SBML Model Report

Model name: "Nakakuki2010-_CellFateDecision_Mechanistic"

May 5, 2016

1 General Overview

This is a document in SBML Level 2 Version 4 format. This model was created by Lukas Endler[1] at April 30th 2010 at 11:41 a. m. and last time modified at February 28th 2014 at four o' clock in the afternoon. 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	3
species types	0	species	49
events	0	constraints	0
reactions	78	function definitions	56
global parameters	141	unit definitions	2
rules	0	initial assignments	0

Model Notes

This mechanistic model describes the activation of immediate early genes such as cFos after EGF or heregulin (HRG) stimulation of the MAPK pathway. Phosphorylated cFos is a key transcription factor triggering downstream cascades of cell fate determination. The model can explain how the switch-like response of p-cFos emerges from the spatiotemporal dynamics. This mechanistic model comprises the explicit reaction kinetics of the signal transduction pathway,

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the transcriptional and the posttranslational feedback and feedforward loops. In the below article, two different mechanistic models have been studied, the first one based on previously known interactions but failing to account for the experimental data and the second one including additional interactions which were discovered and confirmed by new experiments. The mechanistic model encoded here is the second one, the extended and at the time of creation most complete model of cell fate decision making in response to different doses of EGF or HRG stimulation. The encoded parameter set corresponds to 10mM HRG stimulation as shown in Fig.1 of the article. The Supplementary Methods of the article provide further parameter sets that allow simulations for different ligands and different doses. A corresponding core model is available from http://www.ebi.ac.uk/biomodels/ as MODEL1003170000.

Ligand-specific c-Fos expression emerges from the spatiotemporal control of ErbB network dynamics.

Takashi Nakakuki(1), Marc R. Birtwistle(2,3,4), Yuko Saeki(1,5), Noriko Yumoto(1,5), Kaori Ide(1), Takeshi Nagashima(1,5), Lutz Brusch(6), Babatunde A. Ogunnaike(3), Mariko Hatakeyama(1,5), and Boris N. Kholodenko(2,4); Cell In Press, online 20 May 2010 , doi: 10.1016/j.cell.2010.03.054

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2 Unit Definitions

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

2.1 Unit `volume`

Definition pl

2.2 Unit `substance`

Definition nmol

2.3 Unit `area`

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

Definition m^2

2.4 Unit length

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

Definition m

2.5 Unit time

Notes Second is the predefined SBML unit for time.

Definition s

3 Compartments

This model contains three compartments.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
default	default	0000290	3	1	litre	☑	
cytoplasm	cytoplasm	0000290	3	940	pl	☑	
nucleus	nucleus	0000290	3	220	pl	☑	

3.1 Compartment default

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

Name default

SBO:0000290 physical compartment

3.2 Compartment cytoplasm

This is a three dimensional compartment with a constant size of 940 pl.

Name cytoplasm

SBO:0000290 physical compartment

3.3 Compartment nucleus

This is a three dimensional compartment with a constant size of 220 pl.

Name nucleus

SBO:0000290 physical compartment

4 Species

This model contains 49 species. The boundary condition of two of these species is set to `true` so that these species' amount cannot be changed by any reaction. Section 8 provides further details and the derived rates of change of each species.

Table 3: Properties of each species.

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
EGF	EGF	default	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☑	☑
HRG	HRG	default	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☑	☑
A1	A1	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
A1_2	A1_2	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
A2	A2	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
A2_2	A2_2	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
A3	A3	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
A3_2	A3_2	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
DUSPmRNA	DUSPmRNA	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
ERK_c	ERK_c	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
pERK_c	pERK_c	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
ppERK_c	ppERK_c	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
F	F	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
c_FOS_c	c_FOS_c	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
pc_FOS_c	pc_FOS_c	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
c_FOSmRNA	c_FOSmRNA	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
FmRNA	FmRNA	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
Kin	Kin	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
Kin_2	Kin_2	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
pMEK	pMEK	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐
MEK	MEK	cytoplasm	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	☐	☐

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
DUSP_c	DUSP_c	cytoplasm	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
pDUSP_c	pDUSP_c	cytoplasm	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
RSK_c	RSK_c	cytoplasm	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
pRSK_c	pRSK_c	cytoplasm	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
RsD	RsD	cytoplasm	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
RsT	RsT	cytoplasm	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
CREB_n	CREB_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
pCREB_n	pCREB_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
ERK_n	ERK_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
pERK_n	pERK_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
ppERK_n	ppERK_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
Elk1_n	Elk1_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
pElk1_n	pElk1_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
FOSn	FOSn	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
FOSn_2	FOSn_2	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
Fn	Fn	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
DUSP_n	DUSP_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
pDUSP_n	pDUSP_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
pDUSP_n_ERK_n	pDUSP_n_ERK_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
pDUSP_n_pERK_n	pDUSP_n_pERK_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
pDUSP_n_ppERK_n	pDUSP_n_ppERK_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
DUSP_n_ERK_n	DUSP_n_ERK_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
DUSP_n_pERK_n	DUSP_n_pERK_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
DUSP_n_ppERK_n	DUSP_n_ppERK_n	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
PreDUSPmRNA	PreDUSPmRNA	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
PreFOSmRNA	PreFOSmRNA	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟
PreFmRNA	PreFmRNA	nucleus	$\mathrm{nmol \cdot pl^{-1}}$	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
pRSK_n	pRSK_n	nucleus	$\mathrm{nmol} \cdot \mathrm{pl}^{-1}$	⊟	⊟

5 Parameters

This model contains 141 global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V2	V2		0.220		☑
V3	V3		0.720		☑
K3	K3		160.000		☑
V4	V4		0.648		☑
K4	K4		60.000		☑
V5	V5		19.499		☑
K5	K5		29.941		☑
V6	V6		19.499		☑
K6	K6		29.941		☑
KimERK	KimERK		0.012		☑
KexERK	KexERK		0.018		☑
KimERKP	KimERKP		0.012		☑
KexERKP	KexERKP		0.018		☑
KimERKPP	KimERKPP		0.011		☑
KexERKPP	KexERKPP		0.013		☑
V10	V10		29.241		☑
K10	K10		169.047		☑
n10	n10		3.971		☑
p11	p11		$1.26129 \cdot 10^{-4}$		☑
p12	p12		0.008		☑
p13	p13		0.001		☑
V14	V14		5.637		☑
K14	K14		34180.480		☑
V15	V15		2.992		☑
K15	K15		0.001		☑
p16	p16		$2.57 \cdot 10^{-4}$		☑
p17	p17		$4.81 \cdot 10^{-5}$		☑
KimDUSP	KimDUSP		0.024		☑
KexDUSP	KexDUSP		0.070		☑
KimDUSPP	KimDUSPP		0.024		☑
KexDUSPP	KexDUSPP		0.070		☑
V20	V20		0.158		☑
K20	K20		735598.697		☑
V21	V21		0.006		☑
K21	K21		387.838		☑
p22	p22		$2.57 \cdot 10^{-4}$		☑
p23	p23		$4.81 \cdot 10^{-5}$		☑

Id	Name	SBO	Value	Unit	Constant
V24	V24		0.550		☑
K24	K24		29516.066		☑
V1	V1		0.343		☑
K1	K1		307.042		☑
V25	V25		10.091		☑
K25	K25		0.914		☑
KimRSKP	KimRSKP		0.026		☑
KexRSKP	KexRSKP		0.130		☑
V27	V27		19.231		☑
K27	K27		441.583		☑
V28	V28		6.575		☑
K28	K28		14.992		☑
V29	V29		0.519		☑
K29	K29		21312.691		☑
V30	V30		13.795		☑
K30	K30		15.044		☑
V31	V31		0.655		☑
K31	K31		185.976		☑
n31	n31		1.988		☑
p32	p32		0.003		☑
p33	p33		$6.01234209304622 \cdot 10^{-4}$		☑
p34	p34		$7.64816282169636 \cdot 10^{-5}$		☑
V35	V35		8.908		☑
K35	K35		8562.744		☑
V36	V36		$5.97315 \cdot 10^{-4}$		☑
K36	K36		528.552		☑
V37	V37		1.746		☑
K37	K37		0.070		☑
p38	p38		$2.57 \cdot 10^{-4}$		☑
p39	p39		$4.81 \cdot 10^{-5}$		☑
KimFOS	KimFOS		0.545		☑
KexFOS	KexFOS		0.133		☑
KimFOSP	KimFOSP		0.545		☑
KexFOSP	KexFOSP		0.133		☑
V42	V42		0.910		☑
K42	K42		3992.061		☑
V43	V43		0.077		☑
K43	K43		1157.116		☑
V44	V44		0.078		☑
K44	K44		0.051		☑
p45	p45		$2.57 \cdot 10^{-4}$		☑
p46	p46		$4.81 \cdot 10^{-5}$		☑

Id	Name	SBO	Value	Unit	Constant
p47	p47		0.002		☑
m47	m47		15.808		☑
p48	p48		0.686		☑
p49	p49		0.314		☑
m49	m49		2.335		☑
p50	p50		26.595		☑
p51	p51		0.016		☑
m51	m51		9.544		☑
Fct	Fct		0.749		☑
p52	p52		0.002		☑
m52	m52		15.808		☑
p53	p53		0.686		☑
p54	p54		0.314		☑
m54	m54		2.335		☑
p55	p55		26.595		☑
p56	p56		0.016		☑
m56	m56		9.544		☑
V57	V57		1.027		☑
K57	K57		0.637		☑
n57	n57		3.584		☑
p58	p58		$2.70488 \cdot 10^{-4}$		☑
p59	p59		0.001		☑
p60	p60		0.002		☑
p61	p61		$3.49860901414122 \cdot 10^{-5}$		☑
KimF	KimF		0.020		☑
KexF	KexF		0.397		☑
p63	p63		$4.13466150826031 \cdot 10^{-5}$		☑
KF31	KF31		0.014		☑
nF31	nF31		2.800		☑
K2	K2		350.000		☑
Vn	Vn		220.000		☑
Vc	Vc		940.000		☑
V101	V101		0.018		☑
K101	K101		3475.168		☑
V102	V102		0.099		☑
K102	K102		237.200		☑
V103	V103		0.357		☑
K103	K103		1334.132		☑
V104	V104		4.636		☑
K104	K104		4046.710		☑
V105	V105		0.054		☑
K105	K105		1.028		☑

Id	Name	SBO	Value	Unit	Constant
V106	V106		0.109		☑
K106	K106		606.871		☑
V107	V107		5.291		☑
K107	K107		424.688		☑
V108	V108		0.034		☑
K108	K108		11.505		☑
V109	V109		0.137		☑
K109	K109		7424.816		☑
V110	V110		0.083		☑
K110	K110		425.527		☑
V111	V111		0.025		☑
K111	K111		858.342		☑
V112	V112		0.885		☑
K112	K112		4665.217		☑
V113	V113		0.054		☑
K113	K113		20.508		☑
V114	V114		0.040		☑
K114	K114		7.774		☑
V115	V115		13.742		☑
K115	K115		2122.045		☑

6 Function definitions

This is an overview of 56 function definitions.

6.1 Function definition function_4_v003

Name function_4_v003

Arguments K3, K4, V3, [pERK_c], [ppERK_c]

Mathematical Expression

$$\frac{\mathrm{V3} \cdot [\mathrm{pERK\_c}]}{\mathrm{K3} \cdot \left(1 + \frac{[\mathrm{ppERK\_c}]}{\mathrm{K4}}\right) + [\mathrm{pERK\_c}]} \tag{1}$$

6.2 Function definition function_4_v004

Name function_4_v004

Arguments K3, K4, V4, [pERK_c], [ppERK_c]

Mathematical Expression

$$\frac{\mathrm{V4} \cdot [\mathrm{ppERK\_c}]}{\mathrm{K4} \cdot \left(1 + \frac{[\mathrm{pERK\_c}]}{\mathrm{K3}}\right) + [\mathrm{ppERK\_c}]} \tag{2}$$

6.3 Function definition function_4_v005

Name function_4_v005

Arguments K5, K6, V5, [pERK_n], [ppERK_n]

Mathematical Expression

$$\frac{\mathrm{V5} \cdot [\mathrm{pERK\_n}]}{\mathrm{K5} \cdot \left(1 + \frac{[\mathrm{ppERK\_n}]}{\mathrm{K6}}\right) + [\mathrm{pERK\_n}]} \tag{3}$$

6.4 Function definition function_4_v006

Name function_4_v006

Arguments K5, K6, V6, [pERK_n], [ppERK_n]

Mathematical Expression

$$\frac{\mathrm{V6} \cdot [\mathrm{ppERK\_n}]}{\mathrm{K6} \cdot \left(1 + \frac{[\mathrm{pERK\_n}]}{\mathrm{K5}}\right) + [\mathrm{ppERK\_n}]} \tag{4}$$

6.5 Function definition function_4_v007

Name function_4_v007

Arguments KexERK, KimERK, Vc, Vn, [ERK_c], [ERK_n]

Mathematical Expression

$$\mathrm{KimERK} \cdot \mathrm{Vc} \cdot [\mathrm{ERK\_c}] - \mathrm{KexERK} \cdot \mathrm{Vn} \cdot [\mathrm{ERK\_n}] \tag{5}$$

6.6 Function definition function_4_v008

Name function_4_v008

Arguments KexERKP, KimERKP, Vc, Vn, [pERK_c], [pERK_n]

Mathematical Expression

$$\mathrm{KimERKP} \cdot \mathrm{Vc} \cdot [\mathrm{pERK\_c}] - \mathrm{KexERKP} \cdot \mathrm{Vn} \cdot [\mathrm{pERK\_n}] \tag{6}$$

6.7 Function definition function_4_v015

Name function_4_v015

Arguments K15, V15, [pDUSP_c]

Mathematical Expression

$$\frac{\mathrm{V15} \cdot [\mathrm{pDUSP\_c}]}{\mathrm{K15} + [\mathrm{pDUSP\_c}]} \tag{7}$$

6.8 Function definition function_4_v018

Name function_4_v018

Arguments KexDUSP, KimDUSP, Vc, Vn, [DUSP_n], [DUSP_c]

Mathematical Expression

$$\mathrm{KimDUSP} \cdot \mathrm{Vc} \cdot [\mathrm{DUSP\_c}] - \mathrm{KexDUSP} \cdot \mathrm{Vn} \cdot [\mathrm{DUSP\_n}] \tag{8}$$

6.9 Function definition function_4_v019

Name function_4_v019

Arguments KexDUSPP, KimDUSPP, Vc, Vn, [pDUSP_c], [pDUSP_n]

Mathematical Expression

$$\mathrm{KimDUSPP} \cdot \mathrm{Vc} \cdot [\mathrm{pDUSP\_c}] - \mathrm{KexDUSPP} \cdot \mathrm{Vn} \cdot [\mathrm{pDUSP\_n}] \tag{9}$$

6.10 Function definition function_4_v020

Name function_4_v020

Arguments K20, V20, [ppERK_n], [DUSP_n]

Mathematical Expression

$$\frac{\mathrm{V20} \cdot [\mathrm{ppERK\_n}] \cdot [\mathrm{DUSP\_n}]}{\mathrm{K20} + [\mathrm{DUSP\_n}]} \tag{10}$$

6.11 Function definition function_4_v021

Name function_4_v021

Arguments K21, V21, [pDUSP_n]

Mathematical Expression

$$\frac{\mathrm{V21} \cdot [\mathrm{pDUSP\_n}]}{\mathrm{K21} + [\mathrm{pDUSP\_n}]} \tag{11}$$

6.12 Function definition function_4_v024

Name function_4_v024

Arguments K24, V24, [ppERK_c], [RSK_c]

Mathematical Expression

$$\frac{\mathrm{V24} \cdot [\mathrm{ppERK\_c}] \cdot [\mathrm{RSK\_c}]}{\mathrm{K24} + [\mathrm{RSK\_c}]} \tag{12}$$

6.13 Function definition function_4_v001

Name function_4_v001

Arguments Fct, K1, K2, V1, [ERK_c], [pERK_c], MEKc

Mathematical Expression

$$\frac{\mathrm{V1} \cdot \mathrm{Fct} \cdot \mathrm{MEKc} \cdot [\mathrm{ERK\_c}]}{\mathrm{K1} \cdot \left(1 + \frac{[\mathrm{pERK\_c}]}{\mathrm{K2}}\right) + [\mathrm{ERK\_c}]} \tag{13}$$

6.14 Function definition function_4_v009

Name function_4_v009

Arguments KexERKPP, KimERKPP, Vc, Vn, [ppERK_c], [ppERK_n]

Mathematical Expression

$$\mathrm{KimERKPP} \cdot \mathrm{Vc} \cdot [\mathrm{ppERK\_c}] - \mathrm{KexERKPP} \cdot \mathrm{Vn} \cdot [\mathrm{ppERK\_n}] \tag{14}$$

6.15 Function definition function_4_v010

Name function_4_v010

Arguments K10, V10, n10, [ppERK_n]

Mathematical Expression

$$\frac{\mathrm{V10} \cdot [\mathrm{ppERK\_n}]^{\mathrm{n10}}}{\mathrm{K10}^{\mathrm{n10}} + [\mathrm{ppERK\_n}]^{\mathrm{n10}}} \tag{15}$$

6.16 Function definition function_4_v011

Name function_4_v011

Arguments Vn, p11, [PreDUSPmRNA]

Mathematical Expression

$$\mathrm{p11} \cdot \mathrm{Vn} \cdot [\mathrm{PreDUSPmRNA}] \tag{16}$$

6.17 Function definition function_4_v013

Name function_4_v013

Arguments p13, [DUSPmRNA]

