiep} = \mathrm{kaiep} \cdot \mathrm{CLB2} \tag{11}$$

7.7 Rule Vacdh

Rule Vacdh is an assignment rule for parameter Vacdh:

$$\text{Vacdh} = \text{kacdh\_p} + \text{kacdh\_p\_p} \cdot \text{CDC14} \tag{12}$$

7.8 Rule Vicdh

Rule Vicdh is an assignment rule for parameter Vicdh:

$$\begin{aligned}\text{Vicdh} = {} & \text{kicdh\_p} + \text{kicdh\_p\_p} \\ & \cdot (\text{eicdhn3} \cdot \text{CLN3} + \text{eicdhn2} \cdot \text{CLN2} + \text{eicdhb5} \cdot \text{CLB5} + \text{eicdhb2} \cdot \text{CLB2})\end{aligned} \tag{13}$$

7.9 Rule Vkpnet

Rule Vkpnet is an assignment rule for parameter Vkpnet:

$$\text{Vkpnet} = (\text{kkpnet\_p} + \text{kkpnet\_p\_p} \cdot \text{CDC15}) \cdot \text{MASS} \tag{14}$$

7.10 Rule Vppnet

Rule Vppnet is an assignment rule for parameter Vppnet:

$$\text{Vppnet} = \text{kppnet\_p} + \text{kppnet\_p\_p} \cdot \text{PPX} \tag{15}$$

7.11 Rule Vasbf

Rule Vasbf is an assignment rule for parameter Vasbf:

$$\text{Vasbf} = \text{kasbf} \cdot (\text{esbfn2} \cdot \text{CLN2} + \text{esbfn3} \cdot (\text{CLN3} + \text{BCK2}) + \text{esbfb5} \cdot \text{CLB5}) \tag{16}$$

7.12 Rule SBF

Rule SBF is an assignment rule for species SBF:

$$[\text{SBF}] = \text{GK\_219}\,(\text{Vasbf}, \text{Visbf}, \text{Jasbf}, \text{Jisbf}) \tag{17}$$

7.13 Rule MCM1

Rule MCM1 is an assignment rule for species MCM1:

$$[\text{MCM1}] = \text{GK\_219}\,(\text{kamcm} \cdot \text{CLB2}, \text{kimcm}, \text{Jamcm}, \text{Jimcm}) \tag{18}$$

7.14 Rule mu

Rule mu is an assignment rule for parameter mu:

$$\text{mu} = \frac{\ln 2}{\text{mdt}} \tag{19}$$

7.15 Rule D

Rule D is an assignment rule for parameter D:

$$\mathrm{D} = \frac{1.026}{\mathrm{mu}} - 32 \tag{20}$$

7.16 Rule F

Rule F is an assignment rule for parameter F:

$$\mathrm{F} = \exp(\mathrm{mu} \cdot \mathrm{D}) \tag{21}$$

Derived unit dimensionless

7.17 Rule Vd2c1

Rule Vd2c1 is an assignment rule for parameter Vd2c1:

$$\begin{aligned}\mathrm{Vd2c1} = {} & \mathrm{kd2c1} \\ & \cdot(\mathrm{ec1n3}\cdot\mathrm{CLN3} + \mathrm{ec1k2}\cdot\mathrm{BCK2} + \mathrm{ec1n2}\cdot\mathrm{CLN2} + \mathrm{ec1b5}\cdot\mathrm{CLB5} + \mathrm{ec1b2}\cdot\mathrm{CLB2})\end{aligned} \tag{22}$$

7.18 Rule Vd2f6

Rule Vd2f6 is an assignment rule for parameter Vd2f6:

$$\mathrm{Vd2f6} = \mathrm{kd2f6}\cdot(\mathrm{ef6n3}\cdot\mathrm{CLN3} + \mathrm{ef6k2}\cdot\mathrm{BCK2} + \mathrm{ef6n2}\cdot\mathrm{CLN2} + \mathrm{ef6b5}\cdot\mathrm{CLB5} + \mathrm{ef6b2}\cdot\mathrm{CLB2}) \tag{23}$$

7.19 Rule Vkpc1

Rule Vkpc1 is an assignment rule for parameter Vkpc1:

$$\mathrm{Vkpc1} = \mathrm{kd1c1} + \frac{\mathrm{Vd2c1}}{\mathrm{Jd2c1} + \mathrm{SIC1} + \mathrm{C2} + \mathrm{C5} + \mathrm{SIC1P} + \mathrm{C2P} + \mathrm{C5P}} \tag{24}$$

7.20 Rule Vkpf6

Rule Vkpf6 is an assignment rule for parameter Vkpf6:

$$\mathrm{Vkpf6} = \mathrm{kd1f6} + \frac{\mathrm{Vd2f6}}{\mathrm{Jd2f6} + \mathrm{CDC6} + \mathrm{F2} + \mathrm{F5} + \mathrm{CDC6P} + \mathrm{F2P} + \mathrm{F5P}} \tag{25}$$

7.21 Rule Vdb2

Rule Vdb2 is an assignment rule for parameter Vdb2:

$$\mathrm{Vdb2} = \mathrm{kdb2\_p} + \mathrm{kdb2\_p\_p}\cdot\mathrm{CDH1} + \mathrm{kdb2p}\cdot\mathrm{CDC20} \tag{26}$$

7.22 Rule Vdb5

Rule Vdb5 is an assignment rule for parameter Vdb5:

$$\mathrm{Vdb5} = \mathrm{kdb5\_p} + \mathrm{kdb5\_p\_p} \cdot \mathrm{CDC20} \tag{27}$$

7.23 Rule Vdpds

Rule Vdpds is an assignment rule for parameter Vdpds:

$$\mathrm{Vdpds} = \mathrm{kd1pds\_p} + \mathrm{kd2pds\_p\_p} \cdot \mathrm{CDC20} + \mathrm{kd3pds\_p\_p} \cdot \mathrm{CDH1} \tag{28}$$

7.24 Rule Vdppx

Rule Vdppx is an assignment rule for parameter Vdppx:

$$\mathrm{Vdppx} = \mathrm{kdppx\_p} + \frac{\mathrm{kdppx\_p\_p} \cdot (\mathrm{J20ppx} + \mathrm{CDC20}) \cdot \mathrm{Jpds}}{\mathrm{Jpds} + \mathrm{PDS1}} \tag{29}$$

7.25 Rule CLB2T

Rule CLB2T is an assignment rule for species CLB2T:

$$[\mathrm{CLB2T}] = \mathrm{CLB2} + \mathrm{C2} + \mathrm{C2P} + \mathrm{F2} + \mathrm{F2P} \tag{30}$$

Derived unit mol

7.26 Rule CLB5T

Rule CLB5T is an assignment rule for species CLB5T:

$$[\mathrm{CLB5T}] = \mathrm{CLB5} + \mathrm{C5} + \mathrm{C5P} + \mathrm{F5} + \mathrm{F5P} \tag{31}$$

Derived unit mol

7.27 Rule CDC14T

Rule CDC14T is an assignment rule for species CDC14T:

$$[\mathrm{CDC14T}] = \mathrm{CDC14} + \mathrm{RENT} + \mathrm{RENTP} \tag{32}$$

Derived unit mol

7.28 Rule NET1T

Rule NET1T is an assignment rule for species NET1T:

$$[\mathrm{NET1T}] = \mathrm{NET1} + \mathrm{NET1P} + \mathrm{RENT} + \mathrm{RENTP} \tag{33}$$

Derived unit mol

7.29 Rule SIC1T

Rule SIC1T is an assignment rule for species SIC1T:

$$[\text{SIC1T}] = \text{SIC1} + \text{C2} + \text{C5} + \text{SIC1P} + \text{C2P} + \text{C5P} \tag{34}$$

Derived unit mol

7.30 Rule CDC6T

Rule CDC6T is an assignment rule for species CDC6T:

$$[\text{CDC6T}] = \text{CDC6} + \text{F2} + \text{F5} + \text{CDC6P} + \text{F2P} + \text{F5P} \tag{35}$$

Derived unit mol

7.31 Rule CKIT

Rule CKIT is an assignment rule for species CKIT:

$$[\text{CKIT}] = \text{SIC1T} + \text{CDC6T} \tag{36}$$

Derived unit mol

7.32 Rule CDC15i

Rule CDC15i is an assignment rule for species CDC15i:

$$[\text{CDC15i}] = \text{CDC15T} - \text{CDC15} \tag{37}$$

7.33 Rule IE

Rule IE is an assignment rule for species IE:

$$[\text{IE}] = \text{IET} - \text{IEP} \tag{38}$$

7.34 Rule PE

Rule PE is an assignment rule for species PE:

$$[\text{PE}] = \text{ESP1T} - \text{ESP1} \tag{39}$$

7.35 Rule TEM1GDP

Rule TEM1GDP is an assignment rule for species TEM1GDP:

$$[\text{TEM1GDP}] = \text{TEM1T} - \text{TEM1GTP} \tag{40}$$

8 Events

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

8.1 Event `reset_ORI`

Name reset ORI

Trigger condition

$$\mathrm{CLB2} + \mathrm{CLB5} - \mathrm{KEZ2} < 0 \tag{41}$$

Assignment

$$[\mathrm{ORI}] = 0 \tag{42}$$

8.2 Event `start_S`

Name start DNA synthesis

Trigger condition

$$\mathrm{ORI} - 1 > 0 \tag{43}$$

Assignments

$$[\mathrm{MAD2}] = \mathrm{mad2h} \tag{44}$$
$$[\mathrm{BUB2}] = \mathrm{bub2h} \tag{45}$$

8.3 Event `spindle_checkpoint`

Name spindle checkpoint

Trigger condition

$$\mathrm{SPN} - 1 > 0 \tag{46}$$

Assignments

$$[\mathrm{MAD2}] = \mathrm{mad2l} \tag{47}$$
$$[\mathrm{LTE1}] = \mathrm{lte1h} \tag{48}$$
$$[\mathrm{BUB2}] = \mathrm{bub2l} \tag{49}$$

8.4 Event cell_division

Name cell division

Trigger condition

$$\mathrm{CLB2} - \mathrm{KEZ} < 0 \tag{50}$$

Assignments

$$[\mathrm{MASS}] = \mathrm{F} \cdot \mathrm{MASS} \tag{51}$$
$$[\mathrm{LTE1}] = \mathrm{lte11} \tag{52}$$
$$[\mathrm{BUD}] = 0 \tag{53}$$
$$[\mathrm{SPN}] = 0 \tag{54}$$

9 Reactions

This model contains 94 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	Growth	Growth	$\emptyset \longrightarrow \text{MASS}$	
2	Synthesis_of_CLN2	Synthesis of CLN2	$\emptyset \xrightarrow{\text{SBF, MASS}} \text{CLN2}$	
3	Degradation_of_CLN2	Degradation of CLN2	$\text{CLN2} \longrightarrow \emptyset$	
4	Synthesis_of_CLB2	Synthesis of CLB2	$\emptyset \xrightarrow{\text{MCM1, MASS}} \text{CLB2}$	
5	Degradation_of_CLB2	Degradation of CLB2	$\text{CLB2} \longrightarrow \emptyset$	
6	Synthesis_of_CLB5	Synthesis of CLB5	$\emptyset \xrightarrow{\text{SBF, MASS}} \text{CLB5}$	
7	Degradation_of_CLB5	Degradation of CLB5	$\text{CLB5} \longrightarrow \emptyset$	
8	Synthesis_of_SIC1	Synthesis of SIC1	$\emptyset \xrightarrow{\text{SWI5}} \text{SIC1}$	
9	Phosphorylation_of_SIC1	Phosphorylation of SIC1	$\text{SIC1} \longrightarrow \text{SIC1P}$	
10	Dephosphorylation_of_SIC1	Dephosphorylation of SIC1	$\text{SIC1P} \longrightarrow \text{SIC1}$	

