SBML Model Report

Model name: "Schoeberl2002 - EGF MAPK"

May 5, 2016

1 General Overview

This is a document in SBML Level 2 Version 4 format. This model was created by the following five authors: Nicolas Le Novre[1], Rainer Machne[2], Lukas Endler[3], Ken Lau[4] and Birgit Schoeberl[5] at August 15th 2005 at 6:36 a. m. and last time modified at April eighth 2016 at 2:31 p. m. Table 1 shows an overview of the quantities of all components of this model.

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

Element	Quantity	Element	Quantity
compartment types	0	compartments	3
species types	0	species	100
events	0	constraints	0
reactions	125	function definitions	0
global parameters	90	unit definitions	7
rules	8	initial assignments	0

Model Notes

Schoeberl2002 - EGF MAPK

Computational model that offers an integrated quantitative, dynamic, and topological representation of intracellular signal networks, based on known components of epidermal growth factor (EGF) receptor signal pathways.

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The initial model was constructed by Ken Lau from the MATLAB source code.

This model is described in the article:Computational modeling of the dynamics of the MAP kinase cascade activated by surface and internalized EGF receptors.Schoeberl B, Eichler-Jonsson C, Gilles ED, Mller GNat. Biotechnol. 2002 Apr; 20(4): 370-375

Abstract:

We present a computational model that offers an integrated quantitative, dynamic, and topological representation of intracellular signal networks, based on known components of epidermal growth factor (EGF) receptor signal pathways. The model provides insight into signal-response relationships between the binding of EGF to its receptor at the cell surface and the activation of downstream proteins in the signaling cascade. It shows that EGF-induced responses are remarkably stable over a 100-fold range of ligand concentration and that the critical parameter in determining signal efficacy is the initial velocity of receptor activation. The predictions of the model agree well with experimental analysis of the effect of EGF on two downstream responses, phosphorylation of ERK-1/2 and expression of the target gene, c-fos.

This model does **not** exactly reproduce the results given in the original publication. It has, though, the same reaction graph and gives very similar time courses for the conditions depicted in the article.

Several corrections were applied to the parameters described in the paper's supplementary materials. Some parameter names were replaced by the corresponding identical ones: k(r)26 by k(r)18, k(r)27 by k(r)19, k(r)30 by k(r)20, k(r)38 by k(r)24, k(r)39 by k(r)37, k(r)46 by k(r)44, k51 by k49, k(r)54 by k(r)52 and k62 by k62. In particular the parameter values described in the column „remark„ of supplementary table 1 override the values explicitely written in the numerical columns:

name	**in suppl. value used**	**in model value used**	**remarks**
kr16	0.055	0.275	
k30	7.9e6	2.1e6	as k20
kr30	0.3	0.4	as kr24
k38	3e7	1e7	as k20
kr38	0.055	0.55	as kr24
k52	1.1e5	5.34e7	

k5 was used for v116, v119, v122 and v125 in addition of v107, v110 and v113 as listed in the legend of supplementary figure 2. k5 is calculated using th eformula from the matlab file not given in the supplements.

All rate constants were rescaled to minutes (k[min] = 60*k[sec]) and all second order rate constants additionally to molecules/cell with a cell volume of 1 picolitre (k[molecs/cell] = k[M]/(Vc*Na), with Vc=1e-12 l and Na = 6e23).

The association constant of internalized EGF was rescaled to molecules/endosome using an endosomal volume of 4.3 al (= $4.3*10^{-18}$ litre).

The extracellular EGF concentration was converted to molecules per picolitre with a MW of 6045 Da.

[ng/ml]	[numb/pl]
50	4962
0.5	49.6
0.125	12.4

With the initial conditions given in the paper, the results could not be reproduced at all. Therefore the initial conditions used in the MATLAB file were adopted for SHC ($1.01 * 10^5$ instead of $1.01 * 10^6$) and Ras_GDP. ($7.2 * 10^4$ instead of $1.14 * 10^7$)

This model is hosted on BioModels Database and identified by: BIOMD0000000019.

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

2 Unit Definitions

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

2.1 Unit `substance`

Name items

Definition item

2.2 Unit `time`

Name min

Definition 60 s

2.3 Unit `volume`

Name pl

Definition pl

2.4 Unit `pmin`

Name permin

Definition $(60\ \mathrm{s})^{-1}$

2.5 Unit ipmin

Name itemspermin

Definition $\text{item} \cdot (60\ \text{s})^{-1}$

2.6 Unit pipmin

Name peritempermin

Definition $(60\ \text{s})^{-1} \cdot \text{item}^{-1}$

2.7 Unit piplpmin

Name plperitempermin

Definition $\text{pl} \cdot \text{item}^{-1} \cdot (60\ \text{s})^{-1}$

2.8 Unit area

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

Definition m^2

2.9 Unit length

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

Definition m

3 Compartments

This model contains three compartments.

Table 4: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
c1	extracellular volume		3	1	litre	☑	
c2	cytoplasm		3	1	litre	☑	
c3	endosomal volume		3	$4.3 \cdot 10^{-6}$	pl	☑	

3.1 Compartment c1

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

Name extracellular volume

3.2 Compartment c2

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

Name cytoplasm

3.3 Compartment c3

This is a three dimensional compartment with a constant size of $4.3 \cdot 10^{-6}$ pl.

Name endosomal volume

4 Species

This model contains 100 species. The boundary condition of seven 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 5: Properties of each species.

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
x1	EGF	c1	item	⊟	☑
x2	EGFR	c1	item	⊟	⊟
x3	EGF-EGFR	c2	item	⊟	⊟
x4	EGF-EGFR$\hat{2}$	c2	item	⊟	⊟
x5	EGF-EGFR*$\hat{2}$	c2	item	⊟	⊟
x6	EGFRi	c2	item	⊟	⊟
x7	EGF-EGFR*$\hat{2}$-GAP-Grb2-Prot	c2	item	⊟	⊟
x8	EGF-EGFRi*$\hat{2}$	c2	item	⊟	⊟
x9	Proti	c2	item	⊟	⊟
x10	EGF-EGFRi	c2	item	⊟	⊟
x11	EGF-EGFRi$\hat{2}$	c2	item	⊟	⊟
x12	Prot	c2	item	⊟	⊟
x13	EGFideg	c3	item	⊟	⊟
x14	GAP	c2	item	⊟	⊟
x15	EGF-EGFR*$\hat{2}$-GAP	c3	item	⊟	⊟
x16	EGFi	c2	item	⊟	⊟
x17	EGF-EGFRi*$\hat{2}$-GAP	c2	item	⊟	⊟
x18	EGF-EGFRi*$\hat{2}$-GAP-Grb2	c2	item	⊟	⊟
x19	EGF-EGFRi*$\hat{2}$-GAP-Grb2-Sos	c2	item	⊟	⊟
x20	EGF-EGFRi*$\hat{2}$-GAP-Grb2-Sos-Ras-GDP	c2	item	⊟	⊟
x21	EGF-EGFRi*$\hat{2}$-GAP-Grb2-Sos-Ras-GTP	c2	item	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
x22	Grb2	c2	item	⊟	⊟
x23	EGF-EGFR*2̂-GAP-Grb2	c2	item	⊟	⊟
x24	Sos	c2	item	⊟	⊟
x25	EGF-EGFR*2̂-GAP-Grb2-Sos	c2	item	⊟	⊟
x26	Ras-GDP	c2	item	⊟	⊟
x27	EGF-EGFR*2̂-GAP-Grb2-Sos-Ras-GDP	c2	item	⊟	⊟
x28	Ras-GTP	c2	item	⊟	⊟
x29	EGF-EGFR*2̂-GAP-Grb2-Sos-Ras-GTP	c2	item	⊟	⊟
x30	Grb2-Sos	c2	item	⊟	⊟
x31	Shc	c2	item	⊟	⊟
x32	EGF-EGFR*2̂-GAP-Shc	c2	item	⊟	⊟
x33	EGF-EGFR*2̂-GAP-Shc*	c2	item	⊟	⊟
x34	EGF-EGFR*2̂-GAP-Shc*-Grb2	c2	item	⊟	⊟
x35	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos	c2	item	⊟	⊟
x36	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos-Ras-GDP	c2	item	⊟	⊟
x37	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos-Ras-GTP	c2	item	⊟	⊟
x38	Shc*-Grb2-Sos	c2	item	⊟	⊟
x39	Shc*-Grb2	c2	item	⊟	⊟
x40	Shc*	c2	item	⊟	⊟
x41	Raf	c2	item	⊟	⊟
x42	Raf-Ras-GTP	c2	item	⊟	⊟
x43	Ras-GTP*	c2	item	⊟	⊟
x44	Phosphotase1	c2	item	⊟	⊟
x45	Raf*	c2	item	⊟	⊟
x46	Raf*-P'ase	c2	item	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
x47	MEK	c2	item	⊟	⊟
x48	MEK-Raf*	c2	item	⊟	⊟
x49	MEK-P	c2	item	⊟	⊟
x50	MEK-P-Raf*	c2	item	⊟	⊟
x51	MEK-PP	c2	item	⊟	⊟
x52	MEK-PP-P'ase2	c2	item	⊟	⊟
x53	Phosphatase2	c2	item	⊟	⊟
x54	MEK-P-P'ase2	c2	item	⊟	⊟
x55	ERK	c2	item	⊟	⊟
x56	ERK-MEK-PP	c2	item	⊟	⊟
x57	ERK-P	c2	item	⊟	⊟
x58	ERK-P-MEK-PP	c2	item	⊟	⊟
x59	ERK-PP	c2	item	⊟	⊟
x60	Phosphotase3	c2	item	⊟	⊟
x61	ERK-PP-P'ase3	c2	item	⊟	⊟
x62	ERK-P-P'ase3	c2	item	⊟	⊟
x63	EGF-EGFRi*2̂-GAP-Shc	c2	item	⊟	⊟
x64	EGF-EGFRi*2̂-GAP-Shc*	c2	item	⊟	⊟
x65	EGF-EGFRi*2̂-GAP-Shc*-Grb2	c2	item	⊟	⊟
x66	EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos	c2	item	⊟	⊟
x67	EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos-Ras-GDP	c2	item	⊟	⊟
x68	EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos-Ras-GTP	c2	item	⊟	⊟
x69	Rasi-GTP	c2	item	⊟	⊟
x70	Rafi-Rasi-GTP	c2	item	⊟	⊟
x71	Rasi-GTP*	c2	item	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
x72	Rafi*	c2	item	⊟	⊟
x73	Rafi*-P'ase	c2	item	⊟	⊟
x74	MEKi-Rafi*	c2	item	⊟	⊟
x75	MEKi-P	c2	item	⊟	⊟
x76	MEKi-P-Rafi*	c2	item	⊟	⊟
x77	MEKi-PP	c2	item	⊟	⊟
x78	MEKi-PP-P'ase2i	c2	item	⊟	⊟
x79	MEKi-P-P'ase2i	c2	item	⊟	⊟
x80	ERKi-MEKi-PP	c2	item	⊟	⊟
x81	ERKi-P	c2	item	⊟	⊟
x82	ERKi-P-MEKi-PP	c2	item	⊟	⊟
x83	ERKi-PP	c2	item	⊟	⊟
x84	ERKi-PP-P'ase3i	c2	item	⊟	⊟
x85	ERKi-P-P'ase3i	c2	item	⊟	⊟
x86	EGFRideg	c2	item	⊟	⊟
x87	EGF-EGFRi*$\hat{2}$deg	c2	item	⊟	⊟
x88	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Prot	c2	item	⊟	⊟
x89	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Ras-GDP-Prot	c2	item	⊟	⊟
x90	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Ras-GTP-Prot	c2	item	⊟	⊟
x91	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Prot	c2	item	⊟	⊟
x92	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos-Prot	c2	item	⊟	⊟
x93	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GDP-Prot	c2	item	⊟	⊟
x94	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GTP-Prot	c2	item	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
Raf_act	t_Raf*	c2	item	⊟	☑
Ras_GTP	t_Ras_GTP	c2	item	⊟	☑
MEK_PP	t_MEK_PP	c2	item	⊟	☑
ERK_PP	t_ERK_PP	c2	item	⊟	☑
SHC_P_t	t_SHC_P_t	c2	item	⊟	☑
EGF_EGFR_act	t_EGF_EGFR*	c2	item	⊟	☑