Mathematical Expression

$$\mathrm{p13} \cdot [\mathrm{DUSPmRNA}] \tag{17}$$

6.18 Function definition function_4_v014

Name function_4_v014

Arguments K14, V14, [ppERK_c], [DUSP_c]

Mathematical Expression

$$\frac{\mathrm{V14} \cdot [\mathrm{ppERK\_c}] \cdot [\mathrm{DUSP\_c}]}{\mathrm{K14} + [\mathrm{DUSP\_c}]} \tag{18}$$

6.19 Function definition function_4_v002

Name function_4_v002

Arguments Fct, K1, K2, V2, [ERK_c], [pERK_c], MEKc

Mathematical Expression

$$\frac{\mathrm{V2} \cdot \mathrm{Fct} \cdot \mathrm{MEKc} \cdot [\mathrm{pERK\_c}]}{\mathrm{K2} \cdot \left(1 + \frac{[\mathrm{ERK\_c}]}{\mathrm{K1}}\right) + [\mathrm{pERK\_c}]} \tag{19}$$

6.20 Function definition function_4_v029

Name function_4_v029

Arguments K29, V29, [ppERK_n], [Elk1_n]

Mathematical Expression

$$\frac{\mathrm{V29} \cdot [\mathrm{ppERK\_n}] \cdot [\mathrm{Elk1\_n}]}{\mathrm{K29} + [\mathrm{Elk1\_n}]} \tag{20}$$

6.21 Function definition function_4_v025

Name function_4_v025

Arguments K25, V25, [pRSK_c]

Mathematical Expression

$$\frac{\mathrm{V25} \cdot [\mathrm{pRSK\_c}]}{\mathrm{K25} + [\mathrm{pRSK\_c}]} \tag{21}$$

6.22 Function definition function_4_v026

Name function_4_v026

Arguments KexRSKP, KimRSKP, Vc, Vn, [pRSK_n], [pRSK_c]

Mathematical Expression

$$\text{KimRSKP} \cdot \text{Vc} \cdot [\text{pRSK\_c}] - \text{KexRSKP} \cdot \text{Vn} \cdot [\text{pRSK\_n}] \tag{22}$$

6.23 Function definition function_4_v032

Name function_4_v032

Arguments Vn, p32, [PreFOSmRNA]

Mathematical Expression

$$\text{p32} \cdot \text{Vn} \cdot [\text{PreFOSmRNA}] \tag{23}$$

6.24 Function definition function_4_v034

Name function_4_v034

Arguments p34, [c_FOSmRNA]

Mathematical Expression

$$\text{p34} \cdot [\text{c\_FOSmRNA}] \tag{24}$$

6.25 Function definition function_4_v035

Name function_4_v035

Arguments K35, V35, [c_FOS_c], [ppERK_c]

Mathematical Expression

$$\frac{\text{V35} \cdot [\text{ppERK\_c}] \cdot [\text{c\_FOS\_c}]}{\text{K35} + [\text{c\_FOS\_c}]} \tag{25}$$

6.26 Function definition function_4_v036

Name function_4_v036

Arguments K36, V36, [c_FOS_c], [pRSK_c]

Mathematical Expression

$$\frac{\text{V36} \cdot [\text{pRSK\_c}] \cdot [\text{c\_FOS\_c}]}{\text{K36} + [\text{c\_FOS\_c}]} \tag{26}$$

6.27 Function definition function_4_v037

Name function_4_v037

Arguments K37, V37, [pc_FOS_c]

Mathematical Expression

$$\frac{\mathrm{V37} \cdot [\mathrm{pc\_FOS\_c}]}{\mathrm{K37} + [\mathrm{pc\_FOS\_c}]} \tag{27}$$

6.28 Function definition function_4_v027

Name function_4_v027

Arguments K27, V27, [CREB_n], [pRSK_n]

Mathematical Expression

$$\frac{\mathrm{V27} \cdot [\mathrm{pRSK\_n}] \cdot [\mathrm{CREB\_n}]}{\mathrm{K27} + [\mathrm{CREB\_n}]} \tag{28}$$

6.29 Function definition function_4_v028

Name function_4_v028

Arguments K28, V28, [pCREB_n]

Mathematical Expression

$$\frac{\mathrm{V28} \cdot [\mathrm{pCREB\_n}]}{\mathrm{K28} + [\mathrm{pCREB\_n}]} \tag{29}$$

6.30 Function definition function_4_v030

Name function_4_v030

Arguments K30, V30, [pElk1_n]

Mathematical Expression

$$\frac{\mathrm{V30} \cdot [\mathrm{pElk1\_n}]}{\mathrm{K30} + [\mathrm{pElk1\_n}]} \tag{30}$$

6.31 Function definition function_4_v031

Name function_4_v031

Arguments K31, KF31, V31, n31, nF31, [Fn], [pCREB_n], [pElk1_n]

Mathematical Expression

$$\frac{\mathrm{V31} \cdot ([\mathrm{pCREB\_n}] \cdot [\mathrm{pElk1\_n}])^{\mathrm{n31}}}{\mathrm{K31}^{\mathrm{n31}} + ([\mathrm{pCREB\_n}] \cdot [\mathrm{pElk1\_n}])^{\mathrm{n31}} + \left(\frac{[\mathrm{Fn}]}{\mathrm{KF31}}\right)^{\mathrm{nF31}}} \tag{31}$$

6.32 Function definition function_4_v040

Name function_4_v040

Arguments KexFOS, KimFOS, Vc, Vn, [c_FOS_c], [FOSn]

Mathematical Expression

$$\mathrm{KimFOS} \cdot \mathrm{Vc} \cdot [\mathrm{c\_FOS\_c}] - \mathrm{KexFOS} \cdot \mathrm{Vn} \cdot [\mathrm{FOSn}] \tag{32}$$

6.33 Function definition function_4_v041

Name function_4_v041

Arguments KexFOSP, KimFOSP, Vc, Vn, [pc_FOS_c], [FOSn_2]

Mathematical Expression

$$\mathrm{KimFOSP} \cdot \mathrm{Vc} \cdot [\mathrm{pc\_FOS\_c}] - \mathrm{KexFOSP} \cdot \mathrm{Vn} \cdot [\mathrm{FOSn\_2}] \tag{33}$$

6.34 Function definition function_4_v042

Name function_4_v042

Arguments K42, V42, [ppERK_n], [FOSn]

Mathematical Expression

$$\frac{\mathrm{V42} \cdot [\mathrm{ppERK\_n}] \cdot [\mathrm{FOSn}]}{\mathrm{K42} + [\mathrm{FOSn}]} \tag{34}$$

6.35 Function definition function_4_v043

Name function_4_v043

Arguments K43, V43, [FOSn], [pRSK_n]

Mathematical Expression

$$\frac{\mathrm{V43} \cdot [\mathrm{pRSK\_n}] \cdot [\mathrm{FOSn}]}{\mathrm{K43} + [\mathrm{FOSn}]} \tag{35}$$

6.36 Function definition function_4_v044

Name function_4_v044

Arguments K44, V44, [FOSn_2]

Mathematical Expression

$$\frac{\mathrm{V44} \cdot [\mathrm{FOSn\_2}]}{\mathrm{K44} + [\mathrm{FOSn\_2}]} \tag{36}$$

6.37 Function definition function_4_v057

Name function_4_v057

Arguments K57, V57, n57, [FOSn_2]

Mathematical Expression

$$\frac{\mathrm{V57} \cdot [\mathrm{FOSn\_2}]^{\mathrm{n57}}}{\mathrm{K57}^{\mathrm{n57}} + [\mathrm{FOSn\_2}]^{\mathrm{n57}}} \tag{37}$$

6.38 Function definition function_4_v058

Name function_4_v058

Arguments Vn, p58, [PreFmRNA]

Mathematical Expression

$$\mathrm{p58} \cdot \mathrm{Vn} \cdot [\mathrm{PreFmRNA}] \tag{38}$$

6.39 Function definition function_4_v060

Name function_4_v060

Arguments p60, [FmRNA]

Mathematical Expression

$$\mathrm{p60} \cdot [\mathrm{FmRNA}] \tag{39}$$

6.40 Function definition function_4_v062

Name function_4_v062

Arguments KexF, KimF, Vc, Vn, [F], [Fn]

Mathematical Expression

$$\mathrm{KimF} \cdot \mathrm{Vc} \cdot [\mathrm{F}] - \mathrm{KexF} \cdot \mathrm{Vn} \cdot [\mathrm{Fn}] \tag{40}$$

6.41 Function definition function_4_v063

Name function_4_v063

Arguments vol (cytoplasm), vol (nucleus), p63, [Fn]

Mathematical Expression

$$\frac{\text{vol}\,(\text{cytoplasm}) \cdot \text{p63} \cdot [\text{Fn}]}{\text{vol}\,(\text{nucleus})} \tag{41}$$

6.42 Function definition function_4_v101

Name function_4_v101

Arguments K101, V101, [A1], [EGF]

Mathematical Expression

$$\frac{\text{V101} \cdot [\text{EGF}] \cdot [\text{A1}]}{\text{K101} + [\text{A1}]} \tag{42}$$

6.43 Function definition function_4_v102

Name function_4_v102

Arguments K102, V102, [A1_2]

Mathematical Expression

$$\frac{\text{V102} \cdot [\text{A1\_2}]}{\text{K102} + [\text{A1\_2}]} \tag{43}$$

6.44 Function definition function_4_v103

Name function_4_v103

Arguments K103, V103, [A2], [HRG]

Mathematical Expression

$$\frac{\text{V103} \cdot [\text{HRG}] \cdot [\text{A2}]}{\text{K103} + [\text{A2}]} \tag{44}$$

6.45 Function definition function_4_v104

Name function_4_v104

Arguments K104, V104, [A2_2]

Mathematical Expression

$$\frac{\text{V104} \cdot [\text{A2\_2}]}{\text{K104} + [\text{A2\_2}]} \tag{45}$$

6.46 Function definition function_4_v105

Name function_4_v105

Arguments K105, V105, [EGF], [RsD]

Mathematical Expression

$$\frac{\mathrm{V105} \cdot [\mathrm{EGF}] \cdot [\mathrm{RsD}]}{\mathrm{K105} + [\mathrm{RsD}]} \tag{46}$$

6.47 Function definition function_4_v106

Name function_4_v106

Arguments K106, V106, [HRG], [RsD]

Mathematical Expression

$$\frac{\mathrm{V106} \cdot [\mathrm{HRG}] \cdot [\mathrm{RsD}]}{\mathrm{K106} + [\mathrm{RsD}]} \tag{47}$$

6.48 Function definition function_4_v107

Name function_4_v107

Arguments K107, V107, [A1_2], [RsT]

Mathematical Expression

$$\frac{\mathrm{V107} \cdot [\mathrm{A1\_2}] \cdot [\mathrm{RsT}]}{\mathrm{K107} + [\mathrm{RsT}]} \tag{48}$$

6.49 Function definition function_4_v108

Name function_4_v108

Arguments K108, V108, [A2_2], [RsT]

Mathematical Expression

$$\frac{\mathrm{V108} \cdot [\mathrm{A2\_2}] \cdot [\mathrm{RsT}]}{\mathrm{K108} + [\mathrm{RsT}]} \tag{49}$$

6.50 Function definition function_4_v109

Name function_4_v109

Arguments K109, V109, [HRG], [A3]

Mathematical Expression

$$\frac{\mathrm{V109} \cdot [\mathrm{HRG}] \cdot [\mathrm{A3}]}{\mathrm{K109} + [\mathrm{A3}]} \tag{50}$$

6.51 Function definition function_4_v110

Name function_4_v110

Arguments K110, V110, [A3_2]

Mathematical Expression

$$\frac{\mathrm{V110} \cdot [\mathrm{A3\_2}]}{\mathrm{K110} + [\mathrm{A3\_2}]} \tag{51}$$

6.52 Function definition function_4_v111

Name function_4_v111

Arguments K111, V111, [HRG], [Kin]

Mathematical Expression

$$\frac{\mathrm{V111} \cdot [\mathrm{HRG}] \cdot [\mathrm{Kin}]}{\mathrm{K111} + [\mathrm{Kin}]} \tag{52}$$

6.53 Function definition function_4_v112

Name function_4_v112

Arguments K112, V112, [A3_2], [Kin_2]

Mathematical Expression

$$\frac{\mathrm{V112} \cdot [\mathrm{A3\_2}] \cdot [\mathrm{Kin\_2}]}{\mathrm{K112} + [\mathrm{Kin\_2}]} \tag{53}$$

6.54 Function definition function_4_v113

Name function_4_v113

Arguments K113, V113, [RsT], pMEK_c

Mathematical Expression

$$\frac{\mathrm{V113} \cdot [\mathrm{RsT}] \cdot \mathrm{pMEK\_c}}{\mathrm{K113} + \mathrm{pMEK\_c}} \tag{54}$$

6.55 Function definition function_4_v114

Name function_4_v114

Arguments K114, V114, [Kin_2], pMEK_c

Mathematical Expression

$$\frac{\mathrm{V114} \cdot [\mathrm{Kin\_2}] \cdot \mathrm{pMEK\_c}}{\mathrm{K114} + \mathrm{pMEK\_c}} \tag{55}$$

6.56 Function definition function_4_v115

Name function_4_v115

Arguments K115, V115, MEKc

Mathematical Expression

$$\frac{\mathrm{V115} \cdot \mathrm{MEKc}}{\mathrm{K115} + \mathrm{MEKc}} \tag{56}$$

7 Reactions

This model contains 78 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	reaction_32	v001	$\mathrm{ERK\_c} \xrightarrow{\mathrm{pMEK,\ pERK\_c}} \mathrm{pERK\_c}$	
2	reaction_6	v002	$\mathrm{pERK\_c} \xrightarrow{\mathrm{pMEK,\ ERK\_c}} \mathrm{ppERK\_c}$	
3	re85	v003	$\mathrm{pERK\_c} \xrightarrow{\mathrm{ppERK\_c}} \mathrm{ERK\_c}$	
4	re86	v004	$\mathrm{ppERK\_c} \xrightarrow{\mathrm{pERK\_c}} \mathrm{pERK\_c}$	
5	re87	v005	$\mathrm{pERK\_n} \xrightarrow{\mathrm{ppERK\_n}} \mathrm{ERK\_n}$	
6	re88	v006	$\mathrm{ppERK\_n} \xrightarrow{\mathrm{pERK\_n}} \mathrm{pERK\_n}$	
7	re106	v007	$\mathrm{ERK\_c} \rightleftharpoons \mathrm{ERK\_n}$	
8	re107	v008	$\mathrm{pERK\_c} \rightleftharpoons \mathrm{pERK\_n}$	
9	re108	v009	$\mathrm{ppERK\_c} \rightleftharpoons \mathrm{ppERK\_n}$	
10	re109	v010	$\emptyset \xrightarrow{\mathrm{ppERK\_n}} \mathrm{PreDUSPmRNA}$	
11	re110	v011	$\mathrm{PreDUSPmRNA} \longrightarrow \mathrm{DUSPmRNA}$	
12	reaction_17	v012	$\mathrm{DUSPmRNA} \longrightarrow \emptyset$	
13	re89	v013	$\emptyset \xrightarrow{\mathrm{DUSPmRNA}} \mathrm{DUSP\_c}$	
14	reaction_33	v014	$\mathrm{DUSP\_c} \xrightarrow{\mathrm{ppERK\_c}} \mathrm{pDUSP\_c}$	
15	reaction_34	v015	$\mathrm{pDUSP\_c} \longrightarrow \mathrm{DUSP\_c}$	
16	reaction_35	v016	$\mathrm{DUSP\_c} \longrightarrow \emptyset$	
17	reaction_36	v017	$\mathrm{pDUSP\_c} \longrightarrow \emptyset$	
18	re111	v018	$\mathrm{DUSP\_c} \rightleftharpoons \mathrm{DUSP\_n}$	
19	re112	v019	$\mathrm{pDUSP\_c} \rightleftharpoons \mathrm{pDUSP\_n}$	