№	Id	Name	Reaction Equation	SBO
11	Fast_Degradation_of_SIC1P	Fast Degradation of SIC1P	$\text{SIC1P} \longrightarrow \emptyset$	
12	Assoc_of_CLB2_and_SIC1	Assoc. of CLB2 and SIC1	$\text{CLB2} + \text{SIC1} \longrightarrow \text{C2}$	
13	Dissoc_of_CLB2SIC1_complex	Dissoc. of CLB2/SIC1 complex	$\text{C2} \longrightarrow \text{CLB2} + \text{SIC1}$	
14	Assoc_of_CLB5_and_SIC1	Assoc. of CLB5 and SIC1	$\text{CLB5} + \text{SIC1} \longrightarrow \text{C5}$	
15	Dissoc_of_CLB5SIC1	Dissoc. of CLB5/SIC1	$\text{C5} \longrightarrow \text{CLB5} + \text{SIC1}$	
16	Phosphorylation_of_C2	Phosphorylation of C2	$\text{C2} \longrightarrow \text{C2P}$	
17	Dephosphorylation_of_C2P	Dephosphorylation of C2P	$\text{C2P} \longrightarrow \text{C2}$	
18	Phosphorylation_of_C5	Phosphorylation of C5	$\text{C5} \longrightarrow \text{C5P}$	
19	Dephosphorylation_of_C5P	Dephosphorylation of C5P	$\text{C5P} \longrightarrow \text{C5}$	
20	Degradation_of_CLB2_in_C2	Degradation of CLB2 in C2	$\text{C2} \longrightarrow \text{SIC1}$	
21	Degradation_of_CLB5_in_C5	Degradation of CLB5 in C5	$\text{C5} \longrightarrow \text{SIC1}$	
22	Degradation_of_SIC1_in_C2P	Degradation of SIC1 in C2P	$\text{C2P} \longrightarrow \text{CLB2}$	
23	Degradation_of_SIC1P_in_C5P_	Degradation of SIC1P in C5P	$\text{C5P} \longrightarrow \text{CLB5}$	

№	Id	Name	Reaction Equation	SBO
24	Degradation_of_CLB2_in_C2P	Degradation of CLB2 in C2P	C2P $\longrightarrow$ SIC1P	
25	Degradation_of_CLB5_in_C5P	Degradation of CLB5 in C5P	C5P $\longrightarrow$ SIC1P	
26	CDC6_synthesis	CDC6 synthesis	$\emptyset \xrightarrow{\text{SWI5, SBF}}$ CDC6	
27	Phosphorylation_of_CDC6	Phosphorylation of CDC6	CDC6 $\longrightarrow$ CDC6P	
28	Dephosphorylation_of_CDC6	Dephosphorylation of CDC6	CDC6P $\longrightarrow$ CDC6	
29	Degradation_of_CDC6P	Degradation of CDC6P	CDC6P $\longrightarrow \emptyset$	
30	CLB2CDC6_complex_formation	CLB2/CDC6 complex formation	CLB2 + CDC6 $\longrightarrow$ F2	
31	CLB2CDC6_dissociation	CLB2/CDC6 dissociation	F2 $\longrightarrow$ CLB2 + CDC6	
32	CLB5CDC6_complex_formation	CLB5/CDC6 complex formation	CLB5 + CDC6 $\longrightarrow$ F5	
33	CLB5CDC6_dissociation	CLB5/CDC6 dissociation	F5 $\longrightarrow$ CLB5 + CDC6	
34	F2_phosphorylation	F2 phosphorylation	F2 $\longrightarrow$ F2P	
35	F2P_dephosphorylation	F2P dephosphorylation	F2P $\longrightarrow$ F2	
36	F5_phosphorylation	F5 phosphorylation	F5 $\longrightarrow$ F5P	
37	F5P_dephosphorylation	F5P dephosphorylation	F5P $\longrightarrow$ F5	

№	Id	Name	Reaction Equation	SBO
38	CLB2-_degradation-_in_F2	CLB2 degradation in F2	F2 $\longrightarrow$ CDC6	
39	CLB5-_degradation-_in_F5	CLB5 degradation in F5	F5 $\longrightarrow$ CDC6	
40	CDC6-_degradation-_in_F2P	CDC6 degradation in F2P	F2P $\longrightarrow$ CLB2	
41	CDC6-_degradation-_in_F5P	CDC6 degradation in F5P	F5P $\longrightarrow$ CLB5	
42	CLB2-_degradation-_in_F2P	CLB2 degradation in F2P	F2P $\longrightarrow$ CDC6P	
43	CLB5-_degradation-_in_F5P	CLB5 degradation in F5P	F5P $\longrightarrow$ CDC6P	
44	Synthesis_of-_SWI5	Synthesis of SWI5	$\emptyset \xrightarrow{\text{MCM1}}$ SWI5	
45	Degradation_of-_SWI5	Degradation of SWI5	SWI5 $\longrightarrow \emptyset$	
46	Degradation_of-_SWI5P	Degradation of SWI5P	SWI5P $\longrightarrow \emptyset$	
47	Activation_of-_SWI5	Activation of SWI5	SWI5P $\xrightarrow{\text{CDC14}}$ SWI5	
48	Inactivation-_of_SWI5	Inactivation of SWI5	SWI5 $\xrightarrow{\text{CLB2}}$ SWI5P	

№	Id	Name	Reaction Equation	SBO
49	Activation_of_IEP	Activation of IEP	$IE \longrightarrow IEP$	
50	Inactivation_1	Inactivation	$IEP \longrightarrow IE$	
51	Synthesis_of_inactive_CDC20	Synthesis of inactive CDC20	$\emptyset \xrightarrow{MCM1} CDC20i$	
52	Degradation_of_inactiveCDC20	Degradation of inactiveCDC20	$CDC20i \longrightarrow \emptyset$	
53	Degradation_of_active_CDC20	Degradation of active CDC20	$CDC20 \longrightarrow \emptyset$	
54	Activation_of_CDC20	Activation of CDC20	$CDC20i \xrightarrow{IEP} CDC20$	
55	Inactivation_2	Inactivation	$CDC20 \xrightarrow{MAD2} CDC20i$	
56	CDH1_synthesis	CDH1 synthesis	$\emptyset \longrightarrow CDH1$	
57	CDH1_degradation	CDH1 degradation	$CDH1 \longrightarrow \emptyset$	
58	CDH1i_degradation	CDH1i degradation	$CDH1i \longrightarrow \emptyset$	
59	CDH1i_activation	CDH1i activation	$CDH1i \longrightarrow CDH1$	
60	Inactivation_3	Inactivation	$CDH1 \longrightarrow CDH1i$	
61	CDC14_synthesis	CDC14 synthesis	$\emptyset \longrightarrow CDC14$	
62	CDC14_degradation	CDC14 degradation	$CDC14 \longrightarrow \emptyset$	
63	Assoc_with_NET1_to_form_RENT	Assoc. with NET1 to form RENT	$CDC14 + NET1 \longrightarrow RENT$	
64	Dissoc_from_RENT	Dissoc. from RENT	$RENT \longrightarrow NET1 + CDC14$	

№	Id	Name	Reaction Equation	SBO
65	Assoc_with-_NET1P_to_form-_RENTP	Assoc with NET1P to form RENTP	$\mathrm{CDC14} + \mathrm{NET1P} \longrightarrow \mathrm{RENTP}$	
66	Dissoc_from-_RENP	Dissoc. from RENP	$\mathrm{RENTP} \longrightarrow \mathrm{CDC14} + \mathrm{NET1P}$	
67	Net1_synthesis	Net1 synthesis	$\emptyset \longrightarrow \mathrm{NET1}$	
68	Net1-_degradation	Net1 degradation	$\mathrm{NET1} \longrightarrow \emptyset$	
69	Net1P-_degradation	Net1P degradation	$\mathrm{NET1P} \longrightarrow \emptyset$	
70	NET1-_phosphorylation	NET1 phosphorylation	$\mathrm{NET1} \longrightarrow \mathrm{NET1P}$	
71	dephosphorylation_1	dephosphorylation	$\mathrm{NET1P} \longrightarrow \mathrm{NET1}$	
72	RENT-_phosphorylation	RENT phosphorylation	$\mathrm{RENT} \longrightarrow \mathrm{RENTP}$	
73	dephosphorylation_2	dephosphorylation	$\mathrm{RENTP} \longrightarrow \mathrm{RENT}$	
74	Degradation_of-_NET1_in_RENT	Degradation of NET1 in RENT	$\mathrm{RENT} \longrightarrow \mathrm{CDC14}$	
75	Degradation_of-_NET1P_in_RENTP	Degradation of NET1P in RENTP	$\mathrm{RENTP} \longrightarrow \mathrm{CDC14}$	
76	Degradation_of-_CDC14_in_RENT	Degradation of CDC14 in RENT	$\mathrm{RENT} \longrightarrow \mathrm{NET1}$	
77	Degradation_of-_CDC14_in_RENTP	Degradation of CDC14 in RENTP	$\mathrm{RENTP} \longrightarrow \mathrm{NET1P}$	
78	TEM1_activation	TEM1 activation	$\mathrm{TEM1GDP} \xrightarrow{\mathrm{LTE1}} \mathrm{TEM1GTP}$	
79	inactivation_1	inactivation	$\mathrm{TEM1GTP} \xrightarrow{\mathrm{BUB2}} \mathrm{TEM1GDP}$	

№	Id	Name	Reaction Equation	SBO
80	CDC15_activation	CDC15 activation	$\text{CDC15i} \xrightarrow{\text{TEM1GDP, TEM1GTP, CDC14}} \text{CDC15}$	
81	inactivation_2	inactivation	$\text{CDC15} \longrightarrow \text{CDC15i}$	
82	PPX_synthesis	PPX synthesis	$\emptyset \longrightarrow \text{PPX}$	
83	degradation_1	degradation	$\text{PPX} \longrightarrow \emptyset$	
84	PDS1_synthesis	PDS1 synthesis	$\emptyset \xrightarrow{\text{SBF, MCM1}} \text{PDS1}$	
85	degradation_2	degradation	$\text{PDS1} \longrightarrow \emptyset$	
86	Degradation_of_PDS1_in_PE	Degradation of PDS1 in PE	$\text{PE} \longrightarrow \text{ESP1}$	
87	Assoc_with_ESP1_to_form_PE	Assoc. with ESP1 to form PE	$\text{PDS1} + \text{ESP1} \longrightarrow \text{PE}$	
88	Disso_from_PE	Disso. from PE	$\text{PE} \longrightarrow \text{PDS1} + \text{ESP1}$	
89	DNA_synthesis	DNA synthesis	$\emptyset \xrightarrow{\text{CLB5, CLB2}} \text{ORI}$	
90	Negative_regulation_of_DNA_synthesis	Negative regulation of DNA synthesis	$\text{ORI} \longrightarrow \emptyset$	
91	Budding	Budding	$\emptyset \xrightarrow{\text{CLN2, CLN3, CLB5}} \text{BUD}$	
92	Negative_regulation_of_Cell_budding	Negative regulation of Cell budding	$\text{BUD} \longrightarrow \emptyset$	
93	Spindle_formation	Spindle formation	$\emptyset \xrightarrow{\text{CLB2}} \text{SPN}$	
94	Spindle_disassembly	Spindle disassembly	$\text{SPN} \longrightarrow \emptyset$	

9.1 Reaction Growth

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

Name Growth

Reaction equation

$$\emptyset \longrightarrow \mathrm{MASS} \tag{55}$$

Product

Table 6: Properties of each product.

Id	Name	SBO
MASS	MASS	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \mathrm{mu} \cdot \mathrm{MASS} \tag{56}$$

9.2 Reaction Synthesis_of_CLN2

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

Name Synthesis of CLN2

Reaction equation

$$\emptyset \xrightarrow{\mathrm{SBF,\ MASS}} \mathrm{CLN2} \tag{57}$$

Modifiers

Table 7: Properties of each modifier.

Id	Name	SBO
SBF	SBF	
MASS	MASS	

Product

Table 8: Properties of each product.

Id	Name	SBO
CLN2	CLN2	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = (\text{ksn2\_p} + \text{ksn2\_p\_p} \cdot \text{SBF}) \cdot \text{MASS} \tag{58}$$

9.3 Reaction Degradation_of_CLN2

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

Name Degradation of CLN2

Reaction equation

$$\text{CLN2} \longrightarrow \emptyset \tag{59}$$

Reactant

Table 9: Properties of each reactant.

Id	Name	SBO
CLN2	CLN2	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \text{Mass\_Action\_1\_222}\,(\text{kdn2}, \text{CLN2}) \tag{60}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{61}$$

9.4 Reaction Synthesis_of_CLB2

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

Name Synthesis of CLB2

Reaction equation

$$\emptyset \xrightarrow{\text{MCM1, MASS}} \text{CLB2} \tag{62}$$

Modifiers

Table 10: Properties of each modifier.

Id	Name	SBO
MCM1	MCM1	
MASS	MASS	

Product

Table 11: Properties of each product.

Id	Name	SBO
CLB2	CLB2	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = (\text{ksb2\_p} + \text{ksb2\_p\_p} \cdot \text{MCM1}) \cdot \text{MASS} \tag{63}$$

9.5 Reaction Degradation_of_CLB2

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

Name Degradation of CLB2

Reaction equation

$$\text{CLB2} \longrightarrow \emptyset \tag{64}$$

Reactant

Table 12: Properties of each reactant.