5 Parameters

This model contains 90 global parameters.

Table 6: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			0.003	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr1			0.228	$(60\ \mathrm{s})^{-1}$	☑
kr2			6.000	$(60\ \mathrm{s})^{-1}$	☑
k2			0.001	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
k3			60.000	$(60\ \mathrm{s})^{-1}$	☑
kr3			0.600	$(60\ \mathrm{s})^{-1}$	☑
k4			$1.038 \cdot 10^{-5}$	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr4			0.100	$(60\ \mathrm{s})^{-1}$	☑
k5			0.000	$(60\ \mathrm{s})^{-1}$	⊟
k6			0.003	$(60\ \mathrm{s})^{-1}$	☑
kr6			0.300	$(60\ \mathrm{s})^{-1}$	☑
k7			0.003	$(60\ \mathrm{s})^{-1}$	☑
k8			10^{-4}	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr8			12.000	$(60\ \mathrm{s})^{-1}$	☑
k10			3.256	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr10			0.660	$(60\ \mathrm{s})^{-1}$	☑
kr11			6.000	$(60\ \mathrm{s})^{-1}$	☑
k11			0.001	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr12			0.600	$(60\ \mathrm{s})^{-1}$	☑
k12			60.000	$(60\ \mathrm{s})^{-1}$	☑
k13			130.200	$\mathrm{item} \cdot (60\ \mathrm{s})^{-1}$	☑
k14			10^{-4}	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr14			12.000	$(60\ \mathrm{s})^{-1}$	☑
k15			600000.000	$(60\ \mathrm{s})^{-1}$	☑
kr16			16.500	$(60\ \mathrm{s})^{-1}$	☑
k16			0.001	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr17			3.600	$(60\ \mathrm{s})^{-1}$	☑
k17			0.001	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr18			78.000	$(60\ \mathrm{s})^{-1}$	☑
k18			0.002	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr19			10^{-5}	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
k19			30.000	$(60\ \mathrm{s})^{-1}$	☑
kr20			24.000	$(60\ \mathrm{s})^{-1}$	☑
k20			$2.1 \cdot 10^{-4}$	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑

Id	Name	SBO	Value	Unit	Constant
k21			1.380	$(60\ \mathrm{s})^{-1}$	☑
kr21			$2.2 \cdot 10^{-5}$	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
k22			0.002	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr22			6.000	$(60\ \mathrm{s})^{-1}$	☑
k23			360.000	$(60\ \mathrm{s})^{-1}$	☑
kr23			36.000	$(60\ \mathrm{s})^{-1}$	☑
k24			0.001	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr24			33.000	$(60\ \mathrm{s})^{-1}$	☑
kr25			1.284	$(60\ \mathrm{s})^{-1}$	☑
k25			0.001	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
k28			10^{-4}	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr28			0.318	$(60\ \mathrm{s})^{-1}$	☑
k29			60.000	$(60\ \mathrm{s})^{-1}$	☑
kr29			$7 \cdot 10^{-5}$	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr32			$2.4 \cdot 10^{-5}$	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
k32			6.000	$(60\ \mathrm{s})^{-1}$	☑
k33			12.000	$(60\ \mathrm{s})^{-1}$	☑
kr33			0.002	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
k34			1.800	$(60\ \mathrm{s})^{-1}$	☑
kr34			$4.5 \cdot 10^{-4}$	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
k35			0.090	$(60\ \mathrm{s})^{-1}$	☑
kr35			$4.5 \cdot 10^{-4}$	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
Vm36			61200.000	$\mathrm{item} \cdot (60\ \mathrm{s})^{-1}$	☑
Km36			$2 \cdot 10^{14}$	item	☑
k37			18.000	$(60\ \mathrm{s})^{-1}$	☑
kr37			$9 \cdot 10^{-5}$	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
k40			0.003	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr40			3.840	$(60\ \mathrm{s})^{-1}$	☑
kr41			2.574	$(60\ \mathrm{s})^{-1}$	☑
k41			0.003	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
k42			0.007	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr42			12.000	$(60\ \mathrm{s})^{-1}$	☑
k43			60.000	$(60\ \mathrm{s})^{-1}$	☑
kr44			1.100	$(60\ \mathrm{s})^{-1}$	☑
k44			0.001	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
k45			210.000	$(60\ \mathrm{s})^{-1}$	☑
k47			174.000	$(60\ \mathrm{s})^{-1}$	☑
kr48			48.000	$(60\ \mathrm{s})^{-1}$	☑
k48			0.001	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑

Id	Name	SBO	Value	Unit	Constant
k49			3.480	$(60\ \mathrm{s})^{-1}$	☑
kr50			30.000	$(60\ \mathrm{s})^{-1}$	☑
k50			$2.5 \cdot 10^{-5}$	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
k52			0.005	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
kr52			1.980	$(60\ \mathrm{s})^{-1}$	☑
k53			960.000	$(60\ \mathrm{s})^{-1}$	☑
k55			342.000	$(60\ \mathrm{s})^{-1}$	☑
kr56			36.000	$(60\ \mathrm{s})^{-1}$	☑
k56			0.001	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
k57			16.200	$(60\ \mathrm{s})^{-1}$	☑
kr58			30.000	$(60\ \mathrm{s})^{-1}$	☑
k58			$5 \cdot 10^{-4}$	$(60\ \mathrm{s})^{-1} \cdot \mathrm{item}^{-1}$	☑
k59			18.000	$(60\ \mathrm{s})^{-1}$	☑
k60			0.040	$(60\ \mathrm{s})^{-1}$	☑
k61			0.010	$(60\ \mathrm{s})^{-1}$	☑
C	C_internalization		0.000		☐
RT	total_Receptors		50000.000	item	☑

6 Rules

This is an overview of eight rules.

6.1 Rule Ras_GTP

Rule Ras_GTP is an assignment rule for species Ras_GTP:

$$[\mathrm{Ras\_GTP}] = \mathrm{x42} + \mathrm{x28} + \mathrm{x70} + \mathrm{x69} \tag{1}$$

Derived unit item

6.2 Rule MEK_PP

Rule MEK_PP is an assignment rule for species MEK_PP:

$$[\mathrm{MEK\_PP}] = \mathrm{x51} + \mathrm{x77} \tag{2}$$

Derived unit item

6.3 Rule ERK_PP

Rule ERK_PP is an assignment rule for species ERK_PP:

$$[\mathrm{ERK\_PP}] = \mathrm{x59} + \mathrm{x83} \tag{3}$$

Derived unit item

6.4 Rule Raf_act

Rule Raf_act is an assignment rule for species Raf_act:

$$[\text{Raf\_act}] = \text{x45} + \text{x46} + \text{x48} + \text{x50} + \text{x72} + \text{x73} + \text{x74} + \text{x76} \tag{4}$$

Derived unit item

6.5 Rule SHC_P_t

Rule SHC_P_t is an assignment rule for species SHC_P_t:

$$\begin{aligned}[\text{SHC\_P\_t}] = {} & \text{x33} + \text{x34} + \text{x35} + \text{x36} + \text{x37} + \text{x38} + \text{x39} + \text{x40} + \text{x91} \\ & + \text{x92} + \text{x93} + \text{x94} + \text{x64} + \text{x65} + \text{x66} + \text{x67} + \text{x68}\end{aligned} \tag{5}$$