№	Id	Name	Reaction Equation	SBO
20	reaction_12	v020	$\mathrm{DUSP\_n} \xrightarrow{\mathrm{ppERK\_n}} \mathrm{pDUSP\_n}$	
21	reaction_13	v021	$\mathrm{pDUSP\_n} \longrightarrow \mathrm{DUSP\_n}$	
22	reaction_14	v022	$\mathrm{DUSP\_n} \longrightarrow \emptyset$	
23	reaction_15	v023	$\mathrm{pDUSP\_n} \longrightarrow \emptyset$	
24	reaction_41	v024	$\mathrm{RSK\_c} \xrightarrow{\mathrm{ppERK\_c}} \mathrm{pRSK\_c}$	
25	reaction_42	v025	$\mathrm{pRSK\_c} \longrightarrow \mathrm{RSK\_c}$	
26	re113	v026	$\mathrm{pRSK\_c} \rightleftharpoons \mathrm{pRSK\_n}$	
27	reaction_45	v027	$\mathrm{CREB\_n} \xrightarrow{\mathrm{pRSK\_n}} \mathrm{pCREB\_n}$	
28	reaction_46	v028	$\mathrm{pCREB\_n} \longrightarrow \mathrm{CREB\_n}$	
29	reaction_57	v029	$\mathrm{Elk1\_n} \xrightarrow{\mathrm{ppERK\_n}} \mathrm{pElk1\_n}$	
30	reaction_58	v030	$\mathrm{pElk1\_n} \longrightarrow \mathrm{Elk1\_n}$	
31	reaction_47	v031	$\emptyset \xrightarrow{\mathrm{pCREB\_n,\ pElk1\_n,\ Fn}} \mathrm{PreFOSmRNA}$	
32	re115	v032	$\mathrm{PreFOSmRNA} \longrightarrow \mathrm{c\_FOSmRNA}$	
33	reaction_50	v033	$\mathrm{c\_FOSmRNA} \longrightarrow \emptyset$	
34	re90	v034	$\emptyset \xrightarrow{\mathrm{c\_FOSmRNA}} \mathrm{c\_FOS\_c}$	
35	reaction_59	v035	$\mathrm{c\_FOS\_c} \xrightarrow{\mathrm{ppERK\_c}} \mathrm{pc\_FOS\_c}$	
36	reaction_67	v036	$\mathrm{c\_FOS\_c} \xrightarrow{\mathrm{pRSK\_c}} \mathrm{pc\_FOS\_c}$	
37	reaction_60	v037	$\mathrm{pc\_FOS\_c} \longrightarrow \mathrm{c\_FOS\_c}$	
38	reaction_61	v038	$\mathrm{c\_FOS\_c} \longrightarrow \emptyset$	
39	reaction_62	v039	$\mathrm{pc\_FOS\_c} \longrightarrow \emptyset$	
40	re116	v040	$\mathrm{c\_FOS\_c} \rightleftharpoons \mathrm{FOSn}$	
41	re117	v041	$\mathrm{pc\_FOS\_c} \rightleftharpoons \mathrm{FOSn\_2}$	
42	reaction_52	v042	$\mathrm{FOSn} \xrightarrow{\mathrm{ppERK\_n}} \mathrm{FOSn\_2}$	
43	reaction_53	v043	$\mathrm{FOSn} \xrightarrow{\mathrm{pRSK\_n}} \mathrm{FOSn\_2}$	

№	Id	Name	Reaction Equation	SBO
44	reaction_54	v044	$\mathrm{FOSn\_2} \longrightarrow \mathrm{FOSn}$	
45	reaction_55	v045	$\mathrm{FOSn} \longrightarrow \emptyset$	
46	reaction_56	v046	$\mathrm{FOSn\_2} \longrightarrow \emptyset$	
47	reaction_25	v047	$\mathrm{pDUSP\_n} + \mathrm{ppERK\_n} \rightleftharpoons \mathrm{pDUSP\_n\_ppERK\_n}$	
48	reaction_26	v048	$\mathrm{pDUSP\_n\_ppERK\_n} \longrightarrow \mathrm{pDUSP\_n} + \mathrm{pERK\_n}$	
49	reaction_27	v049	$\mathrm{pDUSP\_n} + \mathrm{pERK\_n} \rightleftharpoons \mathrm{pDUSP\_n\_pERK\_n}$	
50	reaction_28	v050	$\mathrm{pDUSP\_n\_pERK\_n} \longrightarrow \mathrm{pDUSP\_n} + \mathrm{ERK\_n}$	
51	reaction_30	v051	$\mathrm{pDUSP\_n} + \mathrm{ERK\_n} \rightleftharpoons \mathrm{pDUSP\_n\_ERK\_n}$	
52	reaction_21	v052	$\mathrm{DUSP\_n} + \mathrm{ppERK\_n} \rightleftharpoons \mathrm{DUSP\_n\_ppERK\_n}$	
53	reaction_22	v053	$\mathrm{DUSP\_n\_ppERK\_n} \longrightarrow \mathrm{DUSP\_n} + \mathrm{pERK\_n}$	
54	reaction_23	v054	$\mathrm{DUSP\_n} + \mathrm{pERK\_n} \rightleftharpoons \mathrm{DUSP\_n\_pERK\_n}$	
55	reaction_24	v055	$\mathrm{DUSP\_n\_pERK\_n} \longrightarrow \mathrm{DUSP\_n} + \mathrm{ERK\_n}$	
56	reaction_29	v056	$\mathrm{DUSP\_n} + \mathrm{ERK\_n} \rightleftharpoons \mathrm{DUSP\_n\_ERK\_n}$	
57	re92	v057	$\emptyset \xrightarrow{\mathrm{FOSn\_2}} \mathrm{PreFmRNA}$	
58	re118	v058	$\mathrm{PreFmRNA} \longrightarrow \mathrm{FmRNA}$	
59	re94	v059	$\mathrm{FmRNA} \longrightarrow \emptyset$	
60	re95	v060	$\emptyset \xrightarrow{\mathrm{FmRNA}} \mathrm{F}$	
61	re96	v061	$\mathrm{F} \longrightarrow \emptyset$	
62	re119	v062	$\mathrm{F} \rightleftharpoons \mathrm{Fn}$	
63	re99	v063	$\mathrm{Fn} \longrightarrow \emptyset$	
64	reaction_31	v101	$\mathrm{A1} \xrightarrow{\mathrm{EGF}} \mathrm{A1\_2}$	
65	reaction_68	v102	$\mathrm{A1\_2} \longrightarrow \mathrm{A1}$	
66	reaction_69	v103	$\mathrm{A2} \xrightarrow{\mathrm{HRG}} \mathrm{A2\_2}$	
67	reaction_70	v104	$\mathrm{A2\_2} \longrightarrow \mathrm{A2}$	
68	reaction_71	v105	$\mathrm{RsD} \xrightarrow{\mathrm{EGF}} \mathrm{RsT}$	
69	reaction_72	v106	$\mathrm{RsD} \xrightarrow{\mathrm{HRG}} \mathrm{RsT}$	

№	Id	Name	Reaction Equation	SBO
70	reaction_73	v107	$\mathrm{RsT} \xrightarrow{\mathrm{A1\_2}} \mathrm{RsD}$	
71	reaction_74	v108	$\mathrm{RsT} \xrightarrow{\mathrm{A2\_2}} \mathrm{RsD}$	
72	reaction_75	v109	$\mathrm{A3} \xrightarrow{\mathrm{HRG}} \mathrm{A3\_2}$	
73	reaction_76	v110	$\mathrm{A3\_2} \longrightarrow \mathrm{A3}$	
74	reaction_77	v111	$\mathrm{Kin} \xrightarrow{\mathrm{HRG}} \mathrm{Kin\_2}$	
75	reaction_78	v112	$\mathrm{Kin\_2} \xrightarrow{\mathrm{A3\_2}} \mathrm{Kin}$	
76	reaction_79	v113	$\mathrm{MEK} \xrightarrow{\mathrm{RsT}} \mathrm{pMEK}$	
77	reaction_80	v114	$\mathrm{MEK} \xrightarrow{\mathrm{Kin\_2}} \mathrm{pMEK}$	
78	reaction_81	v115	$\mathrm{pMEK} \longrightarrow \mathrm{MEK}$	

7.1 Reaction reaction_32

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

Name v001

Reaction equation

$$\text{ERK\_c} \xrightarrow{\text{pMEK, pERK\_c}} \text{pERK\_c} \tag{57}$$

Reactant

Table 6: Properties of each reactant.

Id	Name	SBO
ERK_c	ERK_c	

Modifiers

Table 7: Properties of each modifier.

Id	Name	SBO
pMEK	pMEK	
pERK_c	pERK_c	

Product

Table 8: Properties of each product.

Id	Name	SBO
pERK_c	pERK_c	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \text{vol}\left(\text{cytoplasm}\right) \cdot \text{function\_4\_v001}\left(\text{Fct}, \text{K1}, \text{K2}, \text{V1}, [\text{ERK\_c}], [\text{pERK\_c}], [\text{pMEK}]\right) \tag{58}$$

$$\begin{aligned} &\text{function\_4\_v001}\left(\text{Fct}, \text{K1}, \text{K2}, \text{V1}, [\text{ERK\_c}], [\text{pERK\_c}], \text{MEKc}\right) \\ &= \frac{\text{V1} \cdot \text{Fct} \cdot \text{MEKc} \cdot [\text{ERK\_c}]}{\text{K1} \cdot \left(1 + \frac{[\text{pERK\_c}]}{\text{K2}}\right) + [\text{ERK\_c}]} \end{aligned} \tag{59}$$

$$\begin{aligned}&\text{function\_4\_v001}\left(\text{Fct}, \text{K1}, \text{K2}, \text{V1}, [\text{ERK\_c}], [\text{pERK\_c}], \text{MEKc}\right)\\&= \frac{\text{V1} \cdot \text{Fct} \cdot \text{MEKc} \cdot [\text{ERK\_c}]}{\text{K1} \cdot \left(1 + \frac{[\text{pERK\_c}]}{\text{K2}}\right) + [\text{ERK\_c}]}\end{aligned} \tag{60}$$

7.2 Reaction `reaction_6`

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

Name v002

Reaction equation

$$\text{pERK\_c} \xrightarrow{\text{pMEK, ERK\_c}} \text{ppERK\_c} \tag{61}$$

Reactant

Table 9: Properties of each reactant.

Id	Name	SBO
pERK_c	pERK_c	

Modifiers

Table 10: Properties of each modifier.

Id	Name	SBO
pMEK	pMEK	
ERK_c	ERK_c	

Product

Table 11: Properties of each product.

Id	Name	SBO
ppERK_c	ppERK_c	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \text{vol}\left(\text{cytoplasm}\right) \cdot \text{function\_4\_v002}\left(\text{Fct}, \text{K1}, \text{K2}, \text{V2}, [\text{ERK\_c}], [\text{pERK\_c}], [\text{pMEK}]\right) \tag{62}$$

$$\begin{aligned}&\text{function\_4\_v002}\left(\text{Fct}, \text{K1}, \text{K2}, \text{V2}, [\text{ERK\_c}], [\text{pERK\_c}], \text{MEKc}\right)\\&= \frac{\text{V2} \cdot \text{Fct} \cdot \text{MEKc} \cdot [\text{pERK\_c}]}{\text{K2} \cdot \left(1 + \frac{[\text{ERK\_c}]}{\text{K1}}\right) + [\text{pERK\_c}]}\end{aligned} \tag{63}$$

$$\begin{aligned}&\text{function\_4\_v002}\left(\text{Fct}, \text{K1}, \text{K2}, \text{V2}, [\text{ERK\_c}], [\text{pERK\_c}], \text{MEKc}\right)\\&= \frac{\text{V2} \cdot \text{Fct} \cdot \text{MEKc} \cdot [\text{pERK\_c}]}{\text{K2} \cdot \left(1 + \frac{[\text{ERK\_c}]}{\text{K1}}\right) + [\text{pERK\_c}]}\end{aligned} \tag{64}$$

7.3 Reaction re85

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

Name v003

Reaction equation

$$\text{pERK\_c} \xrightarrow{\text{ppERK\_c}} \text{ERK\_c} \tag{65}$$

Reactant

Table 12: Properties of each reactant.

Id	Name	SBO
pERK_c	pERK_c	

Modifier

Table 13: Properties of each modifier.

Id	Name	SBO
ppERK_c	ppERK_c	

Product

Table 14: Properties of each product.

Id	Name	SBO
ERK_c	ERK_c	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{function\_4\_v003}\,(\mathrm{K3}, \mathrm{K4}, \mathrm{V3}, [\mathrm{pERK\_c}], [\mathrm{ppERK\_c}]) \tag{66}$$

$$\mathrm{function\_4\_v003}\,(\mathrm{K3}, \mathrm{K4}, \mathrm{V3}, [\mathrm{pERK\_c}], [\mathrm{ppERK\_c}]) = \frac{\mathrm{V3} \cdot [\mathrm{pERK\_c}]}{\mathrm{K3} \cdot \left(1 + \frac{[\mathrm{ppERK\_c}]}{\mathrm{K4}}\right) + [\mathrm{pERK\_c}]} \tag{67}$$

$$\mathrm{function\_4\_v003}\,(\mathrm{K3}, \mathrm{K4}, \mathrm{V3}, [\mathrm{pERK\_c}], [\mathrm{ppERK\_c}]) = \frac{\mathrm{V3} \cdot [\mathrm{pERK\_c}]}{\mathrm{K3} \cdot \left(1 + \frac{[\mathrm{ppERK\_c}]}{\mathrm{K4}}\right) + [\mathrm{pERK\_c}]} \tag{68}$$

7.4 Reaction `re86`

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

Name v004

Reaction equation

$$\mathrm{ppERK\_c} \xrightarrow{\mathrm{pERK\_c}} \mathrm{pERK\_c} \tag{69}$$

Reactant

Table 15: Properties of each reactant.

Id	Name	SBO
ppERK_c	ppERK_c	

Modifier

Table 16: Properties of each modifier.

Id	Name	SBO
pERK_c	pERK_c	

Product

Table 17: Properties of each product.

Id	Name	SBO
pERK_c	pERK_c	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{function\_4\_v004}\,(\mathrm{K3}, \mathrm{K4}, \mathrm{V4}, [\mathrm{pERK\_c}], [\mathrm{ppERK\_c}]) \tag{70}$$

$$\mathrm{function\_4\_v004}\,(\mathrm{K3}, \mathrm{K4}, \mathrm{V4}, [\mathrm{pERK\_c}], [\mathrm{ppERK\_c}]) = \frac{\mathrm{V4} \cdot [\mathrm{ppERK\_c}]}{\mathrm{K4} \cdot \left(1 + \frac{[\mathrm{pERK\_c}]}{\mathrm{K3}}\right) + [\mathrm{ppERK\_c}]} \tag{71}$$

$$\mathrm{function\_4\_v004}\,(\mathrm{K3}, \mathrm{K4}, \mathrm{V4}, [\mathrm{pERK\_c}], [\mathrm{ppERK\_c}]) = \frac{\mathrm{V4} \cdot [\mathrm{ppERK\_c}]}{\mathrm{K4} \cdot \left(1 + \frac{[\mathrm{pERK\_c}]}{\mathrm{K3}}\right) + [\mathrm{ppERK\_c}]} \tag{72}$$

7.5 Reaction re87

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

Name v005

Reaction equation

$$\mathrm{pERK\_n} \xrightarrow{\mathrm{ppERK\_n}} \mathrm{ERK\_n} \tag{73}$$

Reactant

Table 18: Properties of each reactant.

Id	Name	SBO
pERK_n	pERK_n	

Modifier

Table 19: Properties of each modifier.

Id	Name	SBO
ppERK_n	ppERK_n	

Product

Table 20: Properties of each product.

Id	Name	SBO
ERK_n	ERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \text{vol}\,(\text{nucleus}) \cdot \text{function\_4\_v005}\,(\text{K5}, \text{K6}, \text{V5}, [\text{pERK\_n}], [\text{ppERK\_n}]) \tag{74}$$

$$\text{function\_4\_v005}\,(\text{K5}, \text{K6}, \text{V5}, [\text{pERK\_n}], [\text{ppERK\_n}]) = \frac{\text{V5} \cdot [\text{pERK\_n}]}{\text{K5} \cdot \left(1 + \frac{[\text{ppERK\_n}]}{\text{K6}}\right) + [\text{pERK\_n}]} \tag{75}$$

$$\text{function\_4\_v005}\,(\text{K5}, \text{K6}, \text{V5}, [\text{pERK\_n}], [\text{ppERK\_n}]) = \frac{\text{V5} \cdot [\text{pERK\_n}]}{\text{K5} \cdot \left(1 + \frac{[\text{ppERK\_n}]}{\text{K6}}\right) + [\text{pERK\_n}]} \tag{76}$$

7.6 Reaction re88

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

Name v006

Reaction equation

$$\text{ppERK\_n} \xrightarrow{\text{pERK\_n}} \text{pERK\_n} \tag{77}$$

Reactant

Table 21: Properties of each reactant.

Id	Name	SBO
ppERK_n	ppERK_n	

Modifier

Table 22: Properties of each modifier.

Id	Name	SBO
pERK_n	pERK_n	

Product

Table 23: Properties of each product.

Id	Name	SBO
pERK_n	pERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_v006}\,(\mathrm{K5}, \mathrm{K6}, \mathrm{V6}, [\mathrm{pERK\_n}], [\mathrm{ppERK\_n}]) \tag{78}$$

$$\mathrm{function\_4\_v006}\,(\mathrm{K5}, \mathrm{K6}, \mathrm{V6}, [\mathrm{pERK\_n}], [\mathrm{ppERK\_n}]) = \frac{\mathrm{V6} \cdot [\mathrm{ppERK\_n}]}{\mathrm{K6} \cdot \left(1 + \frac{[\mathrm{pERK\_n}]}{\mathrm{K5}}\right) + [\mathrm{ppERK\_n}]} \tag{79}$$

$$\mathrm{function\_4\_v006}\,(\mathrm{K5}, \mathrm{K6}, \mathrm{V6}, [\mathrm{pERK\_n}], [\mathrm{ppERK\_n}]) = \frac{\mathrm{V6} \cdot [\mathrm{ppERK\_n}]}{\mathrm{K6} \cdot \left(1 + \frac{[\mathrm{pERK\_n}]}{\mathrm{K5}}\right) + [\mathrm{ppERK\_n}]} \tag{80}$$

7.7 Reaction re106

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

Name v007

Reaction equation

$$\mathrm{ERK\_c} \rightleftharpoons \mathrm{ERK\_n} \tag{81}$$

Reactant

Table 24: Properties of each reactant.

Id	Name	SBO
ERK_c	ERK_c	

Product

Table 25: Properties of each product.