Id	Name	SBO
CLB2	CLB2	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \text{Mass\_Action\_1\_222}\,(\text{Vdb2}, \text{CLB2}) \tag{65}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{66}$$

9.6 Reaction Synthesis_of_CLB5

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

Name Synthesis of CLB5

Reaction equation

$$\emptyset \xrightarrow{\text{SBF, MASS}} \text{CLB5} \tag{67}$$

Modifiers

Table 13: Properties of each modifier.

Id	Name	SBO
SBF	SBF	
MASS	MASS	

Product

Table 14: Properties of each product.

Id	Name	SBO
CLB5	CLB5	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = (\text{ksb5\_p} + \text{ksb5\_p\_p} \cdot \text{SBF}) \cdot \text{MASS} \tag{68}$$

9.7 Reaction Degradation_of_CLB5

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

Name Degradation of CLB5

Reaction equation

$$\text{CLB5} \longrightarrow \emptyset \tag{69}$$

Reactant

Table 15: Properties of each reactant.

Id	Name	SBO
CLB5	CLB5	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \text{Mass\_Action\_1\_222}\,(\text{Vdb5}, \text{CLB5}) \tag{70}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{71}$$

9.8 Reaction Synthesis_of_SIC1

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

Name Synthesis of SIC1

Reaction equation

$$\emptyset \xrightarrow{\text{SWI5}} \text{SIC1} \tag{72}$$

Modifier

Table 16: Properties of each modifier.

Id	Name	SBO
SWI5	SWI5	

Product

Table 17: Properties of each product.

Id	Name	SBO
SIC1	SIC1	

Kinetic Law

Derived unit contains undeclared units

$$v_8 = \text{ksc1\_p} + \text{ksc1\_p\_p} \cdot \text{SWI5} \tag{73}$$

9.9 Reaction Phosphorylation_of_SIC1

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

Name Phosphorylation of SIC1

Reaction equation

$$\mathrm{SIC1} \longrightarrow \mathrm{SIC1P} \tag{74}$$

Reactant

Table 18: Properties of each reactant.

Id	Name	SBO
SIC1	SIC1	

Product

Table 19: Properties of each product.

Id	Name	SBO
SIC1P	SIC1P	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \mathrm{Mass\_Action\_1\_222}\left(\mathrm{Vkpc1}, \mathrm{SIC1}\right) \tag{75}$$

$$\mathrm{Mass\_Action\_1\_222}\left(\mathrm{k1}, \mathrm{S1}\right) = \mathrm{k1} \cdot \mathrm{S1} \tag{76}$$

9.10 Reaction Dephosphorylation_of_SIC1

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

Name Dephosphorylation of SIC1

Reaction equation

$$\mathrm{SIC1P} \longrightarrow \mathrm{SIC1} \tag{77}$$

Reactant

Table 20: Properties of each reactant.

Id	Name	SBO
SIC1P	SIC1P	

Product

Table 21: Properties of each product.

Id	Name	SBO
SIC1	SIC1	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \text{Mass\_Action\_1\_222}\,(\text{Vppc1}, \text{SIC1P}) \tag{78}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{79}$$

9.11 Reaction Fast_Degradation_of_SIC1P

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

Name Fast Degradation of SIC1P

Reaction equation

$$\text{SIC1P} \longrightarrow \emptyset \tag{80}$$

Reactant

Table 22: Properties of each reactant.

Id	Name	SBO
SIC1P	SIC1P	

Kinetic Law

Derived unit contains undeclared units

$$v_{11} = \text{Mass\_Action\_1\_222}\,(\text{kd3c1}, \text{SIC1P}) \tag{81}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1},\text{S1}) = \text{k1}\cdot\text{S1} \tag{82}$$

9.12 Reaction `Assoc_of_CLB2_and_SIC1`

This is an irreversible reaction of two reactants forming one product.

Name Assoc. of CLB2 and SIC1

Reaction equation

$$\text{CLB2} + \text{SIC1} \longrightarrow \text{C2} \tag{83}$$

Reactants

Table 23: Properties of each reactant.

Id	Name	SBO
`CLB2`	CLB2	
`SIC1`	SIC1	

Product

Table 24: Properties of each product.

Id	Name	SBO
`C2`	C2	

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = \text{Mass\_Action\_2\_221}\,(\text{kasb2},\text{CLB2},\text{SIC1}) \tag{84}$$

$$\text{Mass\_Action\_2\_221}\,(\text{k1},\text{S1},\text{S2}) = \text{k1}\cdot\text{S1}\cdot\text{S2} \tag{85}$$

9.13 Reaction `Dissoc_of_CLB2SIC1_complex`

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

Name Dissoc. of CLB2/SIC1 complex

Reaction equation

$$\text{C2} \longrightarrow \text{CLB2} + \text{SIC1} \tag{86}$$

Reactant

Table 25: Properties of each reactant.

Id	Name	SBO
C2	C2	

Products

Table 26: Properties of each product.

Id	Name	SBO
CLB2	CLB2	
SIC1	SIC1	

Kinetic Law

Derived unit contains undeclared units

$$v_{13} = \text{Mass\_Action\_1\_222}\,(\text{kdib2}, \text{C2}) \tag{87}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{88}$$

9.14 Reaction Assoc_of_CLB5_and_SIC1

This is an irreversible reaction of two reactants forming one product.

Name Assoc. of CLB5 and SIC1

Reaction equation

$$\text{CLB5} + \text{SIC1} \longrightarrow \text{C5} \tag{89}$$

Reactants

Table 27: Properties of each reactant.

Id	Name	SBO
CLB5	CLB5	
SIC1	SIC1	

Product

Table 28: Properties of each product.

Id	Name	SBO
C5	C5	

Kinetic Law

Derived unit contains undeclared units

$$v_{14} = \text{Mass\_Action\_2\_221}\left(\text{kasb5}, \text{CLB5}, \text{SIC1}\right) \tag{90}$$

$$\text{Mass\_Action\_2\_221}\left(\text{k1}, \text{S1}, \text{S2}\right) = \text{k1} \cdot \text{S1} \cdot \text{S2} \tag{91}$$

9.15 Reaction Dissoc_of_CLB5SIC1

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

Name Dissoc. of CLB5/SIC1

Reaction equation

$$\text{C5} \longrightarrow \text{CLB5} + \text{SIC1} \tag{92}$$

Reactant

Table 29: Properties of each reactant.

Id	Name	SBO
C5	C5	

Products

Table 30: Properties of each product.

Id	Name	SBO
CLB5	CLB5	
SIC1	SIC1	

Kinetic Law

Derived unit contains undeclared units

$$v_{15} = \text{Mass\_Action\_1\_222}\,(\text{kdib5}, \text{C5}) \tag{93}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{94}$$

9.16 Reaction `Phosphorylation_of_C2`

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

Name Phosphorylation of C2

Reaction equation

$$\text{C2} \longrightarrow \text{C2P} \tag{95}$$

Reactant

Table 31: Properties of each reactant.

Id	Name	SBO
C2	C2	

Product

Table 32: Properties of each product.

Id	Name	SBO
C2P	C2P	

Kinetic Law

Derived unit contains undeclared units

$$v_{16} = \text{Mass\_Action\_1\_222}\,(\text{Vkpc1}, \text{C2}) \tag{96}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{97}$$

9.17 Reaction `Dephosphorylation_of_C2P`

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

Name Dephosphorylation of C2P

Reaction equation

$$\mathrm{C2P} \longrightarrow \mathrm{C2} \tag{98}$$

Reactant

Table 33: Properties of each reactant.

Id	Name	SBO
C2P	C2P	

Product

Table 34: Properties of each product.

Id	Name	SBO
C2	C2	

Kinetic Law

Derived unit contains undeclared units

$$v_{17} = \mathrm{Mass\_Action\_1\_222}\left(\mathrm{Vppc1}, \mathrm{C2P}\right) \tag{99}$$

$$\mathrm{Mass\_Action\_1\_222}\left(\mathrm{k1}, \mathrm{S1}\right) = \mathrm{k1} \cdot \mathrm{S1} \tag{100}$$

9.18 Reaction Phosphorylation_of_C5

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

Name Phosphorylation of C5

Reaction equation

$$\mathrm{C5} \longrightarrow \mathrm{C5P} \tag{101}$$

Reactant

Table 35: Properties of each reactant.

Id	Name	SBO
C5	C5	

Product

Table 36: Properties of each product.

Id	Name	SBO
C5P	C5P	

Kinetic Law

Derived unit contains undeclared units

$$v_{18} = \text{Mass\_Action\_1\_222}\,(\text{Vkpc1}, \text{C5}) \tag{102}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{103}$$

9.19 Reaction Dephosphorylation_of_C5P

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

Name Dephosphorylation of C5P

Reaction equation

$$\text{C5P} \longrightarrow \text{C5} \tag{104}$$

Reactant

Table 37: Properties of each reactant.

Id	Name	SBO
C5P	C5P	

Product

Table 38: Properties of each product.

Id	Name	SBO
C5	C5	

Kinetic Law

Derived unit contains undeclared units

$$v_{19} = \text{Mass\_Action\_1\_222}\,(\text{Vppc1}, \text{C5P}) \tag{105}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{106}$$

9.20 Reaction `Degradation_of_CLB2_in_C2`

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

Name Degradation of CLB2 in C2

Reaction equation

$$\text{C2} \longrightarrow \text{SIC1} \tag{107}$$

Reactant

Table 39: Properties of each reactant.

Id	Name	SBO
C2	C2	

Product

Table 40: Properties of each product.

Id	Name	SBO
SIC1	SIC1	

Kinetic Law

Derived unit contains undeclared units

$$v_{20} = \text{Mass\_Action\_1\_222}\,(\text{Vdb2}, \text{C2}) \tag{108}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{109}$$

9.21 Reaction `Degradation_of_CLB5_in_C5`

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

Name Degradation of CLB5 in C5

Reaction equation

$$\mathrm{C5} \longrightarrow \mathrm{SIC1} \tag{110}$$

Reactant

Table 41: Properties of each reactant.

Id	Name	SBO
C5	C5	

Product

Table 42: Properties of each product.

Id	Name	SBO
SIC1	SIC1	

Kinetic Law

Derived unit contains undeclared units

$$v_{21} = \mathrm{Mass\_Action\_1\_222}\left(\mathrm{Vdb5}, \mathrm{C5}\right) \tag{111}$$

$$\mathrm{Mass\_Action\_1\_222}\left(\mathrm{k1}, \mathrm{S1}\right) = \mathrm{k1} \cdot \mathrm{S1} \tag{112}$$

9.22 Reaction Degradation_of_SIC1_in_C2P

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

Name Degradation of SIC1 in C2P

Reaction equation

$$\mathrm{C2P} \longrightarrow \mathrm{CLB2} \tag{113}$$

Reactant

Table 43: Properties of each reactant.

Id	Name	SBO
C2P	C2P	

Product

Table 44: Properties of each product.

Id	Name	SBO
CLB2	CLB2	

Kinetic Law

Derived unit contains undeclared units

$$v_{22} = \text{Mass\_Action\_1\_222}\,(\text{kd3c1}, \text{C2P}) \tag{114}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{115}$$

9.23 Reaction Degradation_of_SIC1P_in_C5P_

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

Name Degradation of SIC1P in C5P

Reaction equation

$$\text{C5P} \longrightarrow \text{CLB5} \tag{116}$$

Reactant

Table 45: Properties of each reactant.

Id	Name	SBO
C5P	C5P	

Product

Table 46: Properties of each product.

Id	Name	SBO
CLB5	CLB5	

Kinetic Law

Derived unit contains undeclared units

$$v_{23} = \text{Mass\_Action\_1\_222}\,(\text{kd3c1}, \text{C5P}) \tag{117}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{118}$$

9.24 Reaction Degradation_of_CLB2_in_C2P

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

Name Degradation of CLB2 in C2P

Reaction equation

$$\text{C2P} \longrightarrow \text{SIC1P} \tag{119}$$

Reactant

Table 47: Properties of each reactant.

Id	Name	SBO
C2P	C2P	

Product

Table 48: Properties of each product.

Id	Name	SBO
SIC1P	SIC1P	

Kinetic Law

Derived unit contains undeclared units

$$v_{24} = \text{Mass\_Action\_1\_222}\,(\text{Vdb2}, \text{C2P}) \tag{120}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{121}$$

9.25 Reaction Degradation_of_CLB5_in_C5P

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

Name Degradation of CLB5 in C5P

Reaction equation

$$\text{C5P} \longrightarrow \text{SIC1P} \tag{122}$$

Reactant

Table 49: Properties of each reactant.