Derived unit item

6.6 Rule EGF_EGFR_act

Rule EGF_EGFR_act is an assignment rule for species EGF_EGFR_act:

$$\begin{aligned}[\text{EGF\_EGFR\_act}] = {} & \text{x5} + \text{x7} + \text{x15} + \text{x23} + \text{x25} + \text{x27} + \text{x29} + \text{x32} + \text{x33} + \text{x34} + \text{x35} \\ & + \text{x36} + \text{x37} + \text{x88} + \text{x89} + \text{x90} + \text{x91} + \text{x92} + \text{x93} + \text{x94} + \text{x8} + \text{x11} \\ & + \text{x17} + \text{x18} + \text{x19} + \text{x20} + \text{x21} + \text{x63} + \text{x64} + \text{x65} + \text{x66} + \text{x67} + \text{x68}\end{aligned} \tag{6}$$

Derived unit item

6.7 Rule C

Rule C is an assignment rule for parameter C:

$$\text{C} = \frac{\text{RT}}{\frac{\text{kr1}}{\text{k1}\cdot\text{x1}} + 1} \tag{7}$$

6.8 Rule k5

Rule k5 is an assignment rule for parameter k5:

$$\text{k5} = \begin{cases} 1.55 & \text{if } \text{C} < 3100 \\ 0.2 & \text{if } \text{C} > 100000 \\ \text{C} \cdot -1.3500000000000001E - 5 + 1.55 & \text{otherwise} \end{cases} \tag{8}$$

7 Reactions

This model contains 125 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 7: Overview of all reactions

№	Id	Name	Reaction Equation	SBO
1	v1	v1	$x1 + x2 \rightleftharpoons x3$	
2	v2	v2	$2\,x3 \rightleftharpoons x4$	
3	v3	v3	$x4 \rightleftharpoons x5$	
4	v4	v4	$x23 + x12 \rightleftharpoons x7$	
5	v5	v5	$x7 \rightleftharpoons x18 + x9$	
6	v6	v6	$x2 \rightleftharpoons x6$	
7	v7	v7	$x5 \longrightarrow x8$	
8	v8	v8	$x5 + x14 \rightleftharpoons x15$	
9	v9	v9	$x23 \longrightarrow x18$	
10	v10	v10	$x6 + x16 \rightleftharpoons x10$	
11	v11	v11	$2\,x10 \rightleftharpoons x11$	
12	v12	v12	$x11 \rightleftharpoons x8$	
13	v13	v13	$\emptyset \longrightarrow x2$	
14	v14	v14	$x8 + x14 \rightleftharpoons x17$	
15	v15	v15	$x9 \longrightarrow x12$	
16	v16	v16	$x22 + x15 \rightleftharpoons x23$	
17	v17	v17	$x24 + x23 \rightleftharpoons x25$	
18	v18	v18	$x26 + x25 \rightleftharpoons x27$	
19	v19	v19	$x27 \rightleftharpoons x28 + x25$	
20	v20	v20	$x25 + x43 \rightleftharpoons x29$	
21	v21	v21	$x29 \rightleftharpoons x25 + x26$	
22	v22	v22	$x31 + x15 \rightleftharpoons x32$	
23	v23	v23	$x32 \rightleftharpoons x33$	

№	Id	Name	Reaction Equation	SBO
24	v24	v24	$x22 + x33 \rightleftharpoons x34$	
25	v25	v25	$x24 + x34 \rightleftharpoons x35$	
26	v26	v26	$x26 + x35 \rightleftharpoons x36$	
27	v27	v27	$x36 \rightleftharpoons x35 + x28$	
28	v28	v28	$x28 + x41 \rightleftharpoons x42$	
29	v29	v29	$x42 \rightleftharpoons x43 + x45$	
30	v30	v30	$x35 + x43 \rightleftharpoons x37$	
31	v31	v31	$x37 \rightleftharpoons x35 + x26$	
32	v32	v32	$x35 \rightleftharpoons x15 + x38$	
33	v33	v33	$x38 \rightleftharpoons x40 + x30$	
34	v34	v34	$x25 \rightleftharpoons x15 + x30$	
35	v35	v35	$x30 \rightleftharpoons x24 + x22$	
36	v36	v36	$x40 \longrightarrow x31$	
37	v37	v37	$x33 \rightleftharpoons x15 + x40$	
38	v38	v38	$x22 + x40 \rightleftharpoons x39$	
39	v39	v39	$x34 \rightleftharpoons x15 + x39$	
40	v40	v40	$x24 + x39 \rightleftharpoons x38$	
41	v41	v41	$x30 + x33 \rightleftharpoons x35$	
42	v42	v42	$x44 + x45 \rightleftharpoons x46$	
43	v43	v43	$x46 \rightleftharpoons x41 + x44$	
44	v44	v44	$x47 + x45 \rightleftharpoons x48$	
45	v45	v45	$x48 \rightleftharpoons x49 + x45$	
46	v46	v46	$x49 + x45 \rightleftharpoons x50$	
47	v47	v47	$x50 \rightleftharpoons x51 + x45$	
48	v48	v48	$x51 + x53 \rightleftharpoons x52$	
49	v49	v49	$x52 \rightleftharpoons x49 + x53$	
50	v50	v50	$x53 + x49 \rightleftharpoons x54$	
51	v51	v51	$x54 \rightleftharpoons x47 + x53$	
52	v52	v52	$x55 + x51 \rightleftharpoons x56$	

№	Id	Name	Reaction Equation	SBO
53	v53	v53	$x56 \rightleftharpoons x51 + x57$	
54	v54	v54	$x51 + x57 \rightleftharpoons x58$	
55	v55	v55	$x58 \rightleftharpoons x59 + x51$	
56	v56	v56	$x59 + x60 \rightleftharpoons x61$	
57	v57	v57	$x61 \rightleftharpoons x57 + x60$	
58	v58	v58	$x60 + x57 \rightleftharpoons x62$	
59	v59	v59	$x62 \rightleftharpoons x55 + x60$	
60	v60	v60	$x6 \longrightarrow x86$	
61	v61	v61	$x16 \longrightarrow x13$	
62	v62	v62	$x8 \longrightarrow x87$	
63	v63	v63	$x17 + x22 \rightleftharpoons x18$	
64	v64	v64	$x24 + x18 \rightleftharpoons x19$	
65	v65	v65	$x26 + x19 \rightleftharpoons x20$	
66	v66	v66	$x20 \rightleftharpoons x69 + x19$	
67	v67	v67	$x71 + x19 \rightleftharpoons x21$	
68	v68	v68	$x21 \rightleftharpoons x19 + x26$	
69	v69	v69	$x31 + x17 \rightleftharpoons x63$	
70	v70	v70	$x63 \rightleftharpoons x64$	
71	v71	v71	$x22 + x64 \rightleftharpoons x65$	
72	v72	v72	$x24 + x65 \rightleftharpoons x66$	
73	v73	v73	$x26 + x66 \rightleftharpoons x67$	
74	v74	v74	$x67 \rightleftharpoons x66 + x69$	
75	v75	v75	$x69 + x41 \rightleftharpoons x70$	
76	v76	v76	$x70 \rightleftharpoons x71 + x72$	
77	v77	v77	$x71 + x66 \rightleftharpoons x68$	
78	v78	v78	$x68 \rightleftharpoons x66 + x26$	
79	v79	v79	$x66 \rightleftharpoons x17 + x38$	
80	v80	v80	$x19 \rightleftharpoons x17 + x30$	
81	v81	v81	$x64 \rightleftharpoons x17 + x40$	

№	Id	Name	Reaction Equation	SBO
82	v82	v82	$x65 \rightleftharpoons x17 + x39$	
83	v83	v83	$x30 + x64 \rightleftharpoons x66$	
84	v84	v84	$x44 + x72 \rightleftharpoons x73$	
85	v85	v85	$x73 \rightleftharpoons x41 + x44$	
86	v86	v86	$x47 + x72 \rightleftharpoons x74$	
87	v87	v87	$x74 \rightleftharpoons x75 + x72$	
88	v88	v88	$x72 + x75 \rightleftharpoons x76$	
89	v89	v89	$x76 \rightleftharpoons x72 + x77$	
90	v90	v90	$x77 + x53 \rightleftharpoons x78$	
91	v91	v91	$x78 \rightleftharpoons x75 + x53$	
92	v92	v92	$x53 + x75 \rightleftharpoons x79$	
93	v93	v93	$x79 \rightleftharpoons x47 + x53$	
94	v94	v94	$x55 + x77 \rightleftharpoons x80$	
95	v95	v95	$x80 \rightleftharpoons x81 + x77$	
96	v96	v96	$x77 + x81 \rightleftharpoons x82$	
97	v97	v97	$x82 \rightleftharpoons x83 + x77$	
98	v98	v98	$x83 + x60 \rightleftharpoons x84$	
99	v99	v99	$x84 \rightleftharpoons x81 + x60$	
100	v100	v100	$x60 + x81 \rightleftharpoons x85$	
101	v101	v101	$x85 \rightleftharpoons x55 + x60$	
102	v102	v102	$x15 \rightleftharpoons x17$	
103	v103	v103	$x32 \rightleftharpoons x63$	
104	v104	v104	$x33 \rightleftharpoons x64$	
105	v105	v105	$x25 \rightleftharpoons x19$	
106	v106	v106	$x25 + x12 \rightleftharpoons x88$	
107	v107	v107	$x88 \rightleftharpoons x9 + x19$	
108	v108	v108	$x27 \rightleftharpoons x20$	
109	v109	v109	$x27 + x12 \rightleftharpoons x89$	
110	v110	v110	$x89 \rightleftharpoons x9 + x20$	

№	Id	Name	Reaction Equation	SBO
111	v111	v111	$x29 \rightleftharpoons x21$	
112	v112	v112	$x29 + x12 \rightleftharpoons x90$	
113	v113	v113	$x90 \rightleftharpoons x9 + x21$	
114	v114	v114	$x34 \rightleftharpoons x65$	
115	v115	v115	$x34 + x12 \rightleftharpoons x91$	
116	v116	v116	$x91 \rightleftharpoons x9 + x65$	
117	v117	v117	$x35 \rightleftharpoons x66$	
118	v118	v118	$x35 + x12 \rightleftharpoons x92$	
119	v119	v119	$x92 \rightleftharpoons x9 + x66$	
120	v120	v120	$x36 \rightleftharpoons x67$	
121	v121	v121	$x36 + x12 \rightleftharpoons x93$	
122	v122	v122	$x93 \rightleftharpoons x9 + x67$	
123	v123	v123	$x37 \rightleftharpoons x68$	
124	v124	v124	$x37 + x12 \rightleftharpoons x94$	
125	v125	v125	$x94 \rightleftharpoons x68 + x9$	

7.1 Reaction v1

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

Name v1

Reaction equation

$$\mathrm{x1} + \mathrm{x2} \rightleftharpoons \mathrm{x3} \tag{9}$$

Reactants

Table 8: Properties of each reactant.