Id	Name	SBO
ERK_n	ERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \text{function\_4\_v007}\left(\text{KexERK}, \text{KimERK}, \text{Vc}, \text{Vn}, [\text{ERK\_c}], [\text{ERK\_n}]\right) \tag{82}$$

$$\begin{aligned}&\text{function\_4\_v007}\left(\text{KexERK}, \text{KimERK}, \text{Vc}, \text{Vn}, [\text{ERK\_c}], [\text{ERK\_n}]\right)\\ &= \text{KimERK} \cdot \text{Vc} \cdot [\text{ERK\_c}] - \text{KexERK} \cdot \text{Vn} \cdot [\text{ERK\_n}]\end{aligned} \tag{83}$$

7.8 Reaction re107

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

Name v008

Reaction equation

$$\text{pERK\_c} \rightleftharpoons \text{pERK\_n} \tag{84}$$

Reactant

Table 26: Properties of each reactant.

Id	Name	SBO
pERK_c	pERK_c	

Product

Table 27: Properties of each product.

Id	Name	SBO
pERK_n	pERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_8 = \text{function\_4\_v008}\left(\text{KexERKP}, \text{KimERKP}, \text{Vc}, \text{Vn}, [\text{pERK\_c}], [\text{pERK\_n}]\right) \tag{85}$$

$$\begin{aligned}&\text{function\_4\_v008}\left(\text{KexERKP}, \text{KimERKP}, \text{Vc}, \text{Vn}, [\text{pERK\_c}], [\text{pERK\_n}]\right)\\ &= \text{KimERKP} \cdot \text{Vc} \cdot [\text{pERK\_c}] - \text{KexERKP} \cdot \text{Vn} \cdot [\text{pERK\_n}]\end{aligned} \tag{86}$$

7.9 Reaction re108

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

Name v009

Reaction equation

$$\text{ppERK\_c} \rightleftharpoons \text{ppERK\_n} \tag{87}$$

Reactant

Table 28: Properties of each reactant.

Id	Name	SBO
ppERK_c	ppERK_c	

Product

Table 29: Properties of each product.

Id	Name	SBO
ppERK_n	ppERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \text{function\_4\_v009}\left(\text{KexERKPP}, \text{KimERKPP}, \text{Vc}, \text{Vn}, [\text{ppERK\_c}], [\text{ppERK\_n}]\right) \tag{88}$$

$$\begin{aligned}&\text{function\_4\_v009}\left(\text{KexERKPP}, \text{KimERKPP}, \text{Vc}, \text{Vn}, [\text{ppERK\_c}], [\text{ppERK\_n}]\right)\\ &= \text{KimERKPP} \cdot \text{Vc} \cdot [\text{ppERK\_c}] - \text{KexERKPP} \cdot \text{Vn} \cdot [\text{ppERK\_n}]\end{aligned} \tag{89}$$

7.10 Reaction `re109`

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

Name v010

Reaction equation

$$\emptyset \xrightarrow{\text{ppERK\_n}} \text{PreDUSPmRNA} \tag{90}$$

Modifier

Table 30: Properties of each modifier.

Id	Name	SBO
`ppERK_n`	ppERK_n	

Product

Table 31: Properties of each product.

Id	Name	SBO
`PreDUSPmRNA`	PreDUSPmRNA	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \text{vol}\left(\text{nucleus}\right) \cdot \text{function\_4\_v010}\left(\text{K10}, \text{V10}, \text{n10}, [\text{ppERK\_n}]\right) \tag{91}$$

$$\text{function\_4\_v010}\left(\text{K10}, \text{V10}, \text{n10}, [\text{ppERK\_n}]\right) = \frac{\text{V10} \cdot [\text{ppERK\_n}]^{\text{n10}}}{\text{K10}^{\text{n10}} + [\text{ppERK\_n}]^{\text{n10}}} \tag{92}$$

$$\text{function\_4\_v010}(\text{K10}, \text{V10}, \text{n10}, [\text{ppERK\_n}]) = \frac{\text{V10} \cdot [\text{ppERK\_n}]^{\text{n10}}}{\text{K10}^{\text{n10}} + [\text{ppERK\_n}]^{\text{n10}}} \tag{93}$$

7.11 Reaction `re110`

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

Name v011

Reaction equation

$$\text{PreDUSPmRNA} \longrightarrow \text{DUSPmRNA} \tag{94}$$

Reactant

Table 32: Properties of each reactant.

Id	Name	SBO
`PreDUSPmRNA`	PreDUSPmRNA	

Product

Table 33: Properties of each product.

Id	Name	SBO
`DUSPmRNA`	DUSPmRNA	

Kinetic Law

Derived unit contains undeclared units

$$v_{11} = \text{function\_4\_v011}(\text{Vn}, \text{p11}, [\text{PreDUSPmRNA}]) \tag{95}$$

$$\text{function\_4\_v011}(\text{Vn}, \text{p11}, [\text{PreDUSPmRNA}]) = \text{p11} \cdot \text{Vn} \cdot [\text{PreDUSPmRNA}] \tag{96}$$

7.12 Reaction `reaction_17`

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

Name v012

Reaction equation

$$\text{DUSPmRNA} \longrightarrow \emptyset \tag{97}$$

Reactant

Table 34: Properties of each reactant.

Id	Name	SBO
DUSPmRNA	DUSPmRNA	

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{p12} \cdot [\mathrm{DUSPmRNA}] \tag{98}$$

7.13 Reaction re89

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

Name v013

Reaction equation

$$\emptyset \xrightarrow{\mathrm{DUSPmRNA}} \mathrm{DUSP\_c} \tag{99}$$

Modifier

Table 35: Properties of each modifier.

Id	Name	SBO
DUSPmRNA	DUSPmRNA	

Product

Table 36: Properties of each product.

Id	Name	SBO
DUSP_c	DUSP_c	

Kinetic Law

Derived unit contains undeclared units

$$v_{13} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{function\_4\_v013}\,(\mathrm{p13}, [\mathrm{DUSPmRNA}]) \tag{100}$$

$$\text{function\_4\_v013}\,(\text{p13}, [\text{DUSPmRNA}]) = \text{p13} \cdot [\text{DUSPmRNA}] \tag{101}$$

$$\text{function\_4\_v013}\,(\text{p13}, [\text{DUSPmRNA}]) = \text{p13} \cdot [\text{DUSPmRNA}] \tag{102}$$

7.14 Reaction `reaction_33`

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

Name v014

Reaction equation

$$\text{DUSP\_c} \xrightarrow{\text{ppERK\_c}} \text{pDUSP\_c} \tag{103}$$

Reactant

Table 37: Properties of each reactant.

Id	Name	SBO
DUSP_c	DUSP_c	

Modifier

Table 38: Properties of each modifier.

Id	Name	SBO
ppERK_c	ppERK_c	

Product

Table 39: Properties of each product.

Id	Name	SBO
pDUSP_c	pDUSP_c	

Kinetic Law

Derived unit contains undeclared units

$$v_{14} = \text{vol}\,(\text{cytoplasm}) \cdot \text{function\_4\_v014}\,(\text{K14}, \text{V14}, [\text{ppERK\_c}], [\text{DUSP\_c}]) \tag{104}$$

$$\text{function\_4\_v014}\left(\text{K14}, \text{V14}, [\text{ppERK\_c}], [\text{DUSP\_c}]\right) = \frac{\text{V14} \cdot [\text{ppERK\_c}] \cdot [\text{DUSP\_c}]}{\text{K14} + [\text{DUSP\_c}]} \tag{105}$$

$$\text{function\_4\_v014}\left(\text{K14}, \text{V14}, [\text{ppERK\_c}], [\text{DUSP\_c}]\right) = \frac{\text{V14} \cdot [\text{ppERK\_c}] \cdot [\text{DUSP\_c}]}{\text{K14} + [\text{DUSP\_c}]} \tag{106}$$

7.15 Reaction `reaction_34`

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

Name v015

Reaction equation

$$\text{pDUSP\_c} \longrightarrow \text{DUSP\_c} \tag{107}$$

Reactant

Table 40: Properties of each reactant.

Id	Name	SBO
pDUSP_c	pDUSP_c	

Product

Table 41: Properties of each product.

Id	Name	SBO
DUSP_c	DUSP_c	

Kinetic Law

Derived unit contains undeclared units

$$v_{15} = \text{vol}\left(\text{cytoplasm}\right) \cdot \text{function\_4\_v015}\left(\text{K15}, \text{V15}, [\text{pDUSP\_c}]\right) \tag{108}$$

$$\text{function\_4\_v015}\left(\text{K15}, \text{V15}, [\text{pDUSP\_c}]\right) = \frac{\text{V15} \cdot [\text{pDUSP\_c}]}{\text{K15} + [\text{pDUSP\_c}]} \tag{109}$$

$$\text{function\_4\_v015}\left(\text{K15}, \text{V15}, [\text{pDUSP\_c}]\right) = \frac{\text{V15} \cdot [\text{pDUSP\_c}]}{\text{K15} + [\text{pDUSP\_c}]} \tag{110}$$

7.16 Reaction reaction_35

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

Name v016

Reaction equation

$$\text{DUSP\_c} \longrightarrow \emptyset \tag{111}$$

Reactant

Table 42: Properties of each reactant.

Id	Name	SBO
DUSP_c	DUSP_c	

Kinetic Law

Derived unit contains undeclared units

$$v_{16} = \text{vol}(\text{cytoplasm}) \cdot \text{p16} \cdot [\text{DUSP\_c}] \tag{112}$$

7.17 Reaction reaction_36

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

Name v017

Reaction equation

$$\text{pDUSP\_c} \longrightarrow \emptyset \tag{113}$$

Reactant

Table 43: Properties of each reactant.

Id	Name	SBO
pDUSP_c	pDUSP_c	

Kinetic Law

Derived unit contains undeclared units

$$v_{17} = \text{vol}(\text{cytoplasm}) \cdot \text{p17} \cdot [\text{pDUSP\_c}] \tag{114}$$

7.18 Reaction re111

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

Name v018

Reaction equation

$$\text{DUSP\_c} \rightleftharpoons \text{DUSP\_n} \tag{115}$$

Reactant

Table 44: Properties of each reactant.

Id	Name	SBO
DUSP_c	DUSP_c	

Product

Table 45: Properties of each product.

Id	Name	SBO
DUSP_n	DUSP_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{18} = \text{function\_4\_v018}\left(\text{KexDUSP}, \text{KimDUSP}, \text{Vc}, \text{Vn}, [\text{DUSP\_n}], [\text{DUSP\_c}]\right) \tag{116}$$

$$\begin{aligned}&\text{function\_4\_v018}\left(\text{KexDUSP}, \text{KimDUSP}, \text{Vc}, \text{Vn}, [\text{DUSP\_n}], [\text{DUSP\_c}]\right)\\ &= \text{KimDUSP} \cdot \text{Vc} \cdot [\text{DUSP\_c}] - \text{KexDUSP} \cdot \text{Vn} \cdot [\text{DUSP\_n}]\end{aligned} \tag{117}$$

7.19 Reaction re112

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

Name v019

Reaction equation

$$\text{pDUSP\_c} \rightleftharpoons \text{pDUSP\_n} \tag{118}$$

Reactant

Table 46: Properties of each reactant.

Id	Name	SBO
pDUSP_c	pDUSP_c	

Product

Table 47: Properties of each product.

Id	Name	SBO
pDUSP_n	pDUSP_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{19} = \text{function\_4\_v019}\left(\text{KexDUSPP}, \text{KimDUSPP}, \text{Vc}, \text{Vn}, [\text{pDUSP\_c}], [\text{pDUSP\_n}]\right) \quad (119)$$

$$\begin{aligned}&\text{function\_4\_v019}\left(\text{KexDUSPP}, \text{KimDUSPP}, \text{Vc}, \text{Vn}, [\text{pDUSP\_c}], [\text{pDUSP\_n}]\right)\\ &= \text{KimDUSPP} \cdot \text{Vc} \cdot [\text{pDUSP\_c}] - \text{KexDUSPP} \cdot \text{Vn} \cdot [\text{pDUSP\_n}]\end{aligned} \quad (120)$$

7.20 Reaction reaction_12

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

Name v020

Reaction equation

$$\text{DUSP\_n} \xrightarrow{\text{ppERK\_n}} \text{pDUSP\_n} \quad (121)$$

Reactant

Table 48: Properties of each reactant.

Id	Name	SBO
DUSP_n	DUSP_n	

Modifier

Table 49: Properties of each modifier.

Id	Name	SBO
ppERK_n	ppERK_n	

Product

Table 50: Properties of each product.

Id	Name	SBO
pDUSP_n	pDUSP_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{20} = \text{vol}(\text{nucleus}) \cdot \text{function\_4\_v020}(\text{K20}, \text{V20}, [\text{ppERK\_n}], [\text{DUSP\_n}]) \tag{122}$$

$$\text{function\_4\_v020}(\text{K20}, \text{V20}, [\text{ppERK\_n}], [\text{DUSP\_n}]) = \frac{\text{V20} \cdot [\text{ppERK\_n}] \cdot [\text{DUSP\_n}]}{\text{K20} + [\text{DUSP\_n}]} \tag{123}$$

$$\text{function\_4\_v020}(\text{K20}, \text{V20}, [\text{ppERK\_n}], [\text{DUSP\_n}]) = \frac{\text{V20} \cdot [\text{ppERK\_n}] \cdot [\text{DUSP\_n}]}{\text{K20} + [\text{DUSP\_n}]} \tag{124}$$

7.21 Reaction reaction_13

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

Name v021

Reaction equation

$$\text{pDUSP\_n} \longrightarrow \text{DUSP\_n} \tag{125}$$

Reactant

Table 51: Properties of each reactant.

Id	Name	SBO
pDUSP_n	pDUSP_n	

Product

Table 52: Properties of each product.

Id	Name	SBO
DUSP_n	DUSP_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{21} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_v021}\,(\mathrm{K21}, \mathrm{V21}, [\mathrm{pDUSP\_n}]) \tag{126}$$

$$\mathrm{function\_4\_v021}\,(\mathrm{K21}, \mathrm{V21}, [\mathrm{pDUSP\_n}]) = \frac{\mathrm{V21} \cdot [\mathrm{pDUSP\_n}]}{\mathrm{K21} + [\mathrm{pDUSP\_n}]} \tag{127}$$

$$\mathrm{function\_4\_v021}\,(\mathrm{K21}, \mathrm{V21}, [\mathrm{pDUSP\_n}]) = \frac{\mathrm{V21} \cdot [\mathrm{pDUSP\_n}]}{\mathrm{K21} + [\mathrm{pDUSP\_n}]} \tag{128}$$

7.22 Reaction reaction_14

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

Name v022

Reaction equation

$$\mathrm{DUSP\_n} \longrightarrow \emptyset \tag{129}$$

Reactant

Table 53: Properties of each reactant.

Id	Name	SBO
DUSP_n	DUSP_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{22} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{p22} \cdot [\mathrm{DUSP\_n}] \tag{130}$$

7.23 Reaction reaction_15

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

Name v023

Reaction equation

$$\text{pDUSP\_n} \longrightarrow \emptyset \tag{131}$$

Reactant

Table 54: Properties of each reactant.

Id	Name	SBO
pDUSP_n	pDUSP_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{23} = \text{vol}(\text{nucleus}) \cdot \text{p23} \cdot [\text{pDUSP\_n}] \tag{132}$$

7.24 Reaction reaction_41

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

Name v024

Reaction equation

$$\text{RSK\_c} \xrightarrow{\text{ppERK\_c}} \text{pRSK\_c} \tag{133}$$

Reactant

Table 55: Properties of each reactant.

Id	Name	SBO
RSK_c	RSK_c	

Modifier

Table 56: Properties of each modifier.

Id	Name	SBO
ppERK_c	ppERK_c	

Product

Table 57: Properties of each product.

Id	Name	SBO
pRSK_c	pRSK_c	

Kinetic Law

Derived unit contains undeclared units

$$v_{24} = \text{vol}\,(\text{cytoplasm}) \cdot \text{function\_4\_v024}\,(\text{K24}, \text{V24}, [\text{ppERK\_c}], [\text{RSK\_c}]) \tag{134}$$

$$\text{function\_4\_v024}\,(\text{K24}, \text{V24}, [\text{ppERK\_c}], [\text{RSK\_c}]) = \frac{\text{V24} \cdot [\text{ppERK\_c}] \cdot [\text{RSK\_c}]}{\text{K24} + [\text{RSK\_c}]} \tag{135}$$

$$\text{function\_4\_v024}\,(\text{K24}, \text{V24}, [\text{ppERK\_c}], [\text{RSK\_c}]) = \frac{\text{V24} \cdot [\text{ppERK\_c}] \cdot [\text{RSK\_c}]}{\text{K24} + [\text{RSK\_c}]} \tag{136}$$

7.25 Reaction reaction_42

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

Name v025

Reaction equation

$$\text{pRSK\_c} \longrightarrow \text{RSK\_c} \tag{137}$$

Reactant

Table 58: Properties of each reactant.

Id	Name	SBO
pRSK_c	pRSK_c	

Product

Table 59: Properties of each product.

Id	Name	SBO
RSK_c	RSK_c	

Kinetic Law

Derived unit contains undeclared units

$$v_{25} = \text{vol}\,(\text{cytoplasm}) \cdot \text{function\_4\_v025}\,(\text{K25}, \text{V25}, [\text{pRSK\_c}]) \tag{138}$$

$$\text{function\_4\_v025}\,(\text{K25}, \text{V25}, [\text{pRSK\_c}]) = \frac{\text{V25} \cdot [\text{pRSK\_c}]}{\text{K25} + [\text{pRSK\_c}]} \tag{139}$$

$$\text{function\_4\_v025}\,(\text{K25}, \text{V25}, [\text{pRSK\_c}]) = \frac{\text{V25} \cdot [\text{pRSK\_c}]}{\text{K25} + [\text{pRSK\_c}]} \tag{140}$$

7.26 Reaction re113

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

Name v026

Reaction equation

$$\text{pRSK\_c} \rightleftharpoons \text{pRSK\_n} \tag{141}$$

Reactant

Table 60: Properties of each reactant.