Id	Name	SBO
C5P	C5P	

Product

Table 50: Properties of each product.

Id	Name	SBO
SIC1P	SIC1P	

Kinetic Law

Derived unit contains undeclared units

$$v_{25} = \text{Mass\_Action\_1\_222}\,(\text{Vdb5}, \text{C5P}) \tag{123}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{124}$$

9.26 Reaction CDC6_synthesis

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

Name CDC6 synthesis

Reaction equation

$$\emptyset \xrightarrow{\text{SWI5, SBF}} \text{CDC6} \tag{125}$$

Modifiers

Table 51: Properties of each modifier.

Id	Name	SBO
SWI5	SWI5	
SBF	SBF	

Product

Table 52: Properties of each product.

Id	Name	SBO
CDC6	CDC6	

Kinetic Law

Derived unit contains undeclared units

$$v_{26} = \text{ksf6\_p} + \text{ksf6\_p\_p} \cdot \text{SWI5} + \text{ksf6\_p\_p\_p} \cdot \text{SBF} \tag{126}$$

9.27 Reaction Phosphorylation_of_CDC6

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

Name Phosphorylation of CDC6

Reaction equation

$$\text{CDC6} \longrightarrow \text{CDC6P} \tag{127}$$

Reactant

Table 53: Properties of each reactant.

Id	Name	SBO
CDC6	CDC6	

Product

Table 54: Properties of each product.

Id	Name	SBO
CDC6P	CDC6P	

Kinetic Law

Derived unit contains undeclared units

$$v_{27} = \text{Mass\_Action\_1\_222}\left(\text{Vkpf6}, \text{CDC6}\right) \tag{128}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{129}$$

9.28 Reaction Dephosphorylation_of_CDC6

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

Name Dephosphorylation of CDC6

Reaction equation

$$\text{CDC6P} \longrightarrow \text{CDC6} \tag{130}$$

Reactant

Table 55: Properties of each reactant.

Id	Name	SBO
CDC6P	CDC6P	

Product

Table 56: Properties of each product.

Id	Name	SBO
CDC6	CDC6	

Kinetic Law

Derived unit contains undeclared units

$$v_{28} = \text{Mass\_Action\_1\_222}\,(\text{Vppf6}, \text{CDC6P}) \tag{131}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{132}$$

9.29 Reaction Degradation_of_CDC6P

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

Name Degradation of CDC6P

Reaction equation

$$\text{CDC6P} \longrightarrow \emptyset \tag{133}$$

Reactant

Table 57: Properties of each reactant.

Id	Name	SBO
CDC6P	CDC6P	

Kinetic Law

Derived unit contains undeclared units

$$v_{29} = \text{Mass\_Action\_1\_222}\,(\text{kd3f6}, \text{CDC6P}) \tag{134}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{135}$$

9.30 Reaction CLB2CDC6_complex_formation

This is an irreversible reaction of two reactants forming one product.

Name CLB2/CDC6 complex formation

Reaction equation

$$\text{CLB2} + \text{CDC6} \longrightarrow \text{F2} \tag{136}$$

Reactants

Table 58: Properties of each reactant.

Id	Name	SBO
CLB2	CLB2	
CDC6	CDC6	

Product

Table 59: Properties of each product.

Id	Name	SBO
F2	F2	

Kinetic Law

Derived unit contains undeclared units

$$v_{30} = \text{Mass\_Action\_2\_221}\,(\text{kasf2}, \text{CLB2}, \text{CDC6}) \tag{137}$$

$$\text{Mass\_Action\_2\_221}\,(\text{k1},\text{S1},\text{S2}) = \text{k1}\cdot\text{S1}\cdot\text{S2} \tag{138}$$

9.31 Reaction CLB2CDC6_dissociation

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

Name CLB2/CDC6 dissociation

Reaction equation

$$\text{F2} \longrightarrow \text{CLB2} + \text{CDC6} \tag{139}$$

Reactant

Table 60: Properties of each reactant.

Id	Name	SBO
F2	F2	

Products

Table 61: Properties of each product.

Id	Name	SBO
CLB2	CLB2	
CDC6	CDC6	

Kinetic Law

Derived unit contains undeclared units

$$v_{31} = \text{Mass\_Action\_1\_222}\,(\text{kdif2},\text{F2}) \tag{140}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1},\text{S1}) = \text{k1}\cdot\text{S1} \tag{141}$$

9.32 Reaction CLB5CDC6_complex_formation

This is an irreversible reaction of two reactants forming one product.

Name CLB5/CDC6 complex formation

Reaction equation

$$\text{CLB5} + \text{CDC6} \longrightarrow \text{F5} \tag{142}$$

Reactants

Table 62: Properties of each reactant.

Id	Name	SBO
CLB5	CLB5	
CDC6	CDC6	

Product

Table 63: Properties of each product.

Id	Name	SBO
F5	F5	

Kinetic Law

Derived unit contains undeclared units

$$v_{32} = \text{Mass\_Action\_2\_221}\left(\text{kasf5}, \text{CLB5}, \text{CDC6}\right) \tag{143}$$

$$\text{Mass\_Action\_2\_221}\left(\text{k1}, \text{S1}, \text{S2}\right) = \text{k1} \cdot \text{S1} \cdot \text{S2} \tag{144}$$

9.33 Reaction CLB5CDC6_dissociation

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

Name CLB5/CDC6 dissociation

Reaction equation

$$\text{F5} \longrightarrow \text{CLB5} + \text{CDC6} \tag{145}$$

Reactant

Table 64: Properties of each reactant.

Id	Name	SBO
F5	F5	

Products

Table 65: Properties of each product.

Id	Name	SBO
CLB5	CLB5	
CDC6	CDC6	

Kinetic Law

Derived unit contains undeclared units

$$v_{33} = \text{Mass\_Action\_1\_222}\,(\text{kdif5}, \text{F5}) \tag{146}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{147}$$

9.34 Reaction F2_phosphorylation

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

Name F2 phosphorylation

Reaction equation

$$\text{F2} \longrightarrow \text{F2P} \tag{148}$$

Reactant

Table 66: Properties of each reactant.

Id	Name	SBO
F2	F2	

Product

Table 67: Properties of each product.

Id	Name	SBO
F2P	F2P	

Kinetic Law

Derived unit contains undeclared units

$$v_{34} = \text{Mass\_Action\_1\_222}\,(\text{Vkpf6}, \text{F2}) \tag{149}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{150}$$

9.35 Reaction `F2P_dephosphorylation`

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

Name F2P dephosphorylation

Reaction equation

$$\text{F2P} \longrightarrow \text{F2} \tag{151}$$

Reactant

Table 68: Properties of each reactant.

Id	Name	SBO
F2P	F2P	

Product

Table 69: Properties of each product.

Id	Name	SBO
F2	F2	

Kinetic Law

Derived unit contains undeclared units

$$v_{35} = \text{Mass\_Action\_1\_222}\,(\text{Vppf6}, \text{F2P}) \tag{152}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{153}$$

9.36 Reaction `F5_phosphorylation`

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

Name F5 phosphorylation

Reaction equation

$$\text{F5} \longrightarrow \text{F5P} \tag{154}$$

Reactant

Table 70: Properties of each reactant.

Id	Name	SBO
F5	F5	

Product

Table 71: Properties of each product.

Id	Name	SBO
F5P	F5P	

Kinetic Law

Derived unit contains undeclared units

$$v_{36} = \text{Mass\_Action\_1\_222}\,(\text{Vkpf6}, \text{F5}) \tag{155}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{156}$$

9.37 Reaction F5P_dephosphorylation

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

Name F5P dephosphorylation

Reaction equation

$$\text{F5P} \longrightarrow \text{F5} \tag{157}$$

Reactant

Table 72: Properties of each reactant.

Id	Name	SBO
F5P	F5P	

Product

Table 73: Properties of each product.

Id	Name	SBO
F5	F5	

Kinetic Law

Derived unit contains undeclared units

$$v_{37} = \text{Mass\_Action\_1\_222}\,(\text{Vppf6}, \text{F5P}) \tag{158}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{159}$$

9.38 Reaction CLB2_degradation_in_F2

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

Name CLB2 degradation in F2

Reaction equation

$$\text{F2} \longrightarrow \text{CDC6} \tag{160}$$

Reactant

Table 74: Properties of each reactant.

Id	Name	SBO
F2	F2	

Product

Table 75: Properties of each product.

Id	Name	SBO
CDC6	CDC6	

Kinetic Law

Derived unit contains undeclared units

$$v_{38} = \text{Mass\_Action\_1\_222}\,(\text{Vdb2}, \text{F2}) \tag{161}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{162}$$

9.39 Reaction CLB5_degradation_in_F5

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

Name CLB5 degradation in F5

Reaction equation

$$\text{F5} \longrightarrow \text{CDC6} \tag{163}$$

Reactant

Table 76: Properties of each reactant.

Id	Name	SBO
F5	F5	

Product

Table 77: Properties of each product.

Id	Name	SBO
CDC6	CDC6	

Kinetic Law

Derived unit contains undeclared units

$$v_{39} = \text{Mass\_Action\_1\_222}\,(\text{Vdb5}, \text{F5}) \tag{164}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{165}$$

9.40 Reaction CDC6_degradation_in_F2P

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

Name CDC6 degradation in F2P

Reaction equation

$$\text{F2P} \longrightarrow \text{CLB2} \tag{166}$$

Reactant

Table 78: Properties of each reactant.

Id	Name	SBO
F2P	F2P	

Product

Table 79: Properties of each product.

Id	Name	SBO
CLB2	CLB2	

Kinetic Law

Derived unit contains undeclared units

$$v_{40} = \text{Mass\_Action\_1\_222}\,(\text{kd3f6}, \text{F2P}) \tag{167}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{168}$$

9.41 Reaction CDC6_degradation_in_F5P

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

Name CDC6 degradation in F5P

Reaction equation

$$\text{F5P} \longrightarrow \text{CLB5} \tag{169}$$

Reactant

Table 80: Properties of each reactant.

Id	Name	SBO
F5P	F5P	

Product

Table 81: Properties of each product.

Id	Name	SBO
CLB5	CLB5	

Kinetic Law

Derived unit contains undeclared units

$$v_{41} = \text{Mass\_Action\_1\_222}\,(\text{kd3f6}, \text{F5P}) \tag{170}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{171}$$

9.42 Reaction CLB2_degradation_in_F2P

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

Name CLB2 degradation in F2P

Reaction equation

$$\text{F2P} \longrightarrow \text{CDC6P} \tag{172}$$

Reactant

Table 82: Properties of each reactant.

Id	Name	SBO
F2P	F2P	

Product

Table 83: Properties of each product.

Id	Name	SBO
CDC6P	CDC6P	

Kinetic Law

Derived unit contains undeclared units

$$v_{42} = \text{Mass\_Action\_1\_222}\,(\text{Vdb2}, \text{F2P}) \tag{173}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{174}$$

9.43 Reaction CLB5_degradation_in_F5P

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

Name CLB5 degradation in F5P

Reaction equation

$$\text{F5P} \longrightarrow \text{CDC6P} \tag{175}$$

Reactant

Table 84: Properties of each reactant.

Id	Name	SBO
F5P	F5P	

Product

Table 85: Properties of each product.

Id	Name	SBO
CDC6P	CDC6P	

Kinetic Law

Derived unit contains undeclared units

$$v_{43} = \text{Mass\_Action\_1\_222}\,(\text{Vdb5}, \text{F5P}) \tag{176}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{177}$$

9.44 Reaction Synthesis_of_SWI5

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

Name Synthesis of SWI5

Reaction equation

$$\emptyset \xrightarrow{\text{MCM1}} \text{SWI5} \tag{178}$$

Modifier

Table 86: Properties of each modifier.

Id	Name	SBO
MCM1	MCM1	

Product

Table 87: Properties of each product.

Id	Name	SBO
SWI5	SWI5	

Kinetic Law

Derived unit contains undeclared units

$$v_{44} = \text{ksswi\_p} + \text{ksswi\_p\_p} \cdot \text{MCM1} \tag{179}$$

9.45 Reaction Degradation_of_SWI5

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

Name Degradation of SWI5

Reaction equation

$$\text{SWI5} \longrightarrow \emptyset \tag{180}$$

Reactant

Table 88: Properties of each reactant.

Id	Name	SBO
SWI5	SWI5	

Kinetic Law

Derived unit contains undeclared units

$$v_{45} = \text{Mass\_Action\_1\_222}\,(\text{kdswi}, \text{SWI5}) \tag{181}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{182}$$

9.46 Reaction `Degradation_of_SWI5P`

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

Name Degradation of SWI5P

Reaction equation

$$\text{SWI5P} \longrightarrow \emptyset \tag{183}$$

Reactant

Table 89: Properties of each reactant.