Id	Name	SBO
x1	EGF	
x2	EGFR	

Product

Table 9: Properties of each product.

Id	Name	SBO
x3	EGF-EGFR	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_1 = \mathrm{k1} \cdot \mathrm{x1} \cdot \mathrm{x2} - \mathrm{kr1} \cdot \mathrm{x3} \tag{10}$$

7.2 Reaction v2

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

Name v2

Reaction equation

$$2\,\mathrm{x3} \rightleftharpoons \mathrm{x4} \tag{11}$$

Reactant

Table 10: Properties of each reactant.

Id	Name	SBO
x3	EGF-EGFR	

Product

Table 11: Properties of each product.

Id	Name	SBO
x4	EGF-EGFR$\hat{2}$	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_2 = \mathrm{k2} \cdot \mathrm{x3} \cdot \mathrm{x3} - \mathrm{kr2} \cdot \mathrm{x4} \tag{12}$$

7.3 Reaction v3

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

Name v3

Reaction equation

$$\mathrm{x4} \rightleftharpoons \mathrm{x5} \tag{13}$$

Reactant

Table 12: Properties of each reactant.

Id	Name	SBO
x4	EGF-EGFR$\hat{2}$	

Product

Table 13: Properties of each product.

Id	Name	SBO
x5	EGF-EGFR*$\hat{2}$	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_3 = \mathrm{k3} \cdot \mathrm{x4} - \mathrm{kr3} \cdot \mathrm{x5} \tag{14}$$

7.4 Reaction v4

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

Name v4

Reaction equation

$$\mathrm{x23} + \mathrm{x12} \rightleftharpoons \mathrm{x7} \tag{15}$$

Reactants

Table 14: Properties of each reactant.

Id	Name	SBO
x23	EGF-EGFR*2̂-GAP-Grb2	
x12	Prot	

Product

Table 15: Properties of each product.

Id	Name	SBO
x7	EGF-EGFR*2̂-GAP-Grb2-Prot	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_4 = \mathrm{k4} \cdot \mathrm{x23} \cdot \mathrm{x12} - \mathrm{kr4} \cdot \mathrm{x7} \tag{16}$$

7.5 Reaction v5

This is a reversible reaction of one reactant forming two products.

Name v5

Reaction equation

$$\mathrm{x7} \rightleftharpoons \mathrm{x18} + \mathrm{x9} \tag{17}$$

Reactant

Table 16: Properties of each reactant.

Id	Name	SBO
x7	EGF-EGFR*$\hat{2}$-GAP-Grb2-Prot	

Products

Table 17: Properties of each product.

Id	Name	SBO
x18	EGF-EGFRi*$\hat{2}$-GAP-Grb2	
x9	Proti	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_5 = \mathrm{k5} \cdot \mathrm{x7} \tag{18}$$

7.6 Reaction v6

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

Name v6

Reaction equation

$$\mathrm{x2} \rightleftharpoons \mathrm{x6} \tag{19}$$

Reactant

Table 18: Properties of each reactant.

Id	Name	SBO
x2	EGFR	

Product

Table 19: Properties of each product.

Id	Name	SBO
x6	EGFRi	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_6 = \mathrm{k6} \cdot \mathrm{x2} - \mathrm{kr6} \cdot \mathrm{x6} \tag{20}$$

7.7 Reaction v7

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

Name v7

Reaction equation

$$\mathrm{x5} \longrightarrow \mathrm{x8} \tag{21}$$

Reactant

Table 20: Properties of each reactant.

Id	Name	SBO
x5	EGF-EGFR*$\hat{2}$	

Product

Table 21: Properties of each product.

Id	Name	SBO
x8	EGF-EGFRi*$\hat{2}$	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_7 = \mathrm{k7} \cdot \mathrm{x5} \tag{22}$$

7.8 Reaction v8

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

Name v8

Reaction equation

$$\mathrm{x5} + \mathrm{x14} \rightleftharpoons \mathrm{x15} \tag{23}$$

Reactants

Table 22: Properties of each reactant.

Id	Name	SBO
x5	EGF-EGFR*$\hat{2}$	
x14	GAP	

Product

Table 23: Properties of each product.

Id	Name	SBO
x15	EGF-EGFR*$\hat{2}$-GAP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_8 = \mathrm{k8} \cdot \mathrm{x5} \cdot \mathrm{x14} - \mathrm{kr8} \cdot \mathrm{x15} \tag{24}$$

7.9 Reaction v9

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

Name v9

Reaction equation

$$\mathrm{x23} \longrightarrow \mathrm{x18} \tag{25}$$

Reactant

Table 24: Properties of each reactant.

Id	Name	SBO
x23	EGF-EGFR*$\hat{2}$-GAP-Grb2	

Product

Table 25: Properties of each product.

Id	Name	SBO
x18	EGF-EGFRi*$\hat{2}$-GAP-Grb2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_9 = \mathrm{k7} \cdot \mathrm{x23} \tag{26}$$

7.10 Reaction v10

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

Name v10

Reaction equation

$$\mathrm{x6} + \mathrm{x16} \rightleftharpoons \mathrm{x10} \tag{27}$$

Reactants

Table 26: Properties of each reactant.

Id	Name	SBO
x6	EGFRi	
x16	EGFi	

Product

Table 27: Properties of each product.

Id	Name	SBO
x10	EGF-EGFRi	

Id	Name	SBO

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{10} = \mathrm{k10} \cdot \mathrm{x6} \cdot \mathrm{x16} - \mathrm{kr10} \cdot \mathrm{x10} \tag{28}$$

7.11 Reaction v11

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

Name v11

Reaction equation

$$2\,\mathrm{x10} \rightleftharpoons \mathrm{x11} \tag{29}$$

Reactant

Table 28: Properties of each reactant.

Id	Name	SBO
x10	EGF-EGFRi	

Product

Table 29: Properties of each product.

Id	Name	SBO
x11	EGF-EGFRiÎ2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{11} = \mathrm{k2} \cdot \mathrm{x10} \cdot \mathrm{x10} - \mathrm{kr2} \cdot \mathrm{x11} \tag{30}$$

7.12 Reaction v12

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

Name v12

Reaction equation

$$\mathrm{x11} \rightleftharpoons \mathrm{x8} \tag{31}$$

Reactant

Table 30: Properties of each reactant.

Id	Name	SBO
x11	EGF-EGFRi$\hat{2}$	

Product

Table 31: Properties of each product.

Id	Name	SBO
x8	EGF-EGFRi*$\hat{2}$	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{12} = \mathrm{k3} \cdot \mathrm{x11} - \mathrm{kr3} \cdot \mathrm{x8} \tag{32}$$

7.13 Reaction v13

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

Name v13

Reaction equation

$$\emptyset \longrightarrow \mathrm{x2} \tag{33}$$

Product

Table 32: Properties of each product.

Id	Name	SBO
x2	EGFR	

Kinetic Law

Derived unit $\text{item} \cdot (60\ \text{s})^{-1}$

$$v_{13} = \text{k13} \tag{34}$$

7.14 Reaction v14

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

Name v14

Reaction equation

$$\text{x8} + \text{x14} \rightleftharpoons \text{x17} \tag{35}$$

Reactants

Table 33: Properties of each reactant.

Id	Name	SBO
x8	EGF-EGFRi*$\hat{2}$	
x14	GAP	

Product

Table 34: Properties of each product.

Id	Name	SBO
x17	EGF-EGFRi*$\hat{2}$-GAP	

Kinetic Law

Derived unit $(60\ \text{s})^{-1} \cdot \text{item}$

$$v_{14} = \text{k14} \cdot \text{x8} \cdot \text{x14} - \text{kr14} \cdot \text{x17} \tag{36}$$

7.15 Reaction v15

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

Name v15

Reaction equation

$$\mathrm{x9} \longrightarrow \mathrm{x12} \tag{37}$$

Reactant

Table 35: Properties of each reactant.

Id	Name	SBO
x9	Proti	

Product

Table 36: Properties of each product.

Id	Name	SBO
x12	Prot	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{15} = \mathrm{k15} \cdot \mathrm{x9} \tag{38}$$

7.16 Reaction v16

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

Name v16

Reaction equation

$$\mathrm{x22} + \mathrm{x15} \rightleftharpoons \mathrm{x23} \tag{39}$$

Reactants

Table 37: Properties of each reactant.

Id	Name	SBO
x22	Grb2	
x15	EGF-EGFR*2̂-GAP	

Product

Table 38: Properties of each product.

Id	Name	SBO
x23	EGF-EGFR*$\hat{2}$-GAP-Grb2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{16} = \mathrm{k16} \cdot \mathrm{x22} \cdot \mathrm{x15} - \mathrm{kr16} \cdot \mathrm{x23} \tag{40}$$

7.17 Reaction v17

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

Name v17

Reaction equation

$$\mathrm{x24} + \mathrm{x23} \rightleftharpoons \mathrm{x25} \tag{41}$$

Reactants

Table 39: Properties of each reactant.

Id	Name	SBO
x24	Sos	
x23	EGF-EGFR*$\hat{2}$-GAP-Grb2	

Product

Table 40: Properties of each product.

Id	Name	SBO
x25	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{17} = \mathrm{k17} \cdot \mathrm{x24} \cdot \mathrm{x23} - \mathrm{kr17} \cdot \mathrm{x25} \tag{42}$$

7.18 Reaction v18

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

Name v18

Reaction equation

$$\mathrm{x26} + \mathrm{x25} \rightleftharpoons \mathrm{x27} \tag{43}$$

Reactants

Table 41: Properties of each reactant.