Id	Name	SBO
pRSK_c	pRSK_c	

Product

Table 61: Properties of each product.

Id	Name	SBO
pRSK_n	pRSK_n	

Id	Name	SBO

Kinetic Law

Derived unit contains undeclared units

$$v_{26} = \text{function\_4\_v026}\,(\text{KexRSKP}, \text{KimRSKP}, \text{Vc}, \text{Vn}, [\text{pRSK\_n}], [\text{pRSK\_c}]) \tag{142}$$

$$\begin{aligned} &\text{function\_4\_v026}\,(\text{KexRSKP}, \text{KimRSKP}, \text{Vc}, \text{Vn}, [\text{pRSK\_n}], [\text{pRSK\_c}]) \\ &\quad = \text{KimRSKP} \cdot \text{Vc} \cdot [\text{pRSK\_c}] - \text{KexRSKP} \cdot \text{Vn} \cdot [\text{pRSK\_n}] \end{aligned} \tag{143}$$

7.27 Reaction `reaction_45`

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

Name v027

Reaction equation

$$\text{CREB\_n} \xrightarrow{\text{pRSK\_n}} \text{pCREB\_n} \tag{144}$$

Reactant

Table 62: Properties of each reactant.

Id	Name	SBO
CREB_n	CREB_n	

Modifier

Table 63: Properties of each modifier.

Id	Name	SBO
pRSK_n	pRSK_n	

Product

Table 64: Properties of each product.

Id	Name	SBO
pCREB_n	pCREB_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{27} = \text{vol}(\text{nucleus}) \cdot \text{function\_4\_v027}(\text{K27}, \text{V27}, [\text{CREB\_n}], [\text{pRSK\_n}]) \tag{145}$$

$$\text{function\_4\_v027}(\text{K27}, \text{V27}, [\text{CREB\_n}], [\text{pRSK\_n}]) = \frac{\text{V27} \cdot [\text{pRSK\_n}] \cdot [\text{CREB\_n}]}{\text{K27} + [\text{CREB\_n}]} \tag{146}$$

$$\text{function\_4\_v027}(\text{K27}, \text{V27}, [\text{CREB\_n}], [\text{pRSK\_n}]) = \frac{\text{V27} \cdot [\text{pRSK\_n}] \cdot [\text{CREB\_n}]}{\text{K27} + [\text{CREB\_n}]} \tag{147}$$

7.28 Reaction reaction_46

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

Name v028

Reaction equation

$$\text{pCREB\_n} \longrightarrow \text{CREB\_n} \tag{148}$$

Reactant

Table 65: Properties of each reactant.

Id	Name	SBO
pCREB_n	pCREB_n	

Product

Table 66: Properties of each product.

Id	Name	SBO
CREB_n	CREB_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{28} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_v028}\,(\mathrm{K28}, \mathrm{V28}, [\mathrm{pCREB\_n}]) \tag{149}$$

$$\mathrm{function\_4\_v028}\,(\mathrm{K28}, \mathrm{V28}, [\mathrm{pCREB\_n}]) = \frac{\mathrm{V28} \cdot [\mathrm{pCREB\_n}]}{\mathrm{K28} + [\mathrm{pCREB\_n}]} \tag{150}$$

$$\mathrm{function\_4\_v028}\,(\mathrm{K28}, \mathrm{V28}, [\mathrm{pCREB\_n}]) = \frac{\mathrm{V28} \cdot [\mathrm{pCREB\_n}]}{\mathrm{K28} + [\mathrm{pCREB\_n}]} \tag{151}$$

7.29 Reaction `reaction_57`

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

Name v029

Reaction equation

$$\mathrm{Elk1\_n} \xrightarrow{\mathrm{ppERK\_n}} \mathrm{pElk1\_n} \tag{152}$$

Reactant

Table 67: Properties of each reactant.

Id	Name	SBO
`Elk1_n`	Elk1_n	

Modifier

Table 68: Properties of each modifier.

Id	Name	SBO
`ppERK_n`	ppERK_n	

Product

Table 69: Properties of each product.

Id	Name	SBO
pElk1_n	pElk1_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{29} = \text{vol}(\text{nucleus}) \cdot \text{function\_4\_v029}(\text{K29}, \text{V29}, [\text{ppERK\_n}], [\text{Elk1\_n}]) \tag{153}$$

$$\text{function\_4\_v029}(\text{K29}, \text{V29}, [\text{ppERK\_n}], [\text{Elk1\_n}]) = \frac{\text{V29} \cdot [\text{ppERK\_n}] \cdot [\text{Elk1\_n}]}{\text{K29} + [\text{Elk1\_n}]} \tag{154}$$

$$\text{function\_4\_v029}(\text{K29}, \text{V29}, [\text{ppERK\_n}], [\text{Elk1\_n}]) = \frac{\text{V29} \cdot [\text{ppERK\_n}] \cdot [\text{Elk1\_n}]}{\text{K29} + [\text{Elk1\_n}]} \tag{155}$$

7.30 Reaction reaction_58

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

Name v030

Reaction equation

$$\text{pElk1\_n} \longrightarrow \text{Elk1\_n} \tag{156}$$

Reactant

Table 70: Properties of each reactant.

Id	Name	SBO
pElk1_n	pElk1_n	

Product

Table 71: Properties of each product.

Id	Name	SBO
Elk1_n	Elk1_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{30} = \text{vol}(\text{nucleus}) \cdot \text{function\_4\_v030}(\text{K30}, \text{V30}, [\text{pElk1\_n}]) \tag{157}$$

$$\text{function\_4\_v030}(\text{K30}, \text{V30}, [\text{pElk1\_n}]) = \frac{\text{V30} \cdot [\text{pElk1\_n}]}{\text{K30} + [\text{pElk1\_n}]} \tag{158}$$

$$\text{function\_4\_v030}(\text{K30}, \text{V30}, [\text{pElk1\_n}]) = \frac{\text{V30} \cdot [\text{pElk1\_n}]}{\text{K30} + [\text{pElk1\_n}]} \tag{159}$$

7.31 Reaction `reaction_47`

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

Name v031

Reaction equation

$$\emptyset \xrightarrow{\text{pCREB\_n, pElk1\_n, Fn}} \text{PreFOSmRNA} \tag{160}$$

Modifiers

Table 72: Properties of each modifier.

Id	Name	SBO
`pCREB_n`	pCREB_n	
`pElk1_n`	pElk1_n	
`Fn`	Fn	

Product

Table 73: Properties of each product.

Id	Name	SBO
`PreFOSmRNA`	PreFOSmRNA	

Kinetic Law

Derived unit contains undeclared units

$$v_{31} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_v031}\,(\mathrm{K31}, \mathrm{KF31}, \mathrm{V31}, \mathrm{n31}, \mathrm{nF31}, [\mathrm{Fn}], [\mathrm{pCREB\_n}], [\mathrm{pElk1\_n}]) \tag{161}$$

$$\begin{aligned} &\mathrm{function\_4\_v031}\,(\mathrm{K31}, \mathrm{KF31}, \mathrm{V31}, \mathrm{n31}, \mathrm{nF31}, [\mathrm{Fn}], [\mathrm{pCREB\_n}], [\mathrm{pElk1\_n}]) \\ &= \frac{\mathrm{V31} \cdot ([\mathrm{pCREB\_n}] \cdot [\mathrm{pElk1\_n}])^{\mathrm{n31}}}{\mathrm{K31}^{\mathrm{n31}} + ([\mathrm{pCREB\_n}] \cdot [\mathrm{pElk1\_n}])^{\mathrm{n31}} + \left(\frac{[\mathrm{Fn}]}{\mathrm{KF31}}\right)^{\mathrm{nF31}}} \end{aligned} \tag{162}$$

$$\begin{aligned} &\mathrm{function\_4\_v031}\,(\mathrm{K31}, \mathrm{KF31}, \mathrm{V31}, \mathrm{n31}, \mathrm{nF31}, [\mathrm{Fn}], [\mathrm{pCREB\_n}], [\mathrm{pElk1\_n}]) \\ &= \frac{\mathrm{V31} \cdot ([\mathrm{pCREB\_n}] \cdot [\mathrm{pElk1\_n}])^{\mathrm{n31}}}{\mathrm{K31}^{\mathrm{n31}} + ([\mathrm{pCREB\_n}] \cdot [\mathrm{pElk1\_n}])^{\mathrm{n31}} + \left(\frac{[\mathrm{Fn}]}{\mathrm{KF31}}\right)^{\mathrm{nF31}}} \end{aligned} \tag{163}$$

7.32 Reaction `re115`

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

Name v032

Reaction equation

$$\mathrm{PreFOSmRNA} \longrightarrow \mathrm{c\_FOSmRNA} \tag{164}$$

Reactant

Table 74: Properties of each reactant.

Id	Name	SBO
`PreFOSmRNA`	PreFOSmRNA	

Product

Table 75: Properties of each product.

Id	Name	SBO
`c_FOSmRNA`	c_FOSmRNA	

Kinetic Law

Derived unit contains undeclared units

$$v_{32} = \mathrm{function\_4\_v032}\,(\mathrm{Vn}, \mathrm{p32}, [\mathrm{PreFOSmRNA}]) \tag{165}$$

$$\text{function\_4\_v032}\,(\text{Vn}, \text{p32}, [\text{PreFOSmRNA}]) = \text{p32} \cdot \text{Vn} \cdot [\text{PreFOSmRNA}] \tag{166}$$

7.33 Reaction `reaction_50`

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

Name v033

Reaction equation

$$\text{c\_FOSmRNA} \longrightarrow \emptyset \tag{167}$$

Reactant

Table 76: Properties of each reactant.

Id	Name	SBO
`c_FOSmRNA`	c_FOSmRNA	

Kinetic Law

Derived unit contains undeclared units

$$v_{33} = \text{vol}\,(\text{cytoplasm}) \cdot \text{p33} \cdot [\text{c\_FOSmRNA}] \tag{168}$$

7.34 Reaction `re90`

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

Name v034

Reaction equation

$$\emptyset \xrightarrow{\text{c\_FOSmRNA}} \text{c\_FOS\_c} \tag{169}$$

Modifier

Table 77: Properties of each modifier.

Id	Name	SBO
`c_FOSmRNA`	c_FOSmRNA	

Product

Table 78: Properties of each product.

Id	Name	SBO
c_FOS_c	c_FOS_c	

Kinetic Law

Derived unit contains undeclared units

$$v_{34} = \text{vol}\left(\text{cytoplasm}\right) \cdot \text{function\_4\_v034}\left(\text{p34}, [\text{c\_FOSmRNA}]\right) \tag{170}$$

$$\text{function\_4\_v034}\left(\text{p34}, [\text{c\_FOSmRNA}]\right) = \text{p34} \cdot [\text{c\_FOSmRNA}] \tag{171}$$

$$\text{function\_4\_v034}\left(\text{p34}, [\text{c\_FOSmRNA}]\right) = \text{p34} \cdot [\text{c\_FOSmRNA}] \tag{172}$$

7.35 Reaction reaction_59

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

Name v035

Reaction equation

$$\text{c\_FOS\_c} \xrightarrow{\text{ppERK\_c}} \text{pc\_FOS\_c} \tag{173}$$

Reactant

Table 79: Properties of each reactant.

Id	Name	SBO
c_FOS_c	c_FOS_c	

Modifier

Table 80: Properties of each modifier.

Id	Name	SBO
ppERK_c	ppERK_c	

Product

Table 81: Properties of each product.

Id	Name	SBO
pc_FOS_c	pc_FOS_c	

Kinetic Law

Derived unit contains undeclared units

$$v_{35} = \text{vol}\,(\text{cytoplasm}) \cdot \text{function\_4\_v035}\,(\text{K35}, \text{V35}, [\text{c\_FOS\_c}], [\text{ppERK\_c}]) \tag{174}$$

$$\text{function\_4\_v035}\,(\text{K35}, \text{V35}, [\text{c\_FOS\_c}], [\text{ppERK\_c}]) = \frac{\text{V35} \cdot [\text{ppERK\_c}] \cdot [\text{c\_FOS\_c}]}{\text{K35} + [\text{c\_FOS\_c}]} \tag{175}$$

$$\text{function\_4\_v035}\,(\text{K35}, \text{V35}, [\text{c\_FOS\_c}], [\text{ppERK\_c}]) = \frac{\text{V35} \cdot [\text{ppERK\_c}] \cdot [\text{c\_FOS\_c}]}{\text{K35} + [\text{c\_FOS\_c}]} \tag{176}$$

7.36 Reaction reaction_67

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

Name v036

Reaction equation

$$\text{c\_FOS\_c} \xrightarrow{\text{pRSK\_c}} \text{pc\_FOS\_c} \tag{177}$$

Reactant

Table 82: Properties of each reactant.

Id	Name	SBO
c_FOS_c	c_FOS_c	

Modifier

Table 83: Properties of each modifier.

Id	Name	SBO
pRSK_c	pRSK_c	

Product

Table 84: Properties of each product.

Id	Name	SBO
pc_FOS_c	pc_FOS_c	

Kinetic Law

Derived unit contains undeclared units

$$v_{36} = \text{vol}\,(\text{cytoplasm}) \cdot \text{function\_4\_v036}\,(\text{K36}, \text{V36}, [\text{c\_FOS\_c}], [\text{pRSK\_c}]) \tag{178}$$

$$\text{function\_4\_v036}\,(\text{K36}, \text{V36}, [\text{c\_FOS\_c}], [\text{pRSK\_c}]) = \frac{\text{V36} \cdot [\text{pRSK\_c}] \cdot [\text{c\_FOS\_c}]}{\text{K36} + [\text{c\_FOS\_c}]} \tag{179}$$

$$\text{function\_4\_v036}\,(\text{K36}, \text{V36}, [\text{c\_FOS\_c}], [\text{pRSK\_c}]) = \frac{\text{V36} \cdot [\text{pRSK\_c}] \cdot [\text{c\_FOS\_c}]}{\text{K36} + [\text{c\_FOS\_c}]} \tag{180}$$

7.37 Reaction reaction_60

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

Name v037

Reaction equation

$$\text{pc\_FOS\_c} \longrightarrow \text{c\_FOS\_c} \tag{181}$$

Reactant

Table 85: Properties of each reactant.

Id	Name	SBO
pc_FOS_c	pc_FOS_c	

Product

Table 86: Properties of each product.

Id	Name	SBO
c_FOS_c	c_FOS_c	

Kinetic Law

Derived unit contains undeclared units

$$v_{37} = \text{vol}(\text{cytoplasm}) \cdot \text{function\_4\_v037}(\text{K37}, \text{V37}, [\text{pc\_FOS\_c}]) \tag{182}$$

$$\text{function\_4\_v037}(\text{K37}, \text{V37}, [\text{pc\_FOS\_c}]) = \frac{\text{V37} \cdot [\text{pc\_FOS\_c}]}{\text{K37} + [\text{pc\_FOS\_c}]} \tag{183}$$

$$\text{function\_4\_v037}(\text{K37}, \text{V37}, [\text{pc\_FOS\_c}]) = \frac{\text{V37} \cdot [\text{pc\_FOS\_c}]}{\text{K37} + [\text{pc\_FOS\_c}]} \tag{184}$$

7.38 Reaction `reaction_61`

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

Name v038

Reaction equation

$$\text{c\_FOS\_c} \longrightarrow \emptyset \tag{185}$$

Reactant

Table 87: Properties of each reactant.

Id	Name	SBO
c_FOS_c	c_FOS_c	

Kinetic Law

Derived unit contains undeclared units

$$v_{38} = \text{vol}(\text{cytoplasm}) \cdot \text{p38} \cdot [\text{c\_FOS\_c}] \tag{186}$$

7.39 Reaction reaction_62

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

Name v039

Reaction equation

$$\text{pc\_FOS\_c} \longrightarrow \emptyset \tag{187}$$

Reactant

Table 88: Properties of each reactant.

Id	Name	SBO
pc_FOS_c	pc_FOS_c	

Kinetic Law

Derived unit contains undeclared units

$$v_{39} = \text{vol}\,(\text{cytoplasm}) \cdot \text{p39} \cdot [\text{pc\_FOS\_c}] \tag{188}$$

7.40 Reaction re116

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

Name v040

Reaction equation

$$\text{c\_FOS\_c} \rightleftharpoons \text{FOSn} \tag{189}$$

Reactant

Table 89: Properties of each reactant.

Id	Name	SBO
c_FOS_c	c_FOS_c	

Product

Table 90: Properties of each product.

Id	Name	SBO
FOSn	FOSn	

Kinetic Law

Derived unit contains undeclared units

$$v_{40} = \text{function\_4\_v040}\,(\text{KexFOS}, \text{KimFOS}, \text{Vc}, \text{Vn}, [\text{c\_FOS\_c}], [\text{FOSn}]) \tag{190}$$

$$\begin{aligned} &\text{function\_4\_v040}\,(\text{KexFOS}, \text{KimFOS}, \text{Vc}, \text{Vn}, [\text{c\_FOS\_c}], [\text{FOSn}]) \\ &= \text{KimFOS} \cdot \text{Vc} \cdot [\text{c\_FOS\_c}] - \text{KexFOS} \cdot \text{Vn} \cdot [\text{FOSn}] \end{aligned} \tag{191}$$

7.41 Reaction re117

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

Name v041

Reaction equation

$$\text{pc\_FOS\_c} \rightleftharpoons \text{FOSn\_2} \tag{192}$$

Reactant

Table 91: Properties of each reactant.