Id	Name	SBO
`SWI5P`	SWI5P	

Kinetic Law

Derived unit contains undeclared units

$$v_{46} = \text{Mass\_Action\_1\_222}\,(\text{kdswi}, \text{SWI5P}) \tag{184}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{185}$$

9.47 Reaction `Activation_of_SWI5`

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

Name Activation of SWI5

Reaction equation

$$\text{SWI5P} \xrightarrow{\text{CDC14}} \text{SWI5} \tag{186}$$

Reactant

Table 90: Properties of each reactant.

Id	Name	SBO
`SWI5P`	SWI5P	

Modifier

Table 91: Properties of each modifier.

Id	Name	SBO
CDC14	CDC14	

Product

Table 92: Properties of each product.

Id	Name	SBO
SWI5	SWI5	

Kinetic Law

Derived unit contains undeclared units

$$v_{47} = \text{Mass\_Action\_1\_222}\left(\text{kaswi} \cdot \text{CDC14}, \text{SWI5P}\right) \tag{187}$$

$$\text{Mass\_Action\_1\_222}\left(\text{k1}, \text{S1}\right) = \text{k1} \cdot \text{S1} \tag{188}$$

9.48 Reaction Inactivation_of_SWI5

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

Name Inactivation of SWI5

Reaction equation

$$\text{SWI5} \xrightarrow{\text{CLB2}} \text{SWI5P} \tag{189}$$

Reactant

Table 93: Properties of each reactant.

Id	Name	SBO
SWI5	SWI5	

Modifier

Table 94: Properties of each modifier.

Id	Name	SBO
CLB2	CLB2	

Product

Table 95: Properties of each product.

Id	Name	SBO
SWI5P	SWI5P	

Kinetic Law

Derived unit contains undeclared units

$$v_{48} = \text{Mass\_Action\_1\_222}\left(\text{kiswi} \cdot \text{CLB2}, \text{SWI5}\right) \tag{190}$$

$$\text{Mass\_Action\_1\_222}\left(\text{k1}, \text{S1}\right) = \text{k1} \cdot \text{S1} \tag{191}$$

9.49 Reaction Activation_of_IEP

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

Name Activation of IEP

Reaction equation

$$\text{IE} \longrightarrow \text{IEP} \tag{192}$$

Reactant

Table 96: Properties of each reactant.

Id	Name	SBO
IE	IE	

Product

Table 97: Properties of each product.

Id	Name	SBO
IEP	IEP	

Kinetic Law

Derived unit contains undeclared units

$$v_{49} = \text{MichaelisMenten\_220}\,(\text{Vaiep}, \text{Jaiep}, 1, \text{IE}) \tag{193}$$

$$\text{MichaelisMenten\_220}\,(\text{M1}, \text{J1}, \text{k1}, \text{S1}) = \frac{\text{k1} \cdot \text{S1} \cdot \text{M1}}{\text{J1} + \text{S1}} \tag{194}$$

9.50 Reaction Inactivation_1

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

Name Inactivation

Reaction equation

$$\text{IEP} \longrightarrow \text{IE} \tag{195}$$

Reactant

Table 98: Properties of each reactant.

Id	Name	SBO
IEP	IEP	

Product

Table 99: Properties of each product.

Id	Name	SBO
IE	IE	

Kinetic Law

Derived unit contains undeclared units

$$v_{50} = \text{MichaelisMenten\_220}\,(1, \text{Jiiep}, \text{kiiep}, \text{IEP}) \tag{196}$$

$$\text{MichaelisMenten\_220}(\text{M1},\text{J1},\text{k1},\text{S1}) = \frac{\text{k1}\cdot\text{S1}\cdot\text{M1}}{\text{J1}+\text{S1}} \tag{197}$$

9.51 Reaction Synthesis_of_inactive_CDC20

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

Name Synthesis of inactive CDC20

Reaction equation

$$\emptyset \xrightarrow{\text{MCM1}} \text{CDC20i} \tag{198}$$

Modifier

Table 100: Properties of each modifier.

Id	Name	SBO
MCM1	MCM1	

Product

Table 101: Properties of each product.

Id	Name	SBO
CDC20i	CDC20i	

Kinetic Law

Derived unit contains undeclared units

$$v_{51} = \text{ks20\_p} + \text{ks20\_p\_p}\cdot\text{MCM1} \tag{199}$$

9.52 Reaction Degradation_of_inactiveCDC20

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

Name Degradation of inactiveCDC20

Reaction equation

$$\text{CDC20i} \longrightarrow \emptyset \tag{200}$$

Reactant

Table 102: Properties of each reactant.

Id	Name	SBO
CDC20i	CDC20i	

Kinetic Law

Derived unit contains undeclared units

$$v_{52} = \text{Mass\_Action\_1\_222}\,(\text{kd20}, \text{CDC20i}) \tag{201}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{202}$$

9.53 Reaction Degradation_of_active_CDC20

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

Name Degradation of active CDC20

Reaction equation

$$\text{CDC20} \longrightarrow \emptyset \tag{203}$$

Reactant

Table 103: Properties of each reactant.

Id	Name	SBO
CDC20	CDC20	

Kinetic Law

Derived unit contains undeclared units

$$v_{53} = \text{Mass\_Action\_1\_222}\,(\text{kd20}, \text{CDC20}) \tag{204}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{205}$$

9.54 Reaction Activation_of_CDC20

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

Name Activation of CDC20

Reaction equation

$$\text{CDC20i} \xrightarrow{\text{IEP}} \text{CDC20} \tag{206}$$

Reactant

Table 104: Properties of each reactant.

Id	Name	SBO
CDC20i	CDC20i	

Modifier

Table 105: Properties of each modifier.

Id	Name	SBO
IEP	IEP	

Product

Table 106: Properties of each product.

Id	Name	SBO
CDC20	CDC20	

Kinetic Law

Derived unit contains undeclared units

$$v_{54} = \text{Mass\_Action\_1\_222}\left(\text{ka20\_p} + \text{ka20\_p\_p} \cdot \text{IEP}, \text{CDC20i}\right) \tag{207}$$

$$\text{Mass\_Action\_1\_222}\left(\text{k1}, \text{S1}\right) = \text{k1} \cdot \text{S1} \tag{208}$$

9.55 Reaction Inactivation_2

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

Name Inactivation

Reaction equation

$$\text{CDC20} \xrightarrow{\text{MAD2}} \text{CDC20i} \tag{209}$$

Reactant

Table 107: Properties of each reactant.

Id	Name	SBO
CDC20	CDC20	

Modifier

Table 108: Properties of each modifier.

Id	Name	SBO
MAD2	MAD2	

Product

Table 109: Properties of each product.

Id	Name	SBO
CDC20i	CDC20i	

Kinetic Law

Derived unit contains undeclared units

$$v_{55} = \mathrm{k} \cdot \mathrm{Mass\_Action\_1\_222}\left(\mathrm{MAD2}, \mathrm{CDC20}\right) \tag{210}$$

$$\mathrm{Mass\_Action\_1\_222}\left(\mathrm{k1}, \mathrm{S1}\right) = \mathrm{k1} \cdot \mathrm{S1} \tag{211}$$

$$\mathrm{Mass\_Action\_1\_222}\left(\mathrm{k1}, \mathrm{S1}\right) = \mathrm{k1} \cdot \mathrm{S1} \tag{212}$$

Table 110: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k			1.0		☑

9.56 Reaction CDH1_synthesis

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

Name CDH1 synthesis

Reaction equation

$$\emptyset \longrightarrow \mathrm{CDH1} \tag{213}$$

Product

Table 111: Properties of each product.

Id	Name	SBO
CDH1	CDH1	

Kinetic Law

Derived unit not available

$$v_{56} = \mathrm{kscdh} \tag{214}$$

9.57 Reaction CDH1_degradation

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

Name CDH1 degradation

Reaction equation

$$\mathrm{CDH1} \longrightarrow \emptyset \tag{215}$$

Reactant

Table 112: Properties of each reactant.

Id	Name	SBO
CDH1	CDH1	

Kinetic Law

Derived unit contains undeclared units

$$v_{57} = \mathrm{Mass\_Action\_1\_222}\left(\mathrm{kdcdh}, \mathrm{CDH1}\right) \tag{216}$$

$$\mathrm{Mass\_Action\_1\_222}\left(\mathrm{k1}, \mathrm{S1}\right) = \mathrm{k1} \cdot \mathrm{S1} \tag{217}$$

9.58 Reaction CDH1i_degradation

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

Name CDH1i degradation

Reaction equation

$$\text{CDH1i} \longrightarrow \emptyset \tag{218}$$

Reactant

Table 113: Properties of each reactant.

Id	Name	SBO
CDH1i	CDH1i	

Kinetic Law

Derived unit contains undeclared units

$$v_{58} = \text{Mass\_Action\_1\_222}\left(\text{kdcdh}, \text{CDH1i}\right) \tag{219}$$

$$\text{Mass\_Action\_1\_222}\left(\text{k1}, \text{S1}\right) = \text{k1} \cdot \text{S1} \tag{220}$$

9.59 Reaction CDH1i_activation

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

Name CDH1i activation

Reaction equation

$$\text{CDH1i} \longrightarrow \text{CDH1} \tag{221}$$

Reactant

Table 114: Properties of each reactant.

Id	Name	SBO
CDH1i	CDH1i	

Product

Table 115: Properties of each product.

Id	Name	SBO
CDH1	CDH1	

Kinetic Law

Derived unit contains undeclared units

$$v_{59} = \text{MichaelisMenten\_220}\,(\text{Vacdh}, \text{Jacdh}, 1, \text{CDH1i}) \tag{222}$$

$$\text{MichaelisMenten\_220}\,(\text{M1}, \text{J1}, \text{k1}, \text{S1}) = \frac{\text{k1} \cdot \text{S1} \cdot \text{M1}}{\text{J1} + \text{S1}} \tag{223}$$

9.60 Reaction Inactivation_3

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

Name Inactivation

Reaction equation

$$\text{CDH1} \longrightarrow \text{CDH1i} \tag{224}$$

Reactant

Table 116: Properties of each reactant.

Id	Name	SBO
CDH1	CDH1	

Product

Table 117: Properties of each product.

Id	Name	SBO
CDH1i	CDH1i	

Kinetic Law

Derived unit contains undeclared units

$$v_{60} = \text{MichaelisMenten\_220}\,(\text{Vicdh}, \text{Jicdh}, 1, \text{CDH1}) \tag{225}$$

$$\text{MichaelisMenten\_220}\,(\text{M1},\text{J1},\text{k1},\text{S1}) = \frac{\text{k1}\cdot\text{S1}\cdot\text{M1}}{\text{J1}+\text{S1}} \tag{226}$$

9.61 Reaction CDC14_synthesis

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

Name CDC14 synthesis

Reaction equation

$$\emptyset \longrightarrow \text{CDC14} \tag{227}$$

Product

Table 118: Properties of each product.

Id	Name	SBO
CDC14	CDC14	

Kinetic Law

Derived unit not available

$$v_{61} = \text{ks14} \tag{228}$$

9.62 Reaction CDC14_degradation

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

Name CDC14 degradation

Reaction equation

$$\text{CDC14} \longrightarrow \emptyset \tag{229}$$

Reactant

Table 119: Properties of each reactant.

Id	Name	SBO
CDC14	CDC14	

Kinetic Law

Derived unit contains undeclared units

$$v_{62} = \text{Mass\_Action\_1\_222}\,(\text{kd14}, \text{CDC14}) \tag{230}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{231}$$

9.63 Reaction `Assoc_with_NET1_to_form_RENT`

This is an irreversible reaction of two reactants forming one product.

Name Assoc. with NET1 to form RENT

Reaction equation

$$\text{CDC14} + \text{NET1} \longrightarrow \text{RENT} \tag{232}$$

Reactants

Table 120: Properties of each reactant.

Id	Name	SBO
`CDC14`	CDC14	
`NET1`	NET1	

Product

Table 121: Properties of each product.

Id	Name	SBO
`RENT`	RENT	

Kinetic Law

Derived unit contains undeclared units

$$v_{63} = \text{Mass\_Action\_2\_221}\,(\text{kasrent}, \text{CDC14}, \text{NET1}) \tag{233}$$

$$\text{Mass\_Action\_2\_221}\,(\text{k1}, \text{S1}, \text{S2}) = \text{k1} \cdot \text{S1} \cdot \text{S2} \tag{234}$$

9.64 Reaction Dissoc_from_RENT

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

Name Dissoc. from RENT

Reaction equation

$$\text{RENT} \longrightarrow \text{NET1} + \text{CDC14} \tag{235}$$

Reactant

Table 122: Properties of each reactant.