Id	Name	SBO
x26	Ras-GDP	
x25	EGF-EGFR*2̂-GAP-Grb2-Sos	

Product

Table 42: Properties of each product.

Id	Name	SBO
x27	EGF-EGFR*2̂-GAP-Grb2-Sos-Ras-GDP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{18} = \mathrm{k18} \cdot \mathrm{x26} \cdot \mathrm{x25} - \mathrm{kr18} \cdot \mathrm{x27} \tag{44}$$

7.19 Reaction v19

This is a reversible reaction of one reactant forming two products.

Name v19

Reaction equation

$$\mathrm{x27} \rightleftharpoons \mathrm{x28} + \mathrm{x25} \tag{45}$$

Reactant

Table 43: Properties of each reactant.

Id	Name	SBO
x27	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Ras-GDP	

Products

Table 44: Properties of each product.

Id	Name	SBO
x28	Ras-GTP	
x25	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{19} = \mathrm{k19} \cdot \mathrm{x27} - \mathrm{kr19} \cdot \mathrm{x28} \cdot \mathrm{x25} \tag{46}$$

7.20 Reaction v20

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

Name v20

Reaction equation

$$\mathrm{x25} + \mathrm{x43} \rightleftharpoons \mathrm{x29} \tag{47}$$

Reactants

Table 45: Properties of each reactant.

Id	Name	SBO
x25	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos	
x43	Ras-GTP*	

Product

Table 46: Properties of each product.

Id	Name	SBO
x29	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Ras-GTP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{20} = \mathrm{k20} \cdot \mathrm{x25} \cdot \mathrm{x43} - \mathrm{kr20} \cdot \mathrm{x29} \tag{48}$$

7.21 Reaction v21

This is a reversible reaction of one reactant forming two products.

Name v21

Reaction equation

$$\mathrm{x29} \rightleftharpoons \mathrm{x25} + \mathrm{x26} \tag{49}$$

Reactant

Table 47: Properties of each reactant.

Id	Name	SBO
x29	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Ras-GTP	

Products

Table 48: Properties of each product.

Id	Name	SBO
x25	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos	
x26	Ras-GDP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{21} = \mathrm{k21} \cdot \mathrm{x29} - \mathrm{kr21} \cdot \mathrm{x25} \cdot \mathrm{x26} \tag{50}$$

7.22 Reaction v22

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

Name v22

Reaction equation

$$\mathrm{x31} + \mathrm{x15} \rightleftharpoons \mathrm{x32} \tag{51}$$

Reactants

Table 49: Properties of each reactant.

Id	Name	SBO
x31	Shc	
x15	EGF-EGFR*2̂-GAP	

Product

Table 50: Properties of each product.

Id	Name	SBO
x32	EGF-EGFR*2̂-GAP-Shc	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{22} = \mathrm{k22} \cdot \mathrm{x31} \cdot \mathrm{x15} - \mathrm{kr22} \cdot \mathrm{x32} \tag{52}$$

7.23 Reaction v23

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

Name v23

Reaction equation

$$\mathrm{x32} \rightleftharpoons \mathrm{x33} \tag{53}$$

Reactant

Table 51: Properties of each reactant.

Id	Name	SBO
x32	EGF-EGFR*$\hat{2}$-GAP-Shc	

Product

Table 52: Properties of each product.

Id	Name	SBO
x33	EGF-EGFR*$\hat{2}$-GAP-Shc*	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{23} = \mathrm{k23} \cdot \mathrm{x32} - \mathrm{kr23} \cdot \mathrm{x33} \tag{54}$$

7.24 Reaction v24

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

Name v24

Reaction equation

$$\mathrm{x22} + \mathrm{x33} \rightleftharpoons \mathrm{x34} \tag{55}$$

Reactants

Table 53: Properties of each reactant.

Id	Name	SBO
x22	Grb2	
x33	EGF-EGFR*$\hat{2}$-GAP-Shc*	

Product

Table 54: Properties of each product.

Id	Name	SBO
x34	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2	

Id	Name	SBO

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{24} = \mathrm{k24} \cdot \mathrm{x22} \cdot \mathrm{x33} - \mathrm{kr24} \cdot \mathrm{x34} \tag{56}$$

7.25 Reaction v25

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

Name v25

Reaction equation

$$\mathrm{x24} + \mathrm{x34} \rightleftharpoons \mathrm{x35} \tag{57}$$

Reactants

Table 55: Properties of each reactant.

Id	Name	SBO
x24	Sos	
x34	EGF-EGFR*2̂-GAP-Shc*-Grb2	

Product

Table 56: Properties of each product.

Id	Name	SBO
x35	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{25} = \mathrm{k25} \cdot \mathrm{x24} \cdot \mathrm{x34} - \mathrm{kr25} \cdot \mathrm{x35} \tag{58}$$

7.26 Reaction v26

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

Name v26

Reaction equation

$$\mathrm{x26} + \mathrm{x35} \rightleftharpoons \mathrm{x36} \tag{59}$$

Reactants

Table 57: Properties of each reactant.

Id	Name	SBO
x26	Ras-GDP	
x35	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos	

Product

Table 58: Properties of each product.

Id	Name	SBO
x36	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GDP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{26} = \mathrm{k18} \cdot \mathrm{x26} \cdot \mathrm{x35} - \mathrm{kr18} \cdot \mathrm{x36} \tag{60}$$

7.27 Reaction v27

This is a reversible reaction of one reactant forming two products.

Name v27

Reaction equation

$$\mathrm{x36} \rightleftharpoons \mathrm{x35} + \mathrm{x28} \tag{61}$$

Reactant

Table 59: Properties of each reactant.

Id	Name	SBO
x36	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GDP	

Products

Table 60: Properties of each product.

Id	Name	SBO
x35	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos	
x28	Ras-GTP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{27} = \mathrm{k19} \cdot \mathrm{x36} - \mathrm{kr19} \cdot \mathrm{x35} \cdot \mathrm{x28} \tag{62}$$

7.28 Reaction v28

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

Name v28

Reaction equation

$$\mathrm{x28} + \mathrm{x41} \rightleftharpoons \mathrm{x42} \tag{63}$$

Reactants

Table 61: Properties of each reactant.

Id	Name	SBO
x28	Ras-GTP	
x41	Raf	

Product

Table 62: Properties of each product.

Id	Name	SBO
x42	Raf-Ras-GTP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{28} = \mathrm{k28} \cdot \mathrm{x28} \cdot \mathrm{x41} - \mathrm{kr28} \cdot \mathrm{x42} \tag{64}$$

7.29 Reaction v29

This is a reversible reaction of one reactant forming two products.

Name v29

Reaction equation

$$\mathrm{x42} \rightleftharpoons \mathrm{x43} + \mathrm{x45} \tag{65}$$

Reactant

Table 63: Properties of each reactant.

Id	Name	SBO
x42	Raf-Ras-GTP	

Products

Table 64: Properties of each product.

Id	Name	SBO
x43	Ras-GTP*	
x45	Raf*	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{29} = \mathrm{k29} \cdot \mathrm{x42} - \mathrm{kr29} \cdot \mathrm{x43} \cdot \mathrm{x45} \tag{66}$$

7.30 Reaction v30

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

Name v30

Reaction equation

$$\mathrm{x35} + \mathrm{x43} \rightleftharpoons \mathrm{x37} \tag{67}$$

Reactants

Table 65: Properties of each reactant.

Id	Name	SBO
x35	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos	
x43	Ras-GTP*	

Product

Table 66: Properties of each product.

Id	Name	SBO
x37	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos-Ras-GTP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{30} = \mathrm{k20} \cdot \mathrm{x35} \cdot \mathrm{x43} - \mathrm{kr20} \cdot \mathrm{x37} \tag{68}$$

7.31 Reaction v31

This is a reversible reaction of one reactant forming two products.

Name v31

Reaction equation

$$\mathrm{x37} \rightleftharpoons \mathrm{x35} + \mathrm{x26} \tag{69}$$

Reactant

Table 67: Properties of each reactant.

Id	Name	SBO
x37	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos-Ras-GTP	

Products

Table 68: Properties of each product.

Id	Name	SBO
x35	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos	
x26	Ras-GDP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{31} = \mathrm{k21} \cdot \mathrm{x37} - \mathrm{kr21} \cdot \mathrm{x35} \cdot \mathrm{x26} \tag{70}$$

7.32 Reaction v32

This is a reversible reaction of one reactant forming two products.

Name v32

Reaction equation

$$\mathrm{x35} \rightleftharpoons \mathrm{x15} + \mathrm{x38} \tag{71}$$

Reactant

Table 69: Properties of each reactant.

Id	Name	SBO
x35	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos	

Products

Table 70: Properties of each product.

Id	Name	SBO
x15	EGF-EGFR*2̂-GAP	

Id	Name	SBO
x38	Shc*-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{32} = \mathrm{k32} \cdot \mathrm{x35} - \mathrm{kr32} \cdot \mathrm{x15} \cdot \mathrm{x38} \tag{72}$$

7.33 Reaction v33

This is a reversible reaction of one reactant forming two products.

Name v33

Reaction equation

$$\mathrm{x38} \rightleftharpoons \mathrm{x40} + \mathrm{x30} \tag{73}$$

Reactant

Table 71: Properties of each reactant.

Id	Name	SBO
x38	Shc*-Grb2-Sos	

Products

Table 72: Properties of each product.

Id	Name	SBO
x40	Shc*	
x30	Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{33} = \mathrm{k33} \cdot \mathrm{x38} - \mathrm{kr33} \cdot \mathrm{x40} \cdot \mathrm{x30} \tag{74}$$

7.34 Reaction v34

This is a reversible reaction of one reactant forming two products.

Name v34

Reaction equation

$$\mathrm{x25} \rightleftharpoons \mathrm{x15} + \mathrm{x30} \tag{75}$$

Reactant

Table 73: Properties of each reactant.