Id	Name	SBO
pc_FOS_c	pc_FOS_c	

Product

Table 92: Properties of each product.

Id	Name	SBO
FOSn_2	FOSn_2	

Kinetic Law

Derived unit contains undeclared units

$$v_{41} = \text{function\_4\_v041}\,(\text{KexFOSP}, \text{KimFOSP}, \text{Vc}, \text{Vn}, [\text{pc\_FOS\_c}], [\text{FOSn\_2}]) \tag{193}$$

$$\begin{aligned}&\text{function\_4\_v041}\,(\text{KexFOSP}, \text{KimFOSP}, \text{Vc}, \text{Vn}, [\text{pc\_FOS\_c}], [\text{FOSn\_2}])\\ &= \text{KimFOSP} \cdot \text{Vc} \cdot [\text{pc\_FOS\_c}] - \text{KexFOSP} \cdot \text{Vn} \cdot [\text{FOSn\_2}]\end{aligned} \tag{194}$$

7.42 Reaction `reaction_52`

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

Name v042

Reaction equation

$$\text{FOSn} \xrightarrow{\text{ppERK\_n}} \text{FOSn\_2} \tag{195}$$

Reactant

Table 93: Properties of each reactant.

Id	Name	SBO
FOSn	FOSn	

Modifier

Table 94: Properties of each modifier.

Id	Name	SBO
ppERK_n	ppERK_n	

Product

Table 95: Properties of each product.

Id	Name	SBO
FOSn_2	FOSn_2	

Kinetic Law

Derived unit contains undeclared units

$$v_{42} = \text{vol}\,(\text{nucleus}) \cdot \text{function\_4\_v042}\,(\text{K42}, \text{V42}, [\text{ppERK\_n}], [\text{FOSn}]) \tag{196}$$

$$\text{function\_4\_v042}\left(\text{K42}, \text{V42}, [\text{ppERK\_n}], [\text{FOSn}]\right) = \frac{\text{V42} \cdot [\text{ppERK\_n}] \cdot [\text{FOSn}]}{\text{K42} + [\text{FOSn}]} \tag{197}$$

$$\text{function\_4\_v042}\left(\text{K42}, \text{V42}, [\text{ppERK\_n}], [\text{FOSn}]\right) = \frac{\text{V42} \cdot [\text{ppERK\_n}] \cdot [\text{FOSn}]}{\text{K42} + [\text{FOSn}]} \tag{198}$$

7.43 Reaction `reaction_53`

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

Name v043

Reaction equation

$$\text{FOSn} \xrightarrow{\text{pRSK\_n}} \text{FOSn\_2} \tag{199}$$

Reactant

Table 96: Properties of each reactant.

Id	Name	SBO
FOSn	FOSn	

Modifier

Table 97: Properties of each modifier.

Id	Name	SBO
pRSK_n	pRSK_n	

Product

Table 98: Properties of each product.

Id	Name	SBO
FOSn_2	FOSn_2	

Kinetic Law

Derived unit contains undeclared units

$$v_{43} = \text{vol}\left(\text{nucleus}\right) \cdot \text{function\_4\_v043}\left(\text{K43}, \text{V43}, [\text{FOSn}], [\text{pRSK\_n}]\right) \tag{200}$$

$$\text{function\_4\_v043}\left(\text{K43}, \text{V43}, [\text{FOSn}], [\text{pRSK\_n}]\right) = \frac{\text{V43} \cdot [\text{pRSK\_n}] \cdot [\text{FOSn}]}{\text{K43} + [\text{FOSn}]} \tag{201}$$

$$\text{function\_4\_v043}\left(\text{K43}, \text{V43}, [\text{FOSn}], [\text{pRSK\_n}]\right) = \frac{\text{V43} \cdot [\text{pRSK\_n}] \cdot [\text{FOSn}]}{\text{K43} + [\text{FOSn}]} \tag{202}$$

7.44 Reaction `reaction_54`

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

Name v044

Reaction equation

$$\text{FOSn\_2} \longrightarrow \text{FOSn} \tag{203}$$

Reactant

Table 99: Properties of each reactant.

Id	Name	SBO
`FOSn_2`	FOSn_2	

Product

Table 100: Properties of each product.

Id	Name	SBO
`FOSn`	FOSn	

Kinetic Law

Derived unit contains undeclared units

$$v_{44} = \text{vol}\left(\text{nucleus}\right) \cdot \text{function\_4\_v044}\left(\text{K44}, \text{V44}, [\text{FOSn\_2}]\right) \tag{204}$$

$$\text{function\_4\_v044}\left(\text{K44}, \text{V44}, [\text{FOSn\_2}]\right) = \frac{\text{V44} \cdot [\text{FOSn\_2}]}{\text{K44} + [\text{FOSn\_2}]} \tag{205}$$

$$\text{function\_4\_v044}\left(\text{K44}, \text{V44}, [\text{FOSn\_2}]\right) = \frac{\text{V44} \cdot [\text{FOSn\_2}]}{\text{K44} + [\text{FOSn\_2}]} \tag{206}$$

7.45 Reaction reaction_55

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

Name v045

Reaction equation

$$\text{FOSn} \longrightarrow \emptyset \tag{207}$$

Reactant

Table 101: Properties of each reactant.

Id	Name	SBO
FOSn	FOSn	

Kinetic Law

Derived unit contains undeclared units

$$v_{45} = \text{vol}(\text{nucleus}) \cdot \text{p45} \cdot [\text{FOSn}] \tag{208}$$

7.46 Reaction reaction_56

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

Name v046

Reaction equation

$$\text{FOSn\_2} \longrightarrow \emptyset \tag{209}$$

Reactant

Table 102: Properties of each reactant.

Id	Name	SBO
FOSn_2	FOSn_2	

Kinetic Law

Derived unit contains undeclared units

$$v_{46} = \text{vol}(\text{nucleus}) \cdot \text{p46} \cdot [\text{FOSn\_2}] \tag{210}$$

7.47 Reaction reaction_25

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

Name v047

Reaction equation

$$\text{pDUSP\_n} + \text{ppERK\_n} \rightleftharpoons \text{pDUSP\_n\_ppERK\_n} \tag{211}$$

Reactants

Table 103: Properties of each reactant.

Id	Name	SBO
pDUSP_n	pDUSP_n	
ppERK_n	ppERK_n	

Product

Table 104: Properties of each product.

Id	Name	SBO
pDUSP_n_ppERK_n	pDUSP_n_ppERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{47} = \text{vol}\,(\text{nucleus}) \cdot (\text{p52} \cdot [\text{pDUSP\_n}] \cdot [\text{ppERK\_n}] - \text{m52} \cdot [\text{pDUSP\_n\_ppERK\_n}]) \tag{212}$$

7.48 Reaction reaction_26

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

Name v048

Reaction equation

$$\text{pDUSP\_n\_ppERK\_n} \longrightarrow \text{pDUSP\_n} + \text{pERK\_n} \tag{213}$$

Reactant

Table 105: Properties of each reactant.

Id	Name	SBO
pDUSP_n_ppERK_n	pDUSP_n_ppERK_n	

Products

Table 106: Properties of each product.

Id	Name	SBO
pDUSP_n	pDUSP_n	
pERK_n	pERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{48} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{p53} \cdot [\mathrm{pDUSP\_n\_ppERK\_n}] \tag{214}$$

7.49 Reaction reaction_27

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

Name v049

Reaction equation

$$\mathrm{pDUSP\_n} + \mathrm{pERK\_n} \rightleftharpoons \mathrm{pDUSP\_n\_pERK\_n} \tag{215}$$

Reactants

Table 107: Properties of each reactant.

Id	Name	SBO
pDUSP_n	pDUSP_n	
pERK_n	pERK_n	

Product

Table 108: Properties of each product.

Id	Name	SBO
pDUSP_n_pERK_n	pDUSP_n_pERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{49} = \mathrm{vol}(\mathrm{nucleus}) \cdot (\mathrm{p54} \cdot [\mathrm{pDUSP\_n}] \cdot [\mathrm{pERK\_n}] - \mathrm{m54} \cdot [\mathrm{pDUSP\_n\_pERK\_n}]) \quad (216)$$

7.50 Reaction reaction_28

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

Name v050

Reaction equation

$$\mathrm{pDUSP\_n\_pERK\_n} \longrightarrow \mathrm{pDUSP\_n} + \mathrm{ERK\_n} \quad (217)$$

Reactant

Table 109: Properties of each reactant.

Id	Name	SBO
pDUSP_n_pERK_n	pDUSP_n_pERK_n	

Products

Table 110: Properties of each product.

Id	Name	SBO
pDUSP_n	pDUSP_n	
ERK_n	ERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{50} = \mathrm{vol}(\mathrm{nucleus}) \cdot \mathrm{p55} \cdot [\mathrm{pDUSP\_n\_pERK\_n}] \quad (218)$$

7.51 Reaction reaction_30

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

Name v051

Reaction equation

$$\text{pDUSP\_n} + \text{ERK\_n} \rightleftharpoons \text{pDUSP\_n\_ERK\_n} \tag{219}$$

Reactants

Table 111: Properties of each reactant.

Id	Name	SBO
pDUSP_n	pDUSP_n	
ERK_n	ERK_n	

Product

Table 112: Properties of each product.

Id	Name	SBO
pDUSP_n_ERK_n	pDUSP_n_ERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{51} = \text{vol}(\text{nucleus}) \cdot (\text{p56} \cdot [\text{pDUSP\_n}] \cdot [\text{ERK\_n}] - \text{m56} \cdot [\text{pDUSP\_n\_ERK\_n}]) \tag{220}$$

7.52 Reaction reaction_21

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

Name v052

Reaction equation

$$\text{DUSP\_n} + \text{ppERK\_n} \rightleftharpoons \text{DUSP\_n\_ppERK\_n} \tag{221}$$

Reactants

Table 113: Properties of each reactant.

Id	Name	SBO
DUSP_n	DUSP_n	
ppERK_n	ppERK_n	

Product

Table 114: Properties of each product.

Id	Name	SBO
DUSP_n_ppERK_n	DUSP_n_ppERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{52} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot (\mathrm{p47} \cdot [\mathrm{DUSP\_n}] \cdot [\mathrm{ppERK\_n}] - \mathrm{m47} \cdot [\mathrm{DUSP\_n\_ppERK\_n}]) \quad (222)$$

7.53 Reaction reaction_22

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

Name v053

Reaction equation

$$\mathrm{DUSP\_n\_ppERK\_n} \longrightarrow \mathrm{DUSP\_n} + \mathrm{pERK\_n} \quad (223)$$

Reactant

Table 115: Properties of each reactant.

Id	Name	SBO
DUSP_n_ppERK_n	DUSP_n_ppERK_n	

Products

Table 116: Properties of each product.

Id	Name	SBO
DUSP_n	DUSP_n	

Id	Name	SBO
pERK_n	pERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{53} = \mathrm{vol}(\mathrm{nucleus}) \cdot \mathrm{p48} \cdot [\mathrm{DUSP\_n\_ppERK\_n}] \tag{224}$$

7.54 Reaction reaction_23

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

Name v054

Reaction equation

$$\mathrm{DUSP\_n} + \mathrm{pERK\_n} \rightleftharpoons \mathrm{DUSP\_n\_pERK\_n} \tag{225}$$

Reactants

Table 117: Properties of each reactant.

Id	Name	SBO
DUSP_n	DUSP_n	
pERK_n	pERK_n	

Product

Table 118: Properties of each product.

Id	Name	SBO
DUSP_n_pERK_n	DUSP_n_pERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{54} = \mathrm{vol}(\mathrm{nucleus}) \cdot (\mathrm{p49} \cdot [\mathrm{DUSP\_n}] \cdot [\mathrm{pERK\_n}] - \mathrm{m49} \cdot [\mathrm{DUSP\_n\_pERK\_n}]) \tag{226}$$

7.55 Reaction reaction_24

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

Name v055

Reaction equation

$$\text{DUSP\_n\_pERK\_n} \longrightarrow \text{DUSP\_n} + \text{ERK\_n} \tag{227}$$

Reactant

Table 119: Properties of each reactant.

Id	Name	SBO
DUSP_n_pERK_n	DUSP_n_pERK_n	

Products

Table 120: Properties of each product.

Id	Name	SBO
DUSP_n	DUSP_n	
ERK_n	ERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{55} = \text{vol}\,(\text{nucleus}) \cdot \text{p50} \cdot [\text{DUSP\_n\_pERK\_n}] \tag{228}$$

7.56 Reaction reaction_29

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

Name v056

Reaction equation

$$\text{DUSP\_n} + \text{ERK\_n} \rightleftharpoons \text{DUSP\_n\_ERK\_n} \tag{229}$$

Reactants

Table 121: Properties of each reactant.

Id	Name	SBO
DUSP_n	DUSP_n	

Id	Name	SBO
ERK_n	ERK_n	

Product

Table 122: Properties of each product.

Id	Name	SBO
DUSP_n_ERK_n	DUSP_n_ERK_n	

Kinetic Law

Derived unit contains undeclared units

$$v_{56} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot (\mathrm{p51} \cdot [\mathrm{DUSP\_n}] \cdot [\mathrm{ERK\_n}] - \mathrm{m51} \cdot [\mathrm{DUSP\_n\_ERK\_n}]) \qquad (230)$$

7.57 Reaction re92

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

Name v057

Reaction equation

$$\emptyset \xrightarrow{\mathrm{FOSn\_2}} \mathrm{PreFmRNA} \qquad (231)$$

Modifier

Table 123: Properties of each modifier.

Id	Name	SBO
FOSn_2	FOSn_2	

Product

Table 124: Properties of each product.

Id	Name	SBO
PreFmRNA	PreFmRNA	

Kinetic Law

Derived unit contains undeclared units

$$v_{57} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_v057}\,(\mathrm{K57}, \mathrm{V57}, \mathrm{n57}, [\mathrm{FOSn\_2}]) \tag{232}$$

$$\mathrm{function\_4\_v057}\,(\mathrm{K57}, \mathrm{V57}, \mathrm{n57}, [\mathrm{FOSn\_2}]) = \frac{\mathrm{V57} \cdot [\mathrm{FOSn\_2}]^{\mathrm{n57}}}{\mathrm{K57}^{\mathrm{n57}} + [\mathrm{FOSn\_2}]^{\mathrm{n57}}} \tag{233}$$

$$\mathrm{function\_4\_v057}\,(\mathrm{K57}, \mathrm{V57}, \mathrm{n57}, [\mathrm{FOSn\_2}]) = \frac{\mathrm{V57} \cdot [\mathrm{FOSn\_2}]^{\mathrm{n57}}}{\mathrm{K57}^{\mathrm{n57}} + [\mathrm{FOSn\_2}]^{\mathrm{n57}}} \tag{234}$$

7.58 Reaction `re118`

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

Name v058

Reaction equation

$$\mathrm{PreFmRNA} \longrightarrow \mathrm{FmRNA} \tag{235}$$

Reactant

Table 125: Properties of each reactant.

Id	Name	SBO
`PreFmRNA`	PreFmRNA	

Product

Table 126: Properties of each product.

Id	Name	SBO
`FmRNA`	FmRNA	

Kinetic Law

Derived unit contains undeclared units

$$v_{58} = \mathrm{function\_4\_v058}\,(\mathrm{Vn}, \mathrm{p58}, [\mathrm{PreFmRNA}]) \tag{236}$$

$$\mathrm{function\_4\_v058}\,(\mathrm{Vn}, \mathrm{p58}, [\mathrm{PreFmRNA}]) = \mathrm{p58} \cdot \mathrm{Vn} \cdot [\mathrm{PreFmRNA}] \tag{237}$$

7.59 Reaction re94

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

Name v059

Reaction equation

$$\text{FmRNA} \longrightarrow \emptyset \tag{238}$$

Reactant

Table 127: Properties of each reactant.

Id	Name	SBO
FmRNA	FmRNA	

Kinetic Law

Derived unit contains undeclared units

$$v_{59} = \text{vol}\,(\text{cytoplasm}) \cdot \text{p59} \cdot [\text{FmRNA}] \tag{239}$$

7.60 Reaction re95

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

Name v060

Reaction equation

$$\emptyset \xrightarrow{\text{FmRNA}} \text{F} \tag{240}$$

Modifier

Table 128: Properties of each modifier.

Id	Name	SBO
FmRNA	FmRNA	

Product

Table 129: Properties of each product.

Id	Name	SBO
F	F	

Kinetic Law

Derived unit contains undeclared units

$$v_{60} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{function\_4\_v060}\,(\mathrm{p60}, [\mathrm{FmRNA}]) \tag{241}$$

$$\mathrm{function\_4\_v060}\,(\mathrm{p60}, [\mathrm{FmRNA}]) = \mathrm{p60} \cdot [\mathrm{FmRNA}] \tag{242}$$

$$\mathrm{function\_4\_v060}\,(\mathrm{p60}, [\mathrm{FmRNA}]) = \mathrm{p60} \cdot [\mathrm{FmRNA}] \tag{243}$$

7.61 Reaction re96

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

Name v061

Reaction equation

$$\mathrm{F} \longrightarrow \emptyset \tag{244}$$

Reactant

Table 130: Properties of each reactant.

Id	Name	SBO
F	F	

Kinetic Law

Derived unit contains undeclared units

$$v_{61} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{p61} \cdot [\mathrm{F}] \tag{245}$$

7.62 Reaction re119

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

Name v062

Reaction equation

$$\mathrm{F} \rightleftharpoons \mathrm{Fn} \tag{246}$$

Reactant

Table 131: Properties of each reactant.