Id	Name	SBO
RENT	RENT	

Products

Table 123: Properties of each product.

Id	Name	SBO
NET1	NET1	
CDC14	CDC14	

Kinetic Law

Derived unit contains undeclared units

$$v_{64} = \text{Mass\_Action\_1\_222}\,(\text{kdirent}, \text{RENT}) \tag{236}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{237}$$

9.65 Reaction Assoc_with_NET1P_to_form_RENTP

This is an irreversible reaction of two reactants forming one product.

Name Assoc with NET1P to form RENTP

Reaction equation

$$\text{CDC14} + \text{NET1P} \longrightarrow \text{RENTP} \tag{238}$$

Reactants

Table 124: Properties of each reactant.

Id	Name	SBO
CDC14	CDC14	
NET1P	NET1P	

Product

Table 125: Properties of each product.

Id	Name	SBO
RENTP	RENTP	

Kinetic Law

Derived unit contains undeclared units

$$v_{65} = \text{Mass\_Action\_2\_221}\,(\text{kasrentp}, \text{CDC14}, \text{NET1P}) \tag{239}$$

$$\text{Mass\_Action\_2\_221}\,(\text{k1}, \text{S1}, \text{S2}) = \text{k1} \cdot \text{S1} \cdot \text{S2} \tag{240}$$

9.66 Reaction Dissoc_from_RENP

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

Name Dissoc. from RENP

Reaction equation

$$\text{RENTP} \longrightarrow \text{CDC14} + \text{NET1P} \tag{241}$$

Reactant

Table 126: Properties of each reactant.

Id	Name	SBO
RENTP	RENTP	

Products

Table 127: Properties of each product.

Id	Name	SBO
CDC14	CDC14	
NET1P	NET1P	

Kinetic Law

Derived unit contains undeclared units

$$v_{66} = \text{Mass\_Action\_1\_222}\,(\text{kdirentp}, \text{RENTP}) \tag{242}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{243}$$

9.67 Reaction Net1_synthesis

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

Name Net1 synthesis

Reaction equation

$$\emptyset \longrightarrow \text{NET1} \tag{244}$$

Product

Table 128: Properties of each product.

Id	Name	SBO
NET1	NET1	

Kinetic Law

Derived unit not available

$$v_{67} = \text{ksnet} \tag{245}$$

9.68 Reaction Net1_degradation

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

Name Net1 degradation

Reaction equation

$$\text{NET1} \longrightarrow \emptyset \tag{246}$$

Reactant

Table 129: Properties of each reactant.

Id	Name	SBO
NET1	NET1	

Kinetic Law

Derived unit contains undeclared units

$$v_{68} = \text{Mass\_Action\_1\_222}\,(\text{kdnet}, \text{NET1}) \tag{247}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{248}$$

9.69 Reaction Net1P_degradation

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

Name Net1P degradation

Reaction equation

$$\text{NET1P} \longrightarrow \emptyset \tag{249}$$

Reactant

Table 130: Properties of each reactant.

Id	Name	SBO
NET1P	NET1P	

Kinetic Law

Derived unit contains undeclared units

$$v_{69} = \text{Mass\_Action\_1\_222}\,(\text{kdnet}, \text{NET1P}) \tag{250}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{251}$$

9.70 Reaction NET1_phosphorylation

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

Name NET1 phosphorylation

Reaction equation

$$\text{NET1} \longrightarrow \text{NET1P} \tag{252}$$

Reactant

Table 131: Properties of each reactant.

Id	Name	SBO
NET1	NET1	

Product

Table 132: Properties of each product.

Id	Name	SBO
NET1P	NET1P	

Kinetic Law

Derived unit contains undeclared units

$$v_{70} = \text{Mass\_Action\_1\_222}\left(\text{Vkpnet}, \text{NET1}\right) \tag{253}$$

$$\text{Mass\_Action\_1\_222}\left(\text{k1}, \text{S1}\right) = \text{k1} \cdot \text{S1} \tag{254}$$

9.71 Reaction dephosphorylation_1

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

Name dephosphorylation

Reaction equation

$$\text{NET1P} \longrightarrow \text{NET1} \tag{255}$$

Reactant

Table 133: Properties of each reactant.

Id	Name	SBO
NET1P	NET1P	

Product

Table 134: Properties of each product.

Id	Name	SBO
NET1	NET1	

Kinetic Law

Derived unit contains undeclared units

$$v_{71} = \text{Mass\_Action\_1\_222}\,(\text{Vppnet}, \text{NET1P}) \tag{256}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{257}$$

9.72 Reaction RENT_phosphorylation

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

Name RENT phosphorylation

Reaction equation

$$\text{RENT} \longrightarrow \text{RENTP} \tag{258}$$

Reactant

Table 135: Properties of each reactant.

Id	Name	SBO
RENT	RENT	

Product

Table 136: Properties of each product.

Id	Name	SBO
RENTP	RENTP	

Kinetic Law

Derived unit contains undeclared units

$$v_{72} = \text{Mass\_Action\_1\_222}\,(\text{Vkpnet}, \text{RENT}) \tag{259}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{260}$$

9.73 Reaction dephosphorylation_2

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

Name dephosphorylation

Reaction equation

$$\text{RENTP} \longrightarrow \text{RENT} \tag{261}$$

Reactant

Table 137: Properties of each reactant.

Id	Name	SBO
RENTP	RENTP	

Product

Table 138: Properties of each product.

Id	Name	SBO
RENT	RENT	

Kinetic Law

Derived unit contains undeclared units

$$v_{73} = \text{Mass\_Action\_1\_222}\,(\text{Vppnet}, \text{RENTP}) \tag{262}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{263}$$

9.74 Reaction Degradation_of_NET1_in_RENT

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

Name Degradation of NET1 in RENT

Reaction equation

$$\text{RENT} \longrightarrow \text{CDC14} \tag{264}$$

Reactant

Table 139: Properties of each reactant.

Id	Name	SBO
RENT	RENT	

Product

Table 140: Properties of each product.

Id	Name	SBO
CDC14	CDC14	

Kinetic Law

Derived unit contains undeclared units

$$v_{74} = \text{Mass\_Action\_1\_222}\,(\text{kdnet}, \text{RENT}) \tag{265}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{266}$$

9.75 Reaction Degradation_of_NET1P_in_RENTP

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

Name Degradation of NET1P in RENTP

Reaction equation

$$\text{RENTP} \longrightarrow \text{CDC14} \tag{267}$$

Reactant

Table 141: Properties of each reactant.

Id	Name	SBO
RENTP	RENTP	

Product

Table 142: Properties of each product.

Id	Name	SBO
CDC14	CDC14	

Kinetic Law

Derived unit contains undeclared units

$$v_{75} = \text{Mass\_Action\_1\_222}\,(\text{kdnet}, \text{RENTP}) \tag{268}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{269}$$

9.76 Reaction Degradation_of_CDC14_in_RENT

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

Name Degradation of CDC14 in RENT

Reaction equation

$$\text{RENT} \longrightarrow \text{NET1} \tag{270}$$

Reactant

Table 143: Properties of each reactant.

Id	Name	SBO
RENT	RENT	

Product

Table 144: Properties of each product.

Id	Name	SBO
NET1	NET1	

Kinetic Law

Derived unit contains undeclared units

$$v_{76} = \text{Mass\_Action\_1\_222}\,(\text{kd14}, \text{RENT}) \tag{271}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{272}$$

9.77 Reaction Degradation_of_CDC14_in_RENTP

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

Name Degradation of CDC14 in RENTP

Reaction equation

$$\text{RENTP} \longrightarrow \text{NET1P} \tag{273}$$

Reactant

Table 145: Properties of each reactant.

Id	Name	SBO
RENTP	RENTP	

Product

Table 146: Properties of each product.

Id	Name	SBO
NET1P	NET1P	

Kinetic Law

Derived unit contains undeclared units

$$v_{77} = \text{Mass\_Action\_1\_222}\,(\text{kd14}, \text{RENTP}) \tag{274}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1},\text{S1}) = \text{k1}\cdot\text{S1} \tag{275}$$

9.78 Reaction TEM1_activation

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

Name TEM1 activation

Reaction equation

$$\text{TEM1GDP} \xrightarrow{\text{LTE1}} \text{TEM1GTP} \tag{276}$$

Reactant

Table 147: Properties of each reactant.

Id	Name	SBO
TEM1GDP	TEM1GDP	

Modifier

Table 148: Properties of each modifier.

Id	Name	SBO
LTE1	LTE1	

Product

Table 149: Properties of each product.

Id	Name	SBO
TEM1GTP	TEM1GTP	

Kinetic Law

Derived unit contains undeclared units

$$v_{78} = \text{MichaelisMenten\_220}\,(\text{LTE1},\text{Jatem},1,\text{TEM1GDP}) \tag{277}$$

$$\text{MichaelisMenten\_220}\,(\text{M1},\text{J1},\text{k1},\text{S1}) = \frac{\text{k1}\cdot\text{S1}\cdot\text{M1}}{\text{J1}+\text{S1}} \tag{278}$$

9.79 Reaction `inactivation_1`

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

Name inactivation

Reaction equation

$$\text{TEM1GTP} \xrightarrow{\text{BUB2}} \text{TEM1GDP} \tag{279}$$

Reactant

Table 150: Properties of each reactant.

Id	Name	SBO
`TEM1GTP`	TEM1GTP	

Modifier

Table 151: Properties of each modifier.

Id	Name	SBO
`BUB2`	BUB2	

Product

Table 152: Properties of each product.

Id	Name	SBO
`TEM1GDP`	TEM1GDP	

Kinetic Law

Derived unit contains undeclared units

$$v_{79} = \text{MichaelisMenten\_220}\left(\text{BUB2}, \text{Jitem}, 1, \text{TEM1GTP}\right) \tag{280}$$

$$\text{MichaelisMenten\_220}\left(\text{M1}, \text{J1}, \text{k1}, \text{S1}\right) = \frac{\text{k1} \cdot \text{S1} \cdot \text{M1}}{\text{J1} + \text{S1}} \tag{281}$$

9.80 Reaction CDC15_activation

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

Name CDC15 activation

Reaction equation

$$\text{CDC15i} \xrightarrow{\text{TEM1GDP, TEM1GTP, CDC14}} \text{CDC15} \tag{282}$$

Reactant

Table 153: Properties of each reactant.

Id	Name	SBO
CDC15i	CDC15i	

Modifiers

Table 154: Properties of each modifier.

Id	Name	SBO
TEM1GDP	TEM1GDP	
TEM1GTP	TEM1GTP	
CDC14	CDC14	

Product

Table 155: Properties of each product.

Id	Name	SBO
CDC15	CDC15	

Kinetic Law

Derived unit contains undeclared units

$$v_{80} = \text{Mass\_Action\_1\_222}\left(\text{ka15\_p} \cdot \text{TEM1GDP} + \text{ka15\_p\_p} \cdot \text{TEM1GTP} + \text{ka15p} \cdot \text{CDC14}, \text{CDC15i}\right) \tag{283}$$

$$\text{Mass\_Action\_1\_222}\left(\text{k1}, \text{S1}\right) = \text{k1} \cdot \text{S1} \tag{284}$$

9.81 Reaction `inactivation_2`

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

Name inactivation

Reaction equation

$$\text{CDC15} \longrightarrow \text{CDC15i} \tag{285}$$

Reactant

Table 156: Properties of each reactant.

Id	Name	SBO
`CDC15`	CDC15	

Product

Table 157: Properties of each product.

Id	Name	SBO
`CDC15i`	CDC15i	

Kinetic Law

Derived unit contains undeclared units

$$v_{81} = \text{Mass\_Action\_1\_222}\left(\text{ki15}, \text{CDC15}\right) \tag{286}$$

$$\text{Mass\_Action\_1\_222}\left(\text{k1}, \text{S1}\right) = \text{k1} \cdot \text{S1} \tag{287}$$

9.82 Reaction `PPX_synthesis`

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

Name PPX synthesis

Reaction equation

$$\emptyset \longrightarrow \text{PPX} \tag{288}$$

Product

Table 158: Properties of each product.

Id	Name	SBO
PPX	PPX	

Kinetic Law

Derived unit not available

$$v_{82} = \text{ksppx} \tag{289}$$

9.83 Reaction degradation_1

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

Name degradation

Reaction equation

$$\text{PPX} \longrightarrow \emptyset \tag{290}$$

Reactant

Table 159: Properties of each reactant.