Id	Name	SBO
x25	EGF-EGFR*2̂-GAP-Grb2-Sos	

Products

Table 74: Properties of each product.

Id	Name	SBO
x15	EGF-EGFR*2̂-GAP	
x30	Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{34} = \mathrm{k34} \cdot \mathrm{x25} - \mathrm{kr34} \cdot \mathrm{x15} \cdot \mathrm{x30} \tag{76}$$

7.35 Reaction v35

This is a reversible reaction of one reactant forming two products.

Name v35

Reaction equation

$$\mathrm{x30} \rightleftharpoons \mathrm{x24} + \mathrm{x22} \tag{77}$$

Reactant

Table 75: Properties of each reactant.

Id	Name	SBO
x30	Grb2-Sos	

Products

Table 76: Properties of each product.

Id	Name	SBO
x24	Sos	
x22	Grb2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{35} = \mathrm{k35} \cdot \mathrm{x30} - \mathrm{kr35} \cdot \mathrm{x24} \cdot \mathrm{x22} \tag{78}$$

7.36 Reaction v36

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

Name v36

Reaction equation

$$\mathrm{x40} \longrightarrow \mathrm{x31} \tag{79}$$

Reactant

Table 77: Properties of each reactant.

Id	Name	SBO
x40	Shc*	

Product

Table 78: Properties of each product.

Id	Name	SBO
x31	Shc	

Id	Name	SBO

Kinetic Law

Derived unit $\text{item} \cdot (60\ \text{s})^{-1}$

$$v_{36} = \frac{\text{Vm36} \cdot \text{x40}}{\text{Km36} + \text{x40}} \tag{80}$$

7.37 Reaction v37

This is a reversible reaction of one reactant forming two products.

Name v37

Reaction equation

$$\text{x33} \rightleftharpoons \text{x15} + \text{x40} \tag{81}$$

Reactant

Table 79: Properties of each reactant.

Id	Name	SBO
x33	EGF-EGFR*$\hat{2}$-GAP-Shc*	

Products

Table 80: Properties of each product.

Id	Name	SBO
x15	EGF-EGFR*$\hat{2}$-GAP	
x40	Shc*	

Kinetic Law

Derived unit $(60\ \text{s})^{-1} \cdot \text{item}$

$$v_{37} = \text{k37} \cdot \text{x33} - \text{kr37} \cdot \text{x15} \cdot \text{x40} \tag{82}$$

7.38 Reaction v38

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

Name v38

Reaction equation

$$\mathrm{x22} + \mathrm{x40} \rightleftharpoons \mathrm{x39} \tag{83}$$

Reactants

Table 81: Properties of each reactant.

Id	Name	SBO
x22	Grb2	
x40	Shc*	

Product

Table 82: Properties of each product.

Id	Name	SBO
x39	Shc*-Grb2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{38} = \mathrm{k24} \cdot \mathrm{x22} \cdot \mathrm{x40} - \mathrm{kr24} \cdot \mathrm{x39} \tag{84}$$

7.39 Reaction v39

This is a reversible reaction of one reactant forming two products.

Name v39

Reaction equation

$$\mathrm{x34} \rightleftharpoons \mathrm{x15} + \mathrm{x39} \tag{85}$$

Reactant

Table 83: Properties of each reactant.

Id	Name	SBO
x34	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2	

Products

Table 84: Properties of each product.

Id	Name	SBO
x15	EGF-EGFR*$\hat{2}$-GAP	
x39	Shc*-Grb2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{39} = \mathrm{k37} \cdot \mathrm{x34} - \mathrm{kr37} \cdot \mathrm{x15} \cdot \mathrm{x39} \tag{86}$$

7.40 Reaction v40

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

Name v40

Reaction equation

$$\mathrm{x24} + \mathrm{x39} \rightleftharpoons \mathrm{x38} \tag{87}$$

Reactants

Table 85: Properties of each reactant.

Id	Name	SBO
x24	Sos	
x39	Shc*-Grb2	

Product

Table 86: Properties of each product.

Id	Name	SBO
x38	Shc*-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{40} = \mathrm{k40} \cdot \mathrm{x24} \cdot \mathrm{x39} - \mathrm{kr40} \cdot \mathrm{x38} \tag{88}$$

7.41 Reaction v41

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

Name v41

Reaction equation

$$\mathrm{x30} + \mathrm{x33} \rightleftharpoons \mathrm{x35} \tag{89}$$

Reactants

Table 87: Properties of each reactant.

Id	Name	SBO
x30	Grb2-Sos	
x33	EGF-EGFR*$\hat{2}$-GAP-Shc*	

Product

Table 88: Properties of each product.

Id	Name	SBO
x35	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{41} = \mathrm{k41} \cdot \mathrm{x30} \cdot \mathrm{x33} - \mathrm{kr41} \cdot \mathrm{x35} \tag{90}$$

7.42 Reaction v42

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

Name v42

Reaction equation

$$\mathrm{x44} + \mathrm{x45} \rightleftharpoons \mathrm{x46} \tag{91}$$

Reactants

Table 89: Properties of each reactant.

Id	Name	SBO
x44	Phosphotase1	
x45	Raf*	

Product

Table 90: Properties of each product.

Id	Name	SBO
x46	Raf*-P'ase	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{42} = \mathrm{k42} \cdot \mathrm{x44} \cdot \mathrm{x45} - \mathrm{kr42} \cdot \mathrm{x46} \tag{92}$$

7.43 Reaction v43

This is a reversible reaction of one reactant forming two products.

Name v43

Reaction equation

$$\mathrm{x46} \rightleftharpoons \mathrm{x41} + \mathrm{x44} \tag{93}$$

Reactant

Table 91: Properties of each reactant.

Id	Name	SBO
x46	Raf*-P'ase	

Products

Table 92: Properties of each product.

Id	Name	SBO
x41	Raf	
x44	Phosphotase1	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{43} = \mathrm{k43} \cdot \mathrm{x46} \tag{94}$$

7.44 Reaction v44

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

Name v44

Reaction equation

$$\mathrm{x47} + \mathrm{x45} \rightleftharpoons \mathrm{x48} \tag{95}$$

Reactants

Table 93: Properties of each reactant.

Id	Name	SBO
x47	MEK	
x45	Raf*	

Product

Table 94: Properties of each product.

Id	Name	SBO
x48	MEK-Raf*	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{44} = \mathrm{k44} \cdot \mathrm{x47} \cdot \mathrm{x45} - \mathrm{kr44} \cdot \mathrm{x48} \tag{96}$$

7.45 Reaction v45

This is a reversible reaction of one reactant forming two products.

Name v45

Reaction equation

$$\mathrm{x48} \rightleftharpoons \mathrm{x49} + \mathrm{x45} \tag{97}$$

Reactant

Table 95: Properties of each reactant.

Id	Name	SBO
x48	MEK-Raf*	

Products

Table 96: Properties of each product.

Id	Name	SBO
x49	MEK-P	
x45	Raf*	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{45} = \mathrm{k45} \cdot \mathrm{x48} \tag{98}$$

7.46 Reaction v46

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

Name v46

Reaction equation

$$\mathrm{x49} + \mathrm{x45} \rightleftharpoons \mathrm{x50} \tag{99}$$

Reactants

Table 97: Properties of each reactant.

Id	Name	SBO
x49	MEK-P	
x45	Raf*	

Product

Table 98: Properties of each product.

Id	Name	SBO
x50	MEK-P-Raf*	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{46} = \mathrm{k44} \cdot \mathrm{x49} \cdot \mathrm{x45} - \mathrm{kr44} \cdot \mathrm{x50} \tag{100}$$

7.47 Reaction v47

This is a reversible reaction of one reactant forming two products.

Name v47

Reaction equation

$$\mathrm{x50} \rightleftharpoons \mathrm{x51} + \mathrm{x45} \tag{101}$$

Reactant

Table 99: Properties of each reactant.

Id	Name	SBO
x50	MEK-P-Raf*	

Products

Table 100: Properties of each product.

Id	Name	SBO
x51	MEK-PP	
x45	Raf*	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{47} = \mathrm{k47} \cdot \mathrm{x50} \tag{102}$$

7.48 Reaction v48

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

Name v48

Reaction equation

$$\mathrm{x51} + \mathrm{x53} \rightleftharpoons \mathrm{x52} \tag{103}$$

Reactants

Table 101: Properties of each reactant.

Id	Name	SBO
x51	MEK-PP	
x53	Phosphatase2	

Product

Table 102: Properties of each product.

Id	Name	SBO
x52	MEK-PP-P'ase2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{48} = \mathrm{k48} \cdot \mathrm{x51} \cdot \mathrm{x53} - \mathrm{kr48} \cdot \mathrm{x52} \tag{104}$$

7.49 Reaction v49

This is a reversible reaction of one reactant forming two products.

Name v49

Reaction equation

$$\mathrm{x52} \rightleftharpoons \mathrm{x49} + \mathrm{x53} \tag{105}$$

Reactant

Table 103: Properties of each reactant.

Id	Name	SBO
x52	MEK-PP-P'ase2	

Products

Table 104: Properties of each product.

Id	Name	SBO
x49	MEK-P	
x53	Phosphatase2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{49} = \mathrm{k49} \cdot \mathrm{x52} \tag{106}$$

7.50 Reaction v50

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

Name v50

Reaction equation

$$\mathrm{x53} + \mathrm{x49} \rightleftharpoons \mathrm{x54} \tag{107}$$

Reactants

Table 105: Properties of each reactant.

Id	Name	SBO
x53	Phosphatase2	
x49	MEK-P	

Product

Table 106: Properties of each product.

Id	Name	SBO
x54	MEK-P-P'ase2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{50} = \mathrm{k50} \cdot \mathrm{x53} \cdot \mathrm{x49} - \mathrm{kr50} \cdot \mathrm{x54} \tag{108}$$

7.51 Reaction v51

This is a reversible reaction of one reactant forming two products.