Id	Name	SBO
F	F	

Product

Table 132: Properties of each product.

Id	Name	SBO
Fn	Fn	

Kinetic Law

Derived unit contains undeclared units

$$v_{62} = \mathrm{function\_4\_v062}\left(\mathrm{KexF}, \mathrm{KimF}, \mathrm{Vc}, \mathrm{Vn}, [\mathrm{F}], [\mathrm{Fn}]\right) \tag{247}$$

$$\mathrm{function\_4\_v062}\left(\mathrm{KexF}, \mathrm{KimF}, \mathrm{Vc}, \mathrm{Vn}, [\mathrm{F}], [\mathrm{Fn}]\right) = \mathrm{KimF} \cdot \mathrm{Vc} \cdot [\mathrm{F}] - \mathrm{KexF} \cdot \mathrm{Vn} \cdot [\mathrm{Fn}] \tag{248}$$

7.63 Reaction re99

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

Name v063

Reaction equation

$$\mathrm{Fn} \longrightarrow \emptyset \tag{249}$$

Reactant

Table 133: Properties of each reactant.

Id	Name	SBO
Fn	Fn	

Kinetic Law

Derived unit contains undeclared units

$$v_{63} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_v063}\left(\mathrm{vol}\left(\mathrm{cytoplasm}\right), \mathrm{vol}\left(\mathrm{nucleus}\right), \mathrm{p63}, \left[\mathrm{Fn}\right]\right) \quad (250)$$

$$\mathrm{function\_4\_v063}\left(\mathrm{vol}\left(\mathrm{cytoplasm}\right), \mathrm{vol}\left(\mathrm{nucleus}\right), \mathrm{p63}, \left[\mathrm{Fn}\right]\right) = \frac{\mathrm{vol}\left(\mathrm{cytoplasm}\right) \cdot \mathrm{p63} \cdot \left[\mathrm{Fn}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \quad (251)$$

$$\mathrm{function\_4\_v063}\left(\mathrm{vol}\left(\mathrm{cytoplasm}\right), \mathrm{vol}\left(\mathrm{nucleus}\right), \mathrm{p63}, \left[\mathrm{Fn}\right]\right) = \frac{\mathrm{vol}\left(\mathrm{cytoplasm}\right) \cdot \mathrm{p63} \cdot \left[\mathrm{Fn}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \quad (252)$$

7.64 Reaction `reaction_31`

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

Name v101

Reaction equation

$$\mathrm{A1} \xrightarrow{\mathrm{EGF}} \mathrm{A1\_2} \quad (253)$$

Reactant

Table 134: Properties of each reactant.

Id	Name	SBO
A1	A1	

Modifier

Table 135: Properties of each modifier.

Id	Name	SBO
EGF	EGF	

Product

Table 136: Properties of each product.

Id	Name	SBO
A1_2	A1_2	

Kinetic Law

Derived unit contains undeclared units

$$v_{64} = \text{vol}\left(\text{cytoplasm}\right) \cdot \text{function\_4\_v101}\left(\text{K101}, \text{V101}, [\text{A1}], [\text{EGF}]\right) \tag{254}$$

$$\text{function\_4\_v101}\left(\text{K101}, \text{V101}, [\text{A1}], [\text{EGF}]\right) = \frac{\text{V101} \cdot [\text{EGF}] \cdot [\text{A1}]}{\text{K101} + [\text{A1}]} \tag{255}$$

$$\text{function\_4\_v101}\left(\text{K101}, \text{V101}, [\text{A1}], [\text{EGF}]\right) = \frac{\text{V101} \cdot [\text{EGF}] \cdot [\text{A1}]}{\text{K101} + [\text{A1}]} \tag{256}$$

7.65 Reaction reaction_68

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

Name v102

Reaction equation

$$\text{A1\_2} \longrightarrow \text{A1} \tag{257}$$

Reactant

Table 137: Properties of each reactant.

Id	Name	SBO
A1_2	A1_2	

Product

Table 138: Properties of each product.

Id	Name	SBO
A1	A1	

Kinetic Law

Derived unit contains undeclared units

$$v_{65} = \mathrm{vol}\left(\mathrm{cytoplasm}\right) \cdot \mathrm{function\_4\_v102}\left(\mathrm{K102}, \mathrm{V102}, [\mathrm{A1\_2}]\right) \tag{258}$$

$$\mathrm{function\_4\_v102}\left(\mathrm{K102}, \mathrm{V102}, [\mathrm{A1\_2}]\right) = \frac{\mathrm{V102} \cdot [\mathrm{A1\_2}]}{\mathrm{K102} + [\mathrm{A1\_2}]} \tag{259}$$

$$\mathrm{function\_4\_v102}\left(\mathrm{K102}, \mathrm{V102}, [\mathrm{A1\_2}]\right) = \frac{\mathrm{V102} \cdot [\mathrm{A1\_2}]}{\mathrm{K102} + [\mathrm{A1\_2}]} \tag{260}$$

7.66 Reaction `reaction_69`

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

Name v103

Reaction equation

$$\mathrm{A2} \xrightarrow{\mathrm{HRG}} \mathrm{A2\_2} \tag{261}$$

Reactant

Table 139: Properties of each reactant.

Id	Name	SBO
A2	A2	

Modifier

Table 140: Properties of each modifier.

Id	Name	SBO
HRG	HRG	

Product

Table 141: Properties of each product.

Id	Name	SBO
A2_2	A2_2	

Kinetic Law

Derived unit contains undeclared units

$$v_{66} = \text{vol}\,(\text{cytoplasm}) \cdot \text{function\_4\_v103}\,(\text{K103}, \text{V103}, [\text{A2}], [\text{HRG}]) \tag{262}$$

$$\text{function\_4\_v103}\,(\text{K103}, \text{V103}, [\text{A2}], [\text{HRG}]) = \frac{\text{V103} \cdot [\text{HRG}] \cdot [\text{A2}]}{\text{K103} + [\text{A2}]} \tag{263}$$

$$\text{function\_4\_v103}\,(\text{K103}, \text{V103}, [\text{A2}], [\text{HRG}]) = \frac{\text{V103} \cdot [\text{HRG}] \cdot [\text{A2}]}{\text{K103} + [\text{A2}]} \tag{264}$$

7.67 Reaction reaction_70

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

Name v104

Reaction equation

$$\text{A2\_2} \longrightarrow \text{A2} \tag{265}$$

Reactant

Table 142: Properties of each reactant.

Id	Name	SBO
A2_2	A2_2	

Product

Table 143: Properties of each product.

Id	Name	SBO
A2	A2	

Kinetic Law

Derived unit contains undeclared units

$$v_{67} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{function\_4\_v104}\,(\mathrm{K104}, \mathrm{V104}, [\mathrm{A2\_2}]) \tag{266}$$

$$\mathrm{function\_4\_v104}\,(\mathrm{K104}, \mathrm{V104}, [\mathrm{A2\_2}]) = \frac{\mathrm{V104} \cdot [\mathrm{A2\_2}]}{\mathrm{K104} + [\mathrm{A2\_2}]} \tag{267}$$

$$\mathrm{function\_4\_v104}\,(\mathrm{K104}, \mathrm{V104}, [\mathrm{A2\_2}]) = \frac{\mathrm{V104} \cdot [\mathrm{A2\_2}]}{\mathrm{K104} + [\mathrm{A2\_2}]} \tag{268}$$

7.68 Reaction `reaction_71`

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

Name v105

Reaction equation

$$\mathrm{RsD} \xrightarrow{\mathrm{EGF}} \mathrm{RsT} \tag{269}$$

Reactant

Table 144: Properties of each reactant.

Id	Name	SBO
RsD	RsD	

Modifier

Table 145: Properties of each modifier.

Id	Name	SBO
EGF	EGF	

Product

Table 146: Properties of each product.

Id	Name	SBO
RsT	RsT	

Kinetic Law

Derived unit contains undeclared units

$$v_{68} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{function\_4\_v105}\,(\mathrm{K105}, \mathrm{V105}, [\mathrm{EGF}], [\mathrm{RsD}]) \tag{270}$$

$$\mathrm{function\_4\_v105}\,(\mathrm{K105}, \mathrm{V105}, [\mathrm{EGF}], [\mathrm{RsD}]) = \frac{\mathrm{V105} \cdot [\mathrm{EGF}] \cdot [\mathrm{RsD}]}{\mathrm{K105} + [\mathrm{RsD}]} \tag{271}$$

$$\mathrm{function\_4\_v105}\,(\mathrm{K105}, \mathrm{V105}, [\mathrm{EGF}], [\mathrm{RsD}]) = \frac{\mathrm{V105} \cdot [\mathrm{EGF}] \cdot [\mathrm{RsD}]}{\mathrm{K105} + [\mathrm{RsD}]} \tag{272}$$

7.69 Reaction reaction_72

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

Name v106

Reaction equation

$$\mathrm{RsD} \xrightarrow{\mathrm{HRG}} \mathrm{RsT} \tag{273}$$

Reactant

Table 147: Properties of each reactant.

Id	Name	SBO
RsD	RsD	

Modifier

Table 148: Properties of each modifier.

Id	Name	SBO
HRG	HRG	

Product

Table 149: Properties of each product.

Id	Name	SBO
RsT	RsT	

Kinetic Law

Derived unit contains undeclared units

$$v_{69} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{function\_4\_v106}\,(\mathrm{K106}, \mathrm{V106}, [\mathrm{HRG}], [\mathrm{RsD}]) \tag{274}$$

$$\mathrm{function\_4\_v106}\,(\mathrm{K106}, \mathrm{V106}, [\mathrm{HRG}], [\mathrm{RsD}]) = \frac{\mathrm{V106} \cdot [\mathrm{HRG}] \cdot [\mathrm{RsD}]}{\mathrm{K106} + [\mathrm{RsD}]} \tag{275}$$

$$\mathrm{function\_4\_v106}\,(\mathrm{K106}, \mathrm{V106}, [\mathrm{HRG}], [\mathrm{RsD}]) = \frac{\mathrm{V106} \cdot [\mathrm{HRG}] \cdot [\mathrm{RsD}]}{\mathrm{K106} + [\mathrm{RsD}]} \tag{276}$$

7.70 Reaction reaction_73

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

Name v107

Reaction equation

$$\mathrm{RsT} \xrightarrow{\mathrm{A1\_2}} \mathrm{RsD} \tag{277}$$

Reactant

Table 150: Properties of each reactant.

Id	Name	SBO
RsT	RsT	

Modifier

Table 151: Properties of each modifier.

Id	Name	SBO
A1_2	A1_2	

Product

Table 152: Properties of each product.

Id	Name	SBO
RsD	RsD	

Kinetic Law

Derived unit contains undeclared units

$$v_{70} = \text{vol}\,(\text{cytoplasm}) \cdot \text{function\_4\_v107}\,(\text{K107}, \text{V107}, [\text{A1\_2}], [\text{RsT}]) \tag{278}$$

$$\text{function\_4\_v107}\,(\text{K107}, \text{V107}, [\text{A1\_2}], [\text{RsT}]) = \frac{\text{V107} \cdot [\text{A1\_2}] \cdot [\text{RsT}]}{\text{K107} + [\text{RsT}]} \tag{279}$$

$$\text{function\_4\_v107}\,(\text{K107}, \text{V107}, [\text{A1\_2}], [\text{RsT}]) = \frac{\text{V107} \cdot [\text{A1\_2}] \cdot [\text{RsT}]}{\text{K107} + [\text{RsT}]} \tag{280}$$

7.71 Reaction reaction_74

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

Name v108

Reaction equation

$$\text{RsT} \xrightarrow{\text{A2\_2}} \text{RsD} \tag{281}$$

Reactant

Table 153: Properties of each reactant.

Id	Name	SBO
RsT	RsT	

Modifier

Table 154: Properties of each modifier.

Id	Name	SBO
A2_2	A2_2	

Product

Table 155: Properties of each product.

Id	Name	SBO
RsD	RsD	

Kinetic Law

Derived unit contains undeclared units

$$v_{71} = \text{vol}\left(\text{cytoplasm}\right) \cdot \text{function\_4\_v108}\left(\text{K108}, \text{V108}, [\text{A2\_2}], [\text{RsT}]\right) \tag{282}$$

$$\text{function\_4\_v108}\left(\text{K108}, \text{V108}, [\text{A2\_2}], [\text{RsT}]\right) = \frac{\text{V108} \cdot [\text{A2\_2}] \cdot [\text{RsT}]}{\text{K108} + [\text{RsT}]} \tag{283}$$

$$\text{function\_4\_v108}\left(\text{K108}, \text{V108}, [\text{A2\_2}], [\text{RsT}]\right) = \frac{\text{V108} \cdot [\text{A2\_2}] \cdot [\text{RsT}]}{\text{K108} + [\text{RsT}]} \tag{284}$$

7.72 Reaction reaction_75

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

Name v109

Reaction equation

$$\text{A3} \xrightarrow{\text{HRG}} \text{A3\_2} \tag{285}$$

Reactant

Table 156: Properties of each reactant.

Id	Name	SBO
A3	A3	

Modifier

Table 157: Properties of each modifier.

Id	Name	SBO
HRG	HRG	

Product

Table 158: Properties of each product.

Id	Name	SBO
A3_2	A3_2	

Kinetic Law

Derived unit contains undeclared units

$$v_{72} = \text{vol}\,(\text{cytoplasm}) \cdot \text{function\_4\_v109}\,(\text{K109}, \text{V109}, [\text{HRG}], [\text{A3}]) \tag{286}$$

$$\text{function\_4\_v109}\,(\text{K109}, \text{V109}, [\text{HRG}], [\text{A3}]) = \frac{\text{V109} \cdot [\text{HRG}] \cdot [\text{A3}]}{\text{K109} + [\text{A3}]} \tag{287}$$

$$\text{function\_4\_v109}\,(\text{K109}, \text{V109}, [\text{HRG}], [\text{A3}]) = \frac{\text{V109} \cdot [\text{HRG}] \cdot [\text{A3}]}{\text{K109} + [\text{A3}]} \tag{288}$$

7.73 Reaction reaction_76

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

Name v110

Reaction equation

$$\text{A3\_2} \longrightarrow \text{A3} \tag{289}$$

Reactant

Table 159: Properties of each reactant.

Id	Name	SBO
A3_2	A3_2	

Product

Table 160: Properties of each product.

Id	Name	SBO
A3	A3	

Kinetic Law

Derived unit contains undeclared units

$$v_{73} = \text{vol}(\text{cytoplasm}) \cdot \text{function\_4\_v110}(\text{K110}, \text{V110}, [\text{A3\_2}]) \tag{290}$$

$$\text{function\_4\_v110}(\text{K110}, \text{V110}, [\text{A3\_2}]) = \frac{\text{V110} \cdot [\text{A3\_2}]}{\text{K110} + [\text{A3\_2}]} \tag{291}$$

$$\text{function\_4\_v110}(\text{K110}, \text{V110}, [\text{A3\_2}]) = \frac{\text{V110} \cdot [\text{A3\_2}]}{\text{K110} + [\text{A3\_2}]} \tag{292}$$

7.74 Reaction reaction_77

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

Name v111

Reaction equation

$$\text{Kin} \xrightarrow{\text{HRG}} \text{Kin\_2} \tag{293}$$

Reactant

Table 161: Properties of each reactant.

Id	Name	SBO
Kin	Kin	

Modifier

Table 162: Properties of each modifier.

Id	Name	SBO
HRG	HRG	

Product

Table 163: Properties of each product.

Id	Name	SBO
Kin_2	Kin_2	

Kinetic Law

Derived unit contains undeclared units

$$v_{74} = \text{vol}\,(\text{cytoplasm}) \cdot \text{function\_4\_v111}\,(\text{K111}, \text{V111}, [\text{HRG}], [\text{Kin}]) \tag{294}$$

$$\text{function\_4\_v111}\,(\text{K111}, \text{V111}, [\text{HRG}], [\text{Kin}]) = \frac{\text{V111} \cdot [\text{HRG}] \cdot [\text{Kin}]}{\text{K111} + [\text{Kin}]} \tag{295}$$

$$\text{function\_4\_v111}\,(\text{K111}, \text{V111}, [\text{HRG}], [\text{Kin}]) = \frac{\text{V111} \cdot [\text{HRG}] \cdot [\text{Kin}]}{\text{K111} + [\text{Kin}]} \tag{296}$$

7.75 Reaction reaction_78

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

Name v112

Reaction equation

$$\text{Kin\_2} \xrightarrow{\text{A3\_2}} \text{Kin} \tag{297}$$

Reactant

Table 164: Properties of each reactant.

Id	Name	SBO
Kin_2	Kin_2	

Modifier

Table 165: Properties of each modifier.

Id	Name	SBO
A3_2	A3_2	

Product

Table 166: Properties of each product.

Id	Name	SBO
Kin	Kin	

Kinetic Law

Derived unit contains undeclared units

$$v_{75} = \text{vol}\,(\text{cytoplasm}) \cdot \text{function\_4\_v112}\,(\text{K112}, \text{V112}, [\text{A3\_2}], [\text{Kin\_2}]) \tag{298}$$

$$\text{function\_4\_v112}\,(\text{K112}, \text{V112}, [\text{A3\_2}], [\text{Kin\_2}]) = \frac{\text{V112} \cdot [\text{A3\_2}] \cdot [\text{Kin\_2}]}{\text{K112} + [\text{Kin\_2}]} \tag{299}$$

$$\text{function\_4\_v112}\,(\text{K112}, \text{V112}, [\text{A3\_2}], [\text{Kin\_2}]) = \frac{\text{V112} \cdot [\text{A3\_2}] \cdot [\text{Kin\_2}]}{\text{K112} + [\text{Kin\_2}]} \tag{300}$$

7.76 Reaction reaction_79

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

Name v113

Reaction equation

$$\text{MEK} \xrightarrow{\text{RsT}} \text{pMEK} \tag{301}$$

Reactant

Table 167: Properties of each reactant.