Id	Name	SBO
PPX	PPX	

Kinetic Law

Derived unit contains undeclared units

$$v_{83} = \text{Mass\_Action\_1\_222}\left(\text{Vdppx}, \text{PPX}\right) \tag{291}$$

$$\text{Mass\_Action\_1\_222}\left(\text{k1}, \text{S1}\right) = \text{k1} \cdot \text{S1} \tag{292}$$

9.84 Reaction PDS1_synthesis

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

Name PDS1 synthesis

Reaction equation

$$\emptyset \xrightarrow{\text{SBF, MCM1}} \text{PDS1} \tag{293}$$

Modifiers

Table 160: Properties of each modifier.

Id	Name	SBO
SBF	SBF	
MCM1	MCM1	

Product

Table 161: Properties of each product.

Id	Name	SBO
PDS1	PDS1	

Kinetic Law

Derived unit contains undeclared units

$$v_{84} = \text{kspds\_p} + \text{ks1pds\_p\_p} \cdot \text{SBF} + \text{ks2pds\_p\_p} \cdot \text{MCM1} \tag{294}$$

9.85 Reaction degradation_2

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

Name degradation

Reaction equation

$$\text{PDS1} \longrightarrow \emptyset \tag{295}$$

Reactant

Table 162: Properties of each reactant.

Id	Name	SBO
PDS1	PDS1	

Kinetic Law

Derived unit contains undeclared units

$$v_{85} = \text{Mass\_Action\_1\_222}\left(\text{Vdpds}, \text{PDS1}\right) \tag{296}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1},\text{S1}) = \text{k1} \cdot \text{S1} \tag{297}$$

9.86 Reaction Degradation_of_PDS1_in_PE

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

Name Degradation of PDS1 in PE

Reaction equation

$$\text{PE} \longrightarrow \text{ESP1} \tag{298}$$

Reactant

Table 163: Properties of each reactant.

Id	Name	SBO
PE	PE	

Product

Table 164: Properties of each product.

Id	Name	SBO
ESP1	ESP1	

Kinetic Law

Derived unit contains undeclared units

$$v_{86} = \text{Mass\_Action\_1\_222}\,(\text{Vdpds},\text{PE}) \tag{299}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1},\text{S1}) = \text{k1} \cdot \text{S1} \tag{300}$$

9.87 Reaction Assoc_with_ESP1_to_form_PE

This is an irreversible reaction of two reactants forming one product.

Name Assoc. with ESP1 to form PE

Reaction equation

$$\text{PDS1} + \text{ESP1} \longrightarrow \text{PE} \tag{301}$$

Reactants

Table 165: Properties of each reactant.

Id	Name	SBO
PDS1	PDS1	
ESP1	ESP1	

Product

Table 166: Properties of each product.

Id	Name	SBO
PE	PE	

Kinetic Law

Derived unit contains undeclared units

$$v_{87} = \text{Mass\_Action\_2\_221}\,(\text{kasesp}, \text{PDS1}, \text{ESP1}) \tag{302}$$

$$\text{Mass\_Action\_2\_221}\,(\text{k1}, \text{S1}, \text{S2}) = \text{k1} \cdot \text{S1} \cdot \text{S2} \tag{303}$$

9.88 Reaction Disso_from_PE

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

Name Disso. from PE

Reaction equation

$$\text{PE} \longrightarrow \text{PDS1} + \text{ESP1} \tag{304}$$

Reactant

Table 167: Properties of each reactant.

Id	Name	SBO
PE	PE	

Products

Table 168: Properties of each product.

Id	Name	SBO
PDS1	PDS1	
ESP1	ESP1	

Kinetic Law

Derived unit contains undeclared units

$$v_{88} = \text{Mass\_Action\_1\_222}\,(\text{kdiesp}, \text{PE}) \tag{305}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{306}$$

9.89 Reaction DNA_synthesis

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

Name DNA synthesis

Reaction equation

$$\emptyset \xrightarrow{\text{CLB5, CLB2}} \text{ORI} \tag{307}$$

Modifiers

Table 169: Properties of each modifier.

Id	Name	SBO
CLB5	CLB5	
CLB2	CLB2	

Product

Table 170: Properties of each product.

Id	Name	SBO
ORI	ORI	

Kinetic Law

Derived unit contains undeclared units

$$v_{89} = \text{ksori} \cdot (\text{eorib5} \cdot \text{CLB5} + \text{eorib2} \cdot \text{CLB2}) \tag{308}$$

9.90 Reaction Negative_regulation_of_DNA_synthesis

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

Name Negative regulation of DNA synthesis

Reaction equation

$$\text{ORI} \longrightarrow \emptyset \tag{309}$$

Reactant

Table 171: Properties of each reactant.

Id	Name	SBO
ORI	ORI	

Kinetic Law

Derived unit contains undeclared units

$$v_{90} = \text{Mass\_Action\_1\_222}\,(\text{kdori}, \text{ORI}) \tag{310}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{311}$$

9.91 Reaction Budding

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

Name Budding

Reaction equation

$$\emptyset \xrightarrow{\text{CLN2, CLN3, CLB5}} \text{BUD} \tag{312}$$

Modifiers

Table 172: Properties of each modifier.

Id	Name	SBO
CLN2	CLN2	
CLN3	CLN3	
CLB5	CLB5	

Product

Table 173: Properties of each product.

Id	Name	SBO
BUD	BUD	

Kinetic Law

Derived unit contains undeclared units

$$v_{91} = \text{ksbud} \cdot (\text{ebudn2} \cdot \text{CLN2} + \text{ebudn3} \cdot \text{CLN3} + \text{ebudb5} \cdot \text{CLB5}) \tag{313}$$

9.92 Reaction Negative_regulation_of_Cell_budding

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

Name Negative regulation of Cell budding

Reaction equation

$$\text{BUD} \longrightarrow \emptyset \tag{314}$$

Reactant

Table 174: Properties of each reactant.

Id	Name	SBO
BUD	BUD	

Kinetic Law

Derived unit contains undeclared units

$$v_{92} = \text{Mass\_Action\_1\_222}\,(\text{kdbud}, \text{BUD}) \tag{315}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{316}$$

9.93 Reaction Spindle_formation

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

Name Spindle formation

Reaction equation

$$\emptyset \xrightarrow{\text{CLB2}} \text{SPN} \tag{317}$$

Modifier

Table 175: Properties of each modifier.

Id	Name	SBO
CLB2	CLB2	

Product

Table 176: Properties of each product.

Id	Name	SBO
SPN	SPN	

Kinetic Law

Derived unit contains undeclared units

$$v_{93} = \frac{\text{ksspn} \cdot \text{CLB2}}{\text{Jspn} + \text{CLB2}} \tag{318}$$

9.94 Reaction Spindle_disassembly

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

Name Spindle disassembly

Reaction equation

$$\text{SPN} \longrightarrow \emptyset \tag{319}$$

Reactant

Table 177: Properties of each reactant.

Id	Name	SBO
SPN	SPN	

Kinetic Law

Derived unit contains undeclared units

$$v_{94} = \text{Mass\_Action\_1\_222}\,(\text{kdspn}, \text{SPN}) \tag{320}$$

$$\text{Mass\_Action\_1\_222}\,(\text{k1}, \text{S1}) = \text{k1} \cdot \text{S1} \tag{321}$$

10 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.

10.1 Species BCK2

Name BCK2

Involved in rule BCK2

One rule which determines this species' quantity.

10.2 Species BUB2

Name BUB2

Initial amount 0.2 mol

Involved in events start_S, spindle_checkpoint

This species takes part in one reaction (as a modifier in inactivation_1).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{BUB2} = 0 \tag{322}$$

Furthermore, two events influence this species' rate of change.

10.3 Species BUD

Name BUD

Initial amount 0.008473 mol

Involved in event cell_division

This species takes part in two reactions (as a reactant in Negative_regulation_of_Cell-_budding and as a product in Budding).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{BUD} = v_{91} - v_{92} \tag{323}$$

Furthermore, one event influences this species' rate of change.

10.4 Species C2

Name C2

Initial amount 0.238404 mol

This species takes part in five reactions (as a reactant in Dissoc_of_CLB2SIC1_complex, Phosphorylation-_of_C2, Degradation_of_CLB2_in_C2 and as a product in Assoc_of_CLB2_and_SIC1, Dephosphorylation-_of_C2P).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{C2} = v_{12} + v_{17} - v_{13} - v_{16} - v_{20} \tag{324}$$

10.5 Species C2P

Name C2P

Initial amount 0.024034 mol

This species takes part in four reactions (as a reactant in Dephosphorylation_of_C2P, Degradation-_of_SIC1_in_C2P, Degradation_of_CLB2_in_C2P and as a product in Phosphorylation-_of_C2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{C2P} = v_{16} - v_{17} - v_{22} - v_{24} \tag{325}$$

10.6 Species C5

Name C5

Initial amount 0.070081 mol

This species takes part in five reactions (as a reactant in Dissoc_of_CLB5SIC1, Phosphorylation-_of_C5, Degradation_of_CLB5_in_C5 and as a product in Assoc_of_CLB5_and_SIC1, Dephosphorylation-_of_C5P).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{C5} = v_{14} + v_{19} - v_{15} - v_{18} - v_{21} \tag{326}$$

10.7 Species C5P

Name C5P

Initial amount 0.006878 mol

This species takes part in four reactions (as a reactant in Dephosphorylation_of_C5P, Degradation_of_SIC1P_in_C5P_, Degradation_of_CLB5_in_C5P and as a product in Phosphorylation_of_C5).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{C5P} = v_{18} - v_{19} - v_{23} - v_{25} \tag{327}$$

10.8 Species CDC14

Name CDC14

Initial amount 0.468344 mol

This species takes part in ten reactions (as a reactant in CDC14_degradation, Assoc_with_NET1_to_form_RENT, Assoc_with_NET1P_to_form_RENTP and as a product in CDC14_synthesis, Dissoc_from_RENT, Dissoc_from_RENP, Degradation_of_NET1_in_RENT, Degradation_of_NET1P_in_RENTP and as a modifier in Activation_of_SWI5, CDC15_activation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CDC14} = v_{61} + v_{64} + v_{66} + v_{74} + v_{75} - v_{62} - v_{63} - v_{65} \tag{328}$$

10.9 Species CDC14T

Name CDC14T

Initial amount 2 mol

Involved in rule CDC14T

One rule which determines this species' quantity.

10.10 Species CDC15

Name CDC15

Initial amount 0.656533 mol

This species takes part in two reactions (as a reactant in inactivation_2 and as a product in CDC15_activation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CDC15} = v_{80} - v_{81} \tag{329}$$

10.11 Species CDC15i

Name CDC15i

Involved in rule CDC15i

This species takes part in two reactions (as a reactant in CDC15_activation and as a product in inactivation_2). Not these but one rule determines the species' quantity because this species is on the boundary of the reaction system.

10.12 Species CDC20

Name CDC20

Initial amount 0.444296 mol

This species takes part in three reactions (as a reactant in Degradation_of_active_CDC20, Inactivation_2 and as a product in Activation_of_CDC20).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CDC20} = v_{54} - v_{53} - v_{55} \tag{330}$$

10.13 Species CDC20i

Name CDC20i

Initial amount 1.472044 mol

This species takes part in four reactions (as a reactant in Degradation_of_inactiveCDC20, Activation_of_CDC20 and as a product in Synthesis_of_inactive_CDC20, Inactivation_2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CDC20i} = v_{51} + v_{55} - v_{52} - v_{54} \tag{331}$$

10.14 Species CDC6

Name CDC6

Initial amount 0.10758 mol

This species takes part in nine reactions (as a reactant in Phosphorylation_of_CDC6, CLB2CDC6_complex_formation, CLB5CDC6_complex_formation and as a product in CDC6_synthesis, Dephosphorylation_of_CDC6, CLB2CDC6_dissociation, CLB5CDC6_dissociation, CLB2_degradation_in_F2, CLB5_degradation_in_F5).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CDC6} = v_{26} + v_{28} + v_{31} + v_{33} + v_{38} + v_{39} - v_{27} - v_{30} - v_{32} \tag{332}$$

10.15 Species CDC6P

Name CDC6P

Initial amount 0.015486 mol

This species takes part in five reactions (as a reactant in Dephosphorylation_of_CDC6, Degradation_of_CDC6P and as a product in Phosphorylation_of_CDC6, CLB2_degradation_in_F2P, CLB5_degradation_in_F5P).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CDC6P} = v_{27} + v_{42} + v_{43} - v_{28} - v_{29} \tag{333}$$

10.16 Species CDC6T

Name CDC6T

Involved in rule CDC6T

One rule which determines this species' quantity.