Name v51

Reaction equation

$$\mathrm{x54} \rightleftharpoons \mathrm{x47} + \mathrm{x53} \tag{109}$$

Reactant

Table 107: Properties of each reactant.

Id	Name	SBO
x54	MEK-P-P'ase2	

Products

Table 108: Properties of each product.

Id	Name	SBO
x47	MEK	
x53	Phosphatase2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{51} = \mathrm{k49} \cdot \mathrm{x54} \tag{110}$$

7.52 Reaction v52

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

Name v52

Reaction equation

$$\mathrm{x55} + \mathrm{x51} \rightleftharpoons \mathrm{x56} \tag{111}$$

Reactants

Table 109: Properties of each reactant.

Id	Name	SBO
x55	ERK	
x51	MEK-PP	

Product

Table 110: Properties of each product.

Id	Name	SBO
x56	ERK-MEK-PP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{52} = \mathrm{k52} \cdot \mathrm{x55} \cdot \mathrm{x51} - \mathrm{kr52} \cdot \mathrm{x56} \tag{112}$$

7.53 Reaction v53

This is a reversible reaction of one reactant forming two products.

Name v53

Reaction equation

$$\mathrm{x56} \rightleftharpoons \mathrm{x51} + \mathrm{x57} \tag{113}$$

Reactant

Table 111: Properties of each reactant.

Id	Name	SBO
x56	ERK-MEK-PP	

Products

Table 112: Properties of each product.

Id	Name	SBO
x51	MEK-PP	
x57	ERK-P	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{53} = \mathrm{k53} \cdot \mathrm{x56} \tag{114}$$

7.54 Reaction v54

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

Name v54

Reaction equation

$$\mathrm{x51} + \mathrm{x57} \rightleftharpoons \mathrm{x58} \tag{115}$$

Reactants

Table 113: Properties of each reactant.

Id	Name	SBO
x51	MEK-PP	
x57	ERK-P	

Product

Table 114: Properties of each product.

Id	Name	SBO
x58	ERK-P-MEK-PP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{54} = \mathrm{k52} \cdot \mathrm{x51} \cdot \mathrm{x57} - \mathrm{kr52} \cdot \mathrm{x58} \tag{116}$$

7.55 Reaction v55

This is a reversible reaction of one reactant forming two products.

Name v55

Reaction equation

$$\mathrm{x58} \rightleftharpoons \mathrm{x59} + \mathrm{x51} \tag{117}$$

Reactant

Table 115: Properties of each reactant.

Id	Name	SBO
x58	ERK-P-MEK-PP	

Products

Table 116: Properties of each product.

Id	Name	SBO
x59	ERK-PP	
x51	MEK-PP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{55} = \mathrm{k55} \cdot \mathrm{x58} \tag{118}$$

7.56 Reaction v56

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

Name v56

Reaction equation

$$\mathrm{x59} + \mathrm{x60} \rightleftharpoons \mathrm{x61} \tag{119}$$

Reactants

Table 117: Properties of each reactant.

Id	Name	SBO
x59	ERK-PP	
x60	Phosphotase3	

Product

Table 118: Properties of each product.

Id	Name	SBO
x61	ERK-PP-P'ase3	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{56} = \mathrm{k56} \cdot \mathrm{x59} \cdot \mathrm{x60} - \mathrm{kr56} \cdot \mathrm{x61} \tag{120}$$

7.57 Reaction v57

This is a reversible reaction of one reactant forming two products.

Name v57

Reaction equation

$$\mathrm{x61} \rightleftharpoons \mathrm{x57} + \mathrm{x60} \tag{121}$$

Reactant

Table 119: Properties of each reactant.

Id	Name	SBO
x61	ERK-PP-P'ase3	

Products

Table 120: Properties of each product.

Id	Name	SBO
x57	ERK-P	
x60	Phosphotase3	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{57} = \mathrm{k57} \cdot \mathrm{x61} \tag{122}$$

7.58 Reaction v58

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

Name v58

Reaction equation

$$\mathrm{x60} + \mathrm{x57} \rightleftharpoons \mathrm{x62} \tag{123}$$

Reactants

Table 121: Properties of each reactant.

Id	Name	SBO
x60	Phosphotase3	
x57	ERK-P	

Product

Table 122: Properties of each product.

Id	Name	SBO
x62	ERK-P-P'ase3	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{58} = \mathrm{k58} \cdot \mathrm{x60} \cdot \mathrm{x57} - \mathrm{kr58} \cdot \mathrm{x62} \tag{124}$$

7.59 Reaction v59

This is a reversible reaction of one reactant forming two products.

Name v59

Reaction equation

$$\mathrm{x62} \rightleftharpoons \mathrm{x55} + \mathrm{x60} \tag{125}$$

Reactant

Table 123: Properties of each reactant.

Id	Name	SBO
x62	ERK-P-P'ase3	

Products

Table 124: Properties of each product.

Id	Name	SBO
x55	ERK	
x60	Phosphotase3	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{59} = \mathrm{k59} \cdot \mathrm{x62} \tag{126}$$

7.60 Reaction v60

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

Name v60

Reaction equation

$$\mathrm{x6} \longrightarrow \mathrm{x86} \tag{127}$$

Reactant

Table 125: Properties of each reactant.

Id	Name	SBO
x6	EGFRi	

Product

Table 126: Properties of each product.

Id	Name	SBO
x86	EGFRideg	

Id	Name	SBO

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{60} = \mathrm{k60} \cdot \mathrm{x6} \tag{128}$$

7.61 Reaction v61

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

Name v61

Reaction equation

$$\mathrm{x16} \longrightarrow \mathrm{x13} \tag{129}$$

Reactant

Table 127: Properties of each reactant.

Id	Name	SBO
x16	EGFi	

Product

Table 128: Properties of each product.

Id	Name	SBO
x13	EGFideg	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{61} = \mathrm{k61} \cdot \mathrm{x16} \tag{130}$$

7.62 Reaction v62

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

Name v62

Reaction equation

$$\mathrm{x8} \longrightarrow \mathrm{x87} \tag{131}$$

Reactant

Table 129: Properties of each reactant.

Id	Name	SBO
x8	EGF-EGFRi*$\hat{2}$	

Product

Table 130: Properties of each product.

Id	Name	SBO
x87	EGF-EGFRi*$\hat{2}$deg	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{62} = \mathrm{k60} \cdot \mathrm{x8} \tag{132}$$

7.63 Reaction v63

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

Name v63

Reaction equation

$$\mathrm{x17} + \mathrm{x22} \rightleftharpoons \mathrm{x18} \tag{133}$$

Reactants

Table 131: Properties of each reactant.

Id	Name	SBO
x17	EGF-EGFRi*$\hat{2}$-GAP	
x22	Grb2	

Product

Table 132: Properties of each product.

Id	Name	SBO
x18	EGF-EGFRi*2̂-GAP-Grb2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{63} = \mathrm{k16} \cdot \mathrm{x17} \cdot \mathrm{x22} - \mathrm{kr16} \cdot \mathrm{x18} \tag{134}$$

7.64 Reaction v64

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

Name v64

Reaction equation

$$\mathrm{x24} + \mathrm{x18} \rightleftharpoons \mathrm{x19} \tag{135}$$

Reactants

Table 133: Properties of each reactant.

Id	Name	SBO
x24	Sos	
x18	EGF-EGFRi*2̂-GAP-Grb2	

Product

Table 134: Properties of each product.

Id	Name	SBO
x19	EGF-EGFRi*2̂-GAP-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{64} = \mathrm{k17} \cdot \mathrm{x24} \cdot \mathrm{x18} - \mathrm{kr17} \cdot \mathrm{x19} \tag{136}$$

7.65 Reaction v65

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

Name v65

Reaction equation

$$\mathrm{x26} + \mathrm{x19} \rightleftharpoons \mathrm{x20} \tag{137}$$

Reactants

Table 135: Properties of each reactant.

Id	Name	SBO
x26	Ras-GDP	
x19	EGF-EGFRi*2̂-GAP-Grb2-Sos	

Product

Table 136: Properties of each product.

Id	Name	SBO
x20	EGF-EGFRi*2̂-GAP-Grb2-Sos-Ras-GDP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{65} = \mathrm{k18} \cdot \mathrm{x26} \cdot \mathrm{x19} - \mathrm{kr18} \cdot \mathrm{x20} \tag{138}$$

7.66 Reaction v66

This is a reversible reaction of one reactant forming two products.

Name v66

Reaction equation

$$\mathrm{x20} \rightleftharpoons \mathrm{x69} + \mathrm{x19} \tag{139}$$

Reactant

Table 137: Properties of each reactant.

Id	Name	SBO
x20	EGF-EGFRi*2̂-GAP-Grb2-Sos-Ras-GDP	

Products

Table 138: Properties of each product.

Id	Name	SBO
x69	Rasi-GTP	
x19	EGF-EGFRi*2̂-GAP-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{66} = \mathrm{k19} \cdot \mathrm{x20} - \mathrm{kr19} \cdot \mathrm{x69} \cdot \mathrm{x19} \tag{140}$$

7.67 Reaction v67

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

Name v67

Reaction equation

$$\mathrm{x71} + \mathrm{x19} \rightleftharpoons \mathrm{x21} \tag{141}$$

Reactants

Table 139: Properties of each reactant.

Id	Name	SBO
x71	Rasi-GTP*	
x19	EGF-EGFRi*2̂-GAP-Grb2-Sos	

Product

Table 140: Properties of each product.

Id	Name	SBO
x21	EGF-EGFRi*2̂-GAP-Grb2-Sos-Ras-GTP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{67} = \mathrm{k20} \cdot \mathrm{x71} \cdot \mathrm{x19} - \mathrm{kr20} \cdot \mathrm{x21} \tag{142}$$

7.68 Reaction v68

This is a reversible reaction of one reactant forming two products.

Name v68

Reaction equation

$$\mathrm{x21} \rightleftharpoons \mathrm{x19} + \mathrm{x26} \tag{143}$$

Reactant

Table 141: Properties of each reactant.