Id	Name	SBO
MEK	MEK	

Modifier

Table 168: Properties of each modifier.

Id	Name	SBO
RsT	RsT	

Product

Table 169: Properties of each product.

Id	Name	SBO
pMEK	pMEK	

Kinetic Law

Derived unit contains undeclared units

$$v_{76} = \text{vol}\left(\text{cytoplasm}\right) \cdot \text{function\_4\_v113}\left(\text{K113}, \text{V113}, [\text{RsT}], [\text{MEK}]\right) \tag{302}$$

$$\text{function\_4\_v113}\left(\text{K113}, \text{V113}, [\text{RsT}], \text{pMEK\_c}\right) = \frac{\text{V113} \cdot [\text{RsT}] \cdot \text{pMEK\_c}}{\text{K113} + \text{pMEK\_c}} \tag{303}$$

$$\text{function\_4\_v113}\left(\text{K113}, \text{V113}, [\text{RsT}], \text{pMEK\_c}\right) = \frac{\text{V113} \cdot [\text{RsT}] \cdot \text{pMEK\_c}}{\text{K113} + \text{pMEK\_c}} \tag{304}$$

7.77 Reaction reaction_80

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

Name v114

Reaction equation

$$\text{MEK} \xrightarrow{\text{Kin\_2}} \text{pMEK} \tag{305}$$

Reactant

Table 170: Properties of each reactant.

Id	Name	SBO
MEK	MEK	

Modifier

Table 171: Properties of each modifier.

Id	Name	SBO
Kin_2	Kin_2	

Product

Table 172: Properties of each product.

Id	Name	SBO
pMEK	pMEK	

Kinetic Law

Derived unit contains undeclared units

$$v_{77} = \text{vol}\,(\text{cytoplasm}) \cdot \text{function\_4\_v114}\,(\text{K114}, \text{V114}, [\text{Kin\_2}], [\text{MEK}]) \tag{306}$$

$$\text{function\_4\_v114}\,(\text{K114}, \text{V114}, [\text{Kin\_2}], \text{pMEK\_c}) = \frac{\text{V114} \cdot [\text{Kin\_2}] \cdot \text{pMEK\_c}}{\text{K114} + \text{pMEK\_c}} \tag{307}$$

$$\text{function\_4\_v114}\,(\text{K114}, \text{V114}, [\text{Kin\_2}], \text{pMEK\_c}) = \frac{\text{V114} \cdot [\text{Kin\_2}] \cdot \text{pMEK\_c}}{\text{K114} + \text{pMEK\_c}} \tag{308}$$

7.78 Reaction reaction_81

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

Name v115

Reaction equation

$$\text{pMEK} \longrightarrow \text{MEK} \tag{309}$$

Reactant

Table 173: Properties of each reactant.

Id	Name	SBO
pMEK	pMEK	

Product

Table 174: Properties of each product.

Id	Name	SBO
MEK	MEK	

Kinetic Law

Derived unit contains undeclared units

$$v_{78} = \text{vol}\,(\text{cytoplasm}) \cdot \text{function\_4\_v115}\,(\text{K115}, \text{V115}, [\text{pMEK}]) \tag{310}$$

$$\text{function\_4\_v115}\,(\text{K115}, \text{V115}, \text{MEKc}) = \frac{\text{V115} \cdot \text{MEKc}}{\text{K115} + \text{MEKc}} \tag{311}$$

$$\text{function\_4\_v115}\,(\text{K115}, \text{V115}, \text{MEKc}) = \frac{\text{V115} \cdot \text{MEKc}}{\text{K115} + \text{MEKc}} \tag{312}$$

8 Derived Rate Equations

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

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

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

8.1 Species EGF

Name EGF

SBO:0000252 polypeptide chain

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

This species takes part in two reactions (as a modifier in reaction_31, reaction_71), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{EGF} = 0 \tag{313}$$

8.2 Species HRG

Name HRG

SBO:0000252 polypeptide chain

Initial concentration $10\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in four reactions (as a modifier in reaction_69, reaction_72, reaction_75, reaction_77), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{HRG} = 0 \tag{314}$$

8.3 Species A1

Name A1

Initial concentration $182.3524\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in two reactions (as a reactant in reaction_31 and as a product in reaction_68).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{A1} = v_{65} - v_{64} \tag{315}$$

8.4 Species A1_2

Name A1_2

Initial concentration $0\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in three reactions (as a reactant in reaction_68 and as a product in reaction_31 and as a modifier in reaction_73).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{A1\_2} = v_{64} - v_{65} \tag{316}$$

8.5 Species A2

Name A2

Initial concentration $25.38702\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in two reactions (as a reactant in reaction_69 and as a product in reaction_70).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{A2} = v_{67} - v_{66} \tag{317}$$

8.6 Species A2_2

Name A2_2

Initial concentration $0\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in three reactions (as a reactant in reaction_70 and as a product in reaction_69 and as a modifier in reaction_74).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{A2\_2} = v_{66} - v_{67} \tag{318}$$

8.7 Species A3

Name A3

Initial concentration $13.09262\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in two reactions (as a reactant in reaction_75 and as a product in reaction_76).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{A3} = v_{73} - v_{72} \tag{319}$$

8.8 Species A3_2

Name A3_2

Initial concentration $0\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in three reactions (as a reactant in reaction_76 and as a product in reaction_75 and as a modifier in reaction_78).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{A3\_2} = v_{72} - v_{73} \tag{320}$$

8.9 Species DUSPmRNA

Name DUSPmRNA

SBO:0000250 ribonucleic acid

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in three reactions (as a reactant in reaction_17 and as a product in re110 and as a modifier in re89).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DUSPmRNA} = v_{11} - v_{12} \tag{321}$$

8.10 Species ERK_c

Name ERK_c

SBO:0000252 polypeptide chain

Initial concentration $570.4179\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in four reactions (as a reactant in reaction_32, re106 and as a product in re85 and as a modifier in reaction_6).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ERK\_c} = v_3 - v_1 - v_7 \tag{322}$$

8.11 Species pERK_c

Name pERK_c

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in seven reactions (as a reactant in reaction_6, re85, re107 and as a product in reaction_32, re86 and as a modifier in reaction_32, re86).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pERK\_c} = v_1 + v_4 - v_2 - v_3 - v_8 \tag{323}$$

8.12 Species ppERK_c

Name ppERK_c

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in seven reactions (as a reactant in re86, re108 and as a product in reaction_6 and as a modifier in re85, reaction_33, reaction_41, reaction_59).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ppERK\_c} = v_2 - v_4 - v_9 \tag{324}$$

8.13 Species F

Name F

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in three reactions (as a reactant in re96, re119 and as a product in re95).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{F} = v_{60} - v_{61} - v_{62} \tag{325}$$

8.14 Species c_FOS_c

Name c_FOS_c

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in six reactions (as a reactant in reaction_59, reaction_67, reaction_61, re116 and as a product in re90, reaction_60).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{c\_FOS\_c} = v_{34} + v_{37} - v_{35} - v_{36} - v_{38} - v_{40} \tag{326}$$

8.15 Species pc_FOS_c

Name pc_FOS_c

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in five reactions (as a reactant in reaction_60, reaction_62, re117 and as a product in reaction_59, reaction_67).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pc\_FOS\_c} = v_{35} + v_{36} - v_{37} - v_{39} - v_{41} \tag{327}$$

8.16 Species c_FOSmRNA

Name c_FOSmRNA

SBO:0000250 ribonucleic acid

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in three reactions (as a reactant in reaction_50 and as a product in re115 and as a modifier in re90).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{c\_FOSmRNA} = v_{32} - v_{33} \tag{328}$$

8.17 Species FmRNA

Name FmRNA

SBO:0000250 ribonucleic acid

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in three reactions (as a reactant in re94 and as a product in re118 and as a modifier in re95).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{FmRNA} = v_{58} - v_{59} \tag{329}$$

8.18 Species Kin

Name Kin

SBO:0000252 polypeptide chain

Initial concentration $82.66574\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in two reactions (as a reactant in reaction_77 and as a product in reaction_78).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Kin} = v_{75} - v_{74} \tag{330}$$

8.19 Species Kin_2

Name Kin_2

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in three reactions (as a reactant in reaction_78 and as a product in reaction_77 and as a modifier in reaction_80).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Kin\_2} = v_{74} - v_{75} \tag{331}$$

8.20 Species pMEK

Name pMEK

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in five reactions (as a reactant in reaction_81 and as a product in reaction_79, reaction_80 and as a modifier in reaction_32, reaction_6).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pMEK} = v_{76} + v_{77} - v_{78} \tag{332}$$

8.21 Species MEK

Name MEK

SBO:0000252 polypeptide chain

Initial concentration $637.3212\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in three reactions (as a reactant in reaction_79, reaction_80 and as a product in reaction_81).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{MEK} = v_{78} - v_{76} - v_{77} \tag{333}$$

8.22 Species DUSP_c

Name DUSP_c

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in five reactions (as a reactant in reaction_33, reaction_35, re111 and as a product in re89, reaction_34).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DUSP\_c} = v_{13} + v_{15} - v_{14} - v_{16} - v_{18} \tag{334}$$

8.23 Species pDUSP_c

Name pDUSP_c

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in four reactions (as a reactant in reaction_34, reaction_36, re112 and as a product in reaction_33).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pDUSP\_c} = v_{14} - v_{15} - v_{17} - v_{19} \tag{335}$$

8.24 Species RSK_c

Name RSK_c

SBO:0000252 polypeptide chain

Initial concentration $353\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in two reactions (as a reactant in reaction_41 and as a product in reaction_42).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{RSK\_c} = v_{25} - v_{24} \tag{336}$$

8.25 Species pRSK_c

Name pRSK_c

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in four reactions (as a reactant in reaction_42, re113 and as a product in reaction_41 and as a modifier in reaction_67).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pRSK\_c} = v_{24} - v_{25} - v_{26} \tag{337}$$

8.26 Species RsD

Name RsD

SBO:0000252 polypeptide chain

Initial concentration $247.4035\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in four reactions (as a reactant in reaction_71, reaction_72 and as a product in reaction_73, reaction_74).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{RsD} = v_{70} + v_{71} - v_{68} - v_{69} \tag{338}$$

8.27 Species RsT

Name RsT

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in five reactions (as a reactant in reaction_73, reaction_74 and as a product in reaction_71, reaction_72 and as a modifier in reaction_79).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{RsT} = v_{68} + v_{69} - v_{70} - v_{71} \tag{339}$$

8.28 Species CREB_n

Name CREB_n

SBO:0000252 polypeptide chain

Initial concentration $1000\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in two reactions (as a reactant in reaction_45 and as a product in reaction_46).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{CREB\_n} = v_{28} - v_{27} \tag{340}$$

8.29 Species pCREB_n

Name pCREB_n

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in three reactions (as a reactant in reaction_46 and as a product in reaction_45 and as a modifier in reaction_47).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pCREB\_n} = v_{27} - v_{28} \tag{341}$$

8.30 Species ERK_n

Name ERK_n

SBO:0000252 polypeptide chain

Initial concentration $1624.9\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in six reactions (as a reactant in reaction_30, reaction_29 and as a product in re87, re106, reaction_28, reaction_24).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ERK\_n} = v_5 + v_7 + v_{50} + v_{55} - v_{51} - v_{56} \tag{342}$$

8.31 Species pERK_n

Name pERK_n

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in eight reactions (as a reactant in re87, reaction_27, reaction_23 and as a product in re88, re107, reaction_26, reaction_22 and as a modifier in re88).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pERK\_n} = v_6 + v_8 + v_{48} + v_{53} - v_5 - v_{49} - v_{54} \tag{343}$$

8.32 Species ppERK_n

Name ppERK_n

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in nine reactions (as a reactant in re88, reaction_25, reaction_21 and as a product in re108 and as a modifier in re87, re109, reaction_12, reaction_57, reaction_52).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ppERK\_n} = v_9 - v_6 - v_{47} - v_{52} \tag{344}$$

8.33 Species Elk1_n

Name Elk1_n

SBO:0000252 polypeptide chain

Initial concentration $1510\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in two reactions (as a reactant in reaction_57 and as a product in reaction_58).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Elk1\_n} = v_{30} - v_{29} \tag{345}$$

8.34 Species pElk1_n

Name pElk1_n

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in three reactions (as a reactant in reaction_58 and as a product in reaction_57 and as a modifier in reaction_47).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pElk1\_n} = v_{29} - v_{30} \tag{346}$$

8.35 Species FOSn

Name FOSn

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in five reactions (as a reactant in reaction_52, reaction_53, reaction_55 and as a product in re116, reaction_54).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{FOSn} = v_{40} + v_{44} - v_{42} - v_{43} - v_{45} \tag{347}$$

8.36 Species FOSn_2

Name FOSn_2

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in six reactions (as a reactant in reaction_54, reaction_56 and as a product in re117, reaction_52, reaction_53 and as a modifier in re92).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{FOSn\_2} = v_{41} + v_{42} + v_{43} - v_{44} - v_{46} \tag{348}$$

8.37 Species Fn

Name Fn

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in three reactions (as a reactant in re99 and as a product in re119 and as a modifier in reaction_47).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Fn} = v_{62} - v_{63} \tag{349}$$

8.38 Species DUSP_n

Name DUSP_n

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in nine reactions (as a reactant in reaction_12, reaction_14, reaction_21, reaction_23, reaction_29 and as a product in re111, reaction_13, reaction_22, reaction_24).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DUSP\_n} = v_{18} + v_{21} + v_{53} + v_{55} - v_{20} - v_{22} - v_{52} - v_{54} - v_{56} \tag{350}$$

8.39 Species pDUSP_n

Name pDUSP_n

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in nine reactions (as a reactant in reaction_13, reaction_15, reaction_25, reaction_27, reaction_30 and as a product in re112, reaction_12, reaction_26, reaction_28).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pDUSP\_n} = v_{19} + v_{20} + v_{48} + v_{50} - v_{21} - v_{23} - v_{47} - v_{49} - v_{51} \tag{351}$$

8.40 Species pDUSP_n_ERK_n

Name pDUSP_n_ERK_n

SBO:0000297 protein complex

Initial concentration $0\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in one reaction (as a product in reaction_30).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pDUSP\_n\_ERK\_n} = v_{51} \tag{352}$$

8.41 Species pDUSP_n_pERK_n

Name pDUSP_n_pERK_n

SBO:0000297 protein complex

Initial concentration $0\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in two reactions (as a reactant in reaction_28 and as a product in reaction_27).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pDUSP\_n\_pERK\_n} = v_{49} - v_{50} \tag{353}$$

8.42 Species pDUSP_n_ppERK_n

Name pDUSP_n_ppERK_n

SBO:0000297 protein complex

Initial concentration $0\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in two reactions (as a reactant in reaction_26 and as a product in reaction_25).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pDUSP\_n\_ppERK\_n} = v_{47} - v_{48} \tag{354}$$

8.43 Species DUSP_n_ERK_n

Name DUSP_n_ERK_n

SBO:0000297 protein complex

Initial concentration $0\ \mathrm{nmol \cdot pl^{-1}}$

This species takes part in one reaction (as a product in reaction_29).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DUSP\_n\_ERK\_n} = v_{56} \tag{355}$$

8.44 Species DUSP_n_pERK_n

Name DUSP_n_pERK_n

SBO:0000297 protein complex

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in two reactions (as a reactant in reaction_24 and as a product in reaction_23).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DUSP\_n\_pERK\_n} = v_{54} - v_{55} \tag{356}$$

8.45 Species DUSP_n_ppERK_n

Name DUSP_n_ppERK_n

SBO:0000297 protein complex

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in two reactions (as a reactant in reaction_22 and as a product in reaction_21).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DUSP\_n\_ppERK\_n} = v_{52} - v_{53} \tag{357}$$

8.46 Species PreDUSPmRNA

Name PreDUSPmRNA

SBO:0000250 ribonucleic acid

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in two reactions (as a reactant in re110 and as a product in re109).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{PreDUSPmRNA} = v_{10} - v_{11} \tag{358}$$

8.47 Species PreFOSmRNA

Name PreFOSmRNA

SBO:0000250 ribonucleic acid

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in two reactions (as a reactant in re115 and as a product in reaction_47).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{PreFOSmRNA} = v_{31} - v_{32} \tag{359}$$

8.48 Species PreFmRNA

Name PreFmRNA

SBO:0000250 ribonucleic acid

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in two reactions (as a reactant in re118 and as a product in re92).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{PreFmRNA} = v_{57} - v_{58} \tag{360}$$

8.49 Species pRSK_n

Name pRSK_n

SBO:0000252 polypeptide chain

Initial concentration $0\ \mathrm{nmol} \cdot \mathrm{pl}^{-1}$

This species takes part in three reactions (as a product in re113 and as a modifier in reaction_45, reaction_53).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pRSK\_n} = v_{26} \tag{361}$$

A Glossary of Systems Biology Ontology Terms

SBO:0000250 ribonucleic acid: Macromolecule formed by a repetition of ribonucleosides linked by phosphodiester bonds. CHEBI:3369

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

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

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

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