10.17 Species CDH1

Name CDH1

Initial amount 0.930499 mol

This species takes part in four reactions (as a reactant in CDH1_degradation, Inactivation_3 and as a product in CDH1_synthesis, CDH1i_activation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CDH1} = v_{56} + v_{59} - v_{57} - v_{60} \tag{334}$$

10.18 Species CDH1i

Name CDH1i

Initial amount 0.0695 mol

This species takes part in three reactions (as a reactant in CDH1i_degradation, CDH1i_activation and as a product in Inactivation_3).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CDH1i} = v_{60} - v_{58} - v_{59} \tag{335}$$

10.19 Species CKIT

Name CKIT

Involved in rule CKIT

One rule which determines this species' quantity.

10.20 Species CLB2

Name CLB2

Initial amount 0.1469227 mol

This species takes part in eleven reactions (as a reactant in Degradation_of_CLB2, Assoc_of_CLB2_and_SIC1, CLB2CDC6_complex_formation and as a product in Synthesis_of_CLB2, Dissoc_of_CLB2SIC1_complex, Degradation_of_SIC1_in_C2P, CLB2CDC6_dissociation, CDC6_degradation_in_F2P and as a modifier in Inactivation_of_SWI5, DNA_synthesis, Spindle_formation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CLB2} = v_4 + v_{13} + v_{22} + v_{31} + v_{40} - v_5 - v_{12} - v_{30} \tag{336}$$

10.21 Species CLB2T

Name CLB2T

Initial amount 0.17 mol

Involved in rule CLB2T

One rule which determines this species' quantity.

10.22 Species CLB5

Name CLB5

Initial amount 0.0518014 mol

This species takes part in ten reactions (as a reactant in Degradation_of_CLB5, Assoc_of_CLB5_and_SIC1, CLB5CDC6_complex_formation and as a product in Synthesis_of_CLB5, Dissoc_of_CLB5SIC1, Degradation_of_SIC1P_in_C5P_, CLB5CDC6_dissociation, CDC6_degradation_in_F5P and as a modifier in DNA_synthesis, Budding).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CLB5} = v_6 + v_{15} + v_{23} + v_{33} + v_{41} - v_7 - v_{14} - v_{32} \tag{337}$$

10.23 Species CLB5T

Name CLB5T

Initial amount 0.12 mol

Involved in rule CLB5T

One rule which determines this species' quantity.

10.24 Species CLN2

Name CLN2

Initial amount 0.0652511 mol

This species takes part in three reactions (as a reactant in Degradation_of_CLN2 and as a product in Synthesis_of_CLN2 and as a modifier in Budding).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CLN2} = v_2 - v_3 \tag{338}$$

10.25 Species CLN3

Name CLN3

Involved in rule CLN3

This species takes part in one reaction (as a modifier in Budding) and is also involved in one rule which determines this species' quantity.

10.26 Species ESP1

Name ESP1

Initial amount 0.301313 mol

This species takes part in three reactions (as a reactant in Assoc_with_ESP1_to_form_PE and as a product in Degradation_of_PDS1_in_PE, Disso_from_PE).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ESP1} = v_{86} + v_{88} - v_{87} \tag{339}$$

10.27 Species F2

Name F2

Initial amount 0.236058 mol

This species takes part in five reactions (as a reactant in CLB2CDC6_dissociation, F2_phosphorylation, CLB2_degradation_in_F2 and as a product in CLB2CDC6_complex_formation, F2P_dephosphorylation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{F2} = v_{30} + v_{35} - v_{31} - v_{34} - v_{38} \tag{340}$$

10.28 Species F2P

Name F2P

Initial amount 0.0273938 mol

This species takes part in four reactions (as a reactant in F2P_dephosphorylation, CDC6-_degradation_in_F2P, CLB2_degradation_in_F2P and as a product in F2_phosphorylation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{F2P} = v_{34} - v_{35} - v_{40} - v_{42} \tag{341}$$

10.29 Species F5

Name F5

Initial amount $7.24 \cdot 10^{-5}$ mol

This species takes part in five reactions (as a reactant in CLB5CDC6_dissociation, F5_phosphorylation, CLB5_degradation_in_F5 and as a product in CLB5CDC6_complex_formation, F5P_dephosphorylation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{F5} = v_{32} + v_{37} - v_{33} - v_{36} - v_{39} \tag{342}$$

10.30 Species F5P

Name F5P

Initial amount $7.91 \cdot 10^{-5}$ mol

This species takes part in four reactions (as a reactant in F5P_dephosphorylation, CDC6-_degradation_in_F5P, CLB5_degradation_in_F5P and as a product in F5_phosphorylation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{F5P} = v_{36} - v_{37} - v_{41} - v_{43} \tag{343}$$

10.31 Species IE

Name IE

Involved in rule IE

This species takes part in two reactions (as a reactant in Activation_of_IEP and as a product in Inactivation_1). Not these but one rule determines the species' quantity because this species is on the boundary of the reaction system.

10.32 Species IEP

Name IEP

Initial amount 0.1015 mol

This species takes part in three reactions (as a reactant in Inactivation_1 and as a product in Activation_of_IEP and as a modifier in Activation_of_CDC20).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IEP} = v_{49} - v_{50} \tag{344}$$

10.33 Species LTE1

Name LTE1

Initial amount 0.1 mol

Involved in events spindle_checkpoint, cell_division

This species takes part in one reaction (as a modifier in TEM1_activation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{LTE1} = 0 \tag{345}$$

Furthermore, two events influence this species' rate of change.

10.34 Species MAD2

Name MAD2

Initial amount 0.01 mol

Involved in events start_S, spindle_checkpoint

This species takes part in one reaction (as a modifier in Inactivation_2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{MAD2} = 0 \tag{346}$$

Furthermore, two events influence this species' rate of change.

10.35 Species MASS

Name MASS

Initial amount 1.206019 mol

Involved in event cell_division

This species takes part in four reactions (as a product in Growth and as a modifier in Synthesis_of_CLN2, Synthesis_of_CLB2, Synthesis_of_CLB5).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{MASS} = v_{1} \tag{347}$$

Furthermore, one event influences this species' rate of change.

10.36 Species MCM1

Name MCM1

Involved in rule MCM1

This species takes part in four reactions (as a modifier in Synthesis_of_CLB2, Synthesis_of_SWI5, Synthesis_of_inactive_CDC20, PDS1_synthesis) and is also involved in one rule which determines this species' quantity.

10.37 Species NET1

Name NET1

Initial amount 0.018645 mol

This species takes part in seven reactions (as a reactant in Assoc_with_NET1_to_form_RENT, Net1_degradation, NET1_phosphorylation and as a product in Dissoc_from_RENT, Net1_synthesis, dephosphorylation_1, Degradation_of_CDC14_in_RENT).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{NET1} = v_{64} + v_{67} + v_{71} + v_{76} - v_{63} - v_{68} - v_{70} \tag{348}$$

10.38 Species NET1P

Name NET1P

Initial amount 0.970271 mol

This species takes part in six reactions (as a reactant in Assoc_with_NET1P_to_form_RENTP, Net1P_degradation, dephosphorylation_1 and as a product in Dissoc_from_RENP, NET1_phosphorylation, Degradation_of_CDC14_in_RENTP).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{NET1P} = v_{66} + v_{70} + v_{77} - v_{65} - v_{69} - v_{71} \tag{349}$$

10.39 Species NET1T

Name NET1T

Initial amount 2.8 mol

Involved in rule NET1T

One rule which determines this species' quantity.

10.40 Species ORI

Name ORI

Initial amount $9.09 \cdot 10^{-4}$ mol

Involved in event reset_ORI

This species takes part in two reactions (as a reactant in Negative_regulation_of_DNA-_synthesis and as a product in DNA_synthesis).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ORI} = v_{89} - v_{90} \tag{350}$$

Furthermore, one event influences this species' rate of change.

10.41 Species PDS1

Name PDS1

Initial amount 0.025612 mol

This species takes part in four reactions (as a reactant in degradation_2, Assoc_with_ESP1-_to_form_PE and as a product in PDS1_synthesis, Disso_from_PE).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{PDS1} = v_{84} + v_{88} - v_{85} - v_{87} \tag{351}$$

10.42 Species PE

Name PE

Involved in rule PE

This species takes part in three reactions (as a reactant in Degradation_of_PDS1_in_PE, Disso-_from_PE and as a product in Assoc_with_ESP1_to_form_PE). Not these but one rule determines the species' quantity because this species is on the boundary of the reaction system.

10.43 Species PPX

Name PPX

Initial amount 0.123179 mol

This species takes part in two reactions (as a reactant in degradation_1 and as a product in PPX_synthesis).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{PPX} = v_{82} - v_{83} \tag{352}$$

10.44 Species RENT

Name RENT

Initial amount 1.04954 mol

This species takes part in six reactions (as a reactant in Dissoc_from_RENT, RENT_phosphorylation, Degradation_of_NET1_in_RENT, Degradation_of_CDC14_in_RENT and as a product in Assoc_with_NET1_to_form_RENT, dephosphorylation_2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{RENT} = v_{63} + v_{73} - v_{64} - v_{72} - v_{74} - v_{76} \tag{353}$$

10.45 Species RENTP

Name RENTP

Initial amount 0.6 mol

This species takes part in six reactions (as a reactant in Dissoc_from_RENP, dephosphorylation_2, Degradation_of_NET1P_in_RENTP, Degradation_of_CDC14_in_RENTP and as a product in Assoc_with_NET1P_to_form_RENTP, RENT_phosphorylation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{RENTP} = v_{65} + v_{72} - v_{66} - v_{73} - v_{75} - v_{77} \tag{354}$$

10.46 Species SBF

Name SBF

Involved in rule SBF

This species takes part in four reactions (as a modifier in Synthesis_of_CLN2, Synthesis_of_CLB5, CDC6_synthesis, PDS1_synthesis) and is also involved in one rule which determines this species' quantity.

10.47 Species SIC1

Name SIC1

Initial amount 0.0228776 mol

This species takes part in nine reactions (as a reactant in Phosphorylation_of_SIC1, Assoc_of_CLB2_and_SIC1, Assoc_of_CLB5_and_SIC1 and as a product in Synthesis_of_SIC1, Dephosphorylation_of_SIC1, Dissoc_of_CLB2SIC1_complex, Dissoc_of_CLB5SIC1, Degradation_of_CLB2_in_C2, Degradation_of_CLB5_in_C5).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{SIC1} = v_{8} + v_{10} + v_{13} + v_{15} + v_{20} + v_{21} - v_{9} - v_{12} - v_{14} \tag{355}$$

10.48 Species SIC1P

Name SIC1P

Initial amount 0.00641 mol

This species takes part in five reactions (as a reactant in Dephosphorylation_of_SIC1, Fast-_Degradation_of_SIC1P and as a product in Phosphorylation_of_SIC1, Degradation_of-_CLB2_in_C2P, Degradation_of_CLB5_in_C5P).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{SIC1P} = v_9 + v_{24} + v_{25} - v_{10} - v_{11} \tag{356}$$

10.49 Species SIC1T

Name SIC1T

Involved in rule SIC1T

One rule which determines this species' quantity.

10.50 Species SPN

Name SPN

Initial amount 0.03 mol

Involved in event cell_division

This species takes part in two reactions (as a reactant in Spindle_disassembly and as a product in Spindle_formation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{SPN} = v_{93} - v_{94} \tag{357}$$

Furthermore, one event influences this species' rate of change.

10.51 Species SWI5

Name SWI5

Initial amount 0.95 mol

This species takes part in six reactions (as a reactant in Degradation_of_SWI5, Inactivation-_of_SWI5 and as a product in Synthesis_of_SWI5, Activation_of_SWI5 and as a modifier in Synthesis_of_SIC1, CDC6_synthesis).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{SWI5} = v_{44} + v_{47} - v_{45} - v_{48} \tag{358}$$

10.52 Species SWI5P

Name SWI5P

Initial amount 0.02 mol

This species takes part in three reactions (as a reactant in Degradation_of_SWI5P, Activation_of_SWI5 and as a product in Inactivation_of_SWI5).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{SWI5P} = v_{48} - v_{46} - v_{47} \tag{359}$$

10.53 Species TEM1GDP

Name TEM1GDP

Involved in rule TEM1GDP

This species takes part in three reactions (as a reactant in TEM1_activation and as a product in inactivation_1 and as a modifier in CDC15_activation). Not these but one rule determines the species' quantity because this species is on the boundary of the reaction system.

10.54 Species TEM1GTP

Name TEM1GTP

Initial amount 0.9 mol

This species takes part in three reactions (as a reactant in inactivation_1 and as a product in TEM1_activation and as a modifier in CDC15_activation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TEM1GTP} = v_{78} - v_{79} \tag{360}$$

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