Id	Name	SBO
x21	EGF-EGFRi*2̂-GAP-Grb2-Sos-Ras-GTP	

Products

Table 142: Properties of each product.

Id	Name	SBO
x19	EGF-EGFRi*2̂-GAP-Grb2-Sos	
x26	Ras-GDP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{68} = \mathrm{k21} \cdot \mathrm{x21} - \mathrm{kr21} \cdot \mathrm{x19} \cdot \mathrm{x26} \tag{144}$$

7.69 Reaction v69

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

Name v69

Reaction equation

$$\mathrm{x31} + \mathrm{x17} \rightleftharpoons \mathrm{x63} \tag{145}$$

Reactants

Table 143: Properties of each reactant.

Id	Name	SBO
x31	Shc	
x17	EGF-EGFRi*2̂-GAP	

Product

Table 144: Properties of each product.

Id	Name	SBO
x63	EGF-EGFRi*2̂-GAP-Shc	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{69} = \mathrm{k22} \cdot \mathrm{x31} \cdot \mathrm{x17} - \mathrm{kr22} \cdot \mathrm{x63} \tag{146}$$

7.70 Reaction v70

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

Name v70

Reaction equation

$$\mathrm{x63} \rightleftharpoons \mathrm{x64} \tag{147}$$

Reactant

Table 145: Properties of each reactant.

Id	Name	SBO
x63	EGF-EGFRi*2̂-GAP-Shc	

Product

Table 146: Properties of each product.

Id	Name	SBO
x64	EGF-EGFRi*2̂-GAP-Shc*	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{70} = \mathrm{k23} \cdot \mathrm{x63} - \mathrm{kr23} \cdot \mathrm{x64} \tag{148}$$

7.71 Reaction v71

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

Name v71

Reaction equation

$$\mathrm{x22} + \mathrm{x64} \rightleftharpoons \mathrm{x65} \tag{149}$$

Reactants

Table 147: Properties of each reactant.

Id	Name	SBO
x22	Grb2	
x64	EGF-EGFRi*2̂-GAP-Shc*	

Product

Table 148: Properties of each product.

Id	Name	SBO
x65	EGF-EGFRi*2̂-GAP-Shc*-Grb2	

Id	Name	SBO

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{71} = \mathrm{k24} \cdot \mathrm{x22} \cdot \mathrm{x64} - \mathrm{kr24} \cdot \mathrm{x65} \tag{150}$$

7.72 Reaction v72

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

Name v72

Reaction equation

$$\mathrm{x24} + \mathrm{x65} \rightleftharpoons \mathrm{x66} \tag{151}$$

Reactants

Table 149: Properties of each reactant.

Id	Name	SBO
x24	Sos	
x65	EGF-EGFRi*$\hat{2}$-GAP-Shc*-Grb2	

Product

Table 150: Properties of each product.

Id	Name	SBO
x66	EGF-EGFRi*$\hat{2}$-GAP-Shc*-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{72} = \mathrm{k25} \cdot \mathrm{x24} \cdot \mathrm{x65} - \mathrm{kr25} \cdot \mathrm{x66} \tag{152}$$

7.73 Reaction v73

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

Name v73

Reaction equation

$$\mathrm{x26} + \mathrm{x66} \rightleftharpoons \mathrm{x67} \tag{153}$$

Reactants

Table 151: Properties of each reactant.

Id	Name	SBO
x26	Ras-GDP	
x66	EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos	

Product

Table 152: Properties of each product.

Id	Name	SBO
x67	EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos-Ras-GDP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{73} = \mathrm{k18} \cdot \mathrm{x26} \cdot \mathrm{x66} - \mathrm{kr18} \cdot \mathrm{x67} \tag{154}$$

7.74 Reaction v74

This is a reversible reaction of one reactant forming two products.

Name v74

Reaction equation

$$\mathrm{x67} \rightleftharpoons \mathrm{x66} + \mathrm{x69} \tag{155}$$

Reactant

Table 153: Properties of each reactant.

Id	Name	SBO
x67	EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos-Ras-GDP	

Products

Table 154: Properties of each product.

Id	Name	SBO
x66	EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos	
x69	Rasi-GTP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{74} = \mathrm{k19} \cdot \mathrm{x67} - \mathrm{kr19} \cdot \mathrm{x66} \cdot \mathrm{x69} \tag{156}$$

7.75 Reaction v75

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

Name v75

Reaction equation

$$\mathrm{x69} + \mathrm{x41} \rightleftharpoons \mathrm{x70} \tag{157}$$

Reactants

Table 155: Properties of each reactant.

Id	Name	SBO
x69	Rasi-GTP	
x41	Raf	

Product

Table 156: Properties of each product.

Id	Name	SBO
x70	Rafi-Rasi-GTP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{75} = \mathrm{k28} \cdot \mathrm{x69} \cdot \mathrm{x41} - \mathrm{kr28} \cdot \mathrm{x70} \tag{158}$$

7.76 Reaction v76

This is a reversible reaction of one reactant forming two products.

Name v76

Reaction equation

$$\mathrm{x70} \rightleftharpoons \mathrm{x71} + \mathrm{x72} \tag{159}$$

Reactant

Table 157: Properties of each reactant.

Id	Name	SBO
x70	Rafi-Rasi-GTP	

Products

Table 158: Properties of each product.

Id	Name	SBO
x71	Rasi-GTP*	
x72	Rafi*	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{76} = \mathrm{k29} \cdot \mathrm{x70} - \mathrm{kr29} \cdot \mathrm{x71} \cdot \mathrm{x72} \tag{160}$$

7.77 Reaction v77

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

Name v77

Reaction equation

$$\mathrm{x71} + \mathrm{x66} \rightleftharpoons \mathrm{x68} \tag{161}$$

Reactants

Table 159: Properties of each reactant.

Id	Name	SBO
x71	Rasi-GTP*	
x66	EGF-EGFRi*$\hat{2}$-GAP-Shc*-Grb2-Sos	

Product

Table 160: Properties of each product.

Id	Name	SBO
x68	EGF-EGFRi*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GTP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{77} = \mathrm{k20} \cdot \mathrm{x71} \cdot \mathrm{x66} - \mathrm{kr20} \cdot \mathrm{x68} \tag{162}$$

7.78 Reaction v78

This is a reversible reaction of one reactant forming two products.

Name v78

Reaction equation

$$\mathrm{x68} \rightleftharpoons \mathrm{x66} + \mathrm{x26} \tag{163}$$

Reactant

Table 161: Properties of each reactant.

Id	Name	SBO
x68	EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos-Ras-GTP	

Products

Table 162: Properties of each product.

Id	Name	SBO
x66	EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos	
x26	Ras-GDP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{78} = \mathrm{k21} \cdot \mathrm{x68} - \mathrm{kr21} \cdot \mathrm{x66} \cdot \mathrm{x26} \tag{164}$$

7.79 Reaction v79

This is a reversible reaction of one reactant forming two products.

Name v79

Reaction equation

$$\mathrm{x66} \rightleftharpoons \mathrm{x17} + \mathrm{x38} \tag{165}$$

Reactant

Table 163: Properties of each reactant.

Id	Name	SBO
x66	EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos	

Products

Table 164: Properties of each product.

Id	Name	SBO
x17	EGF-EGFRi*2̂-GAP	

Id	Name	SBO
x38	Shc*-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{79} = \mathrm{k32} \cdot \mathrm{x66} - \mathrm{kr32} \cdot \mathrm{x17} \cdot \mathrm{x38} \tag{166}$$

7.80 Reaction v80

This is a reversible reaction of one reactant forming two products.

Name v80

Reaction equation

$$\mathrm{x19} \rightleftharpoons \mathrm{x17} + \mathrm{x30} \tag{167}$$

Reactant

Table 165: Properties of each reactant.

Id	Name	SBO
x19	EGF-EGFRi*2̂-GAP-Grb2-Sos	

Products

Table 166: Properties of each product.

Id	Name	SBO
x17	EGF-EGFRi*2̂-GAP	
x30	Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{80} = \mathrm{k34} \cdot \mathrm{x19} - \mathrm{kr34} \cdot \mathrm{x17} \cdot \mathrm{x30} \tag{168}$$

7.81 Reaction v81

This is a reversible reaction of one reactant forming two products.

Name v81

Reaction equation

$$\mathrm{x64} \rightleftharpoons \mathrm{x17} + \mathrm{x40} \tag{169}$$

Reactant

Table 167: Properties of each reactant.

Id	Name	SBO
x64	EGF-EGFRi*2̂-GAP-Shc*	

Products

Table 168: Properties of each product.

Id	Name	SBO
x17	EGF-EGFRi*2̂-GAP	
x40	Shc*	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{81} = \mathrm{k37} \cdot \mathrm{x64} - \mathrm{kr37} \cdot \mathrm{x17} \cdot \mathrm{x40} \tag{170}$$

7.82 Reaction v82

This is a reversible reaction of one reactant forming two products.

Name v82

Reaction equation

$$\mathrm{x65} \rightleftharpoons \mathrm{x17} + \mathrm{x39} \tag{171}$$

Reactant

Table 169: Properties of each reactant.

Id	Name	SBO
x65	EGF-EGFRi*$\hat{2}$-GAP-Shc*-Grb2	

Products

Table 170: Properties of each product.

Id	Name	SBO
x17	EGF-EGFRi*$\hat{2}$-GAP	
x39	Shc*-Grb2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{82} = \mathrm{k37} \cdot \mathrm{x65} - \mathrm{kr37} \cdot \mathrm{x17} \cdot \mathrm{x39} \tag{172}$$

7.83 Reaction v83

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

Name v83

Reaction equation

$$\mathrm{x30} + \mathrm{x64} \rightleftharpoons \mathrm{x66} \tag{173}$$

Reactants

Table 171: Properties of each reactant.

Id	Name	SBO
x30	Grb2-Sos	
x64	EGF-EGFRi*$\hat{2}$-GAP-Shc*	

Product

Table 172: Properties of each product.

Id	Name	SBO
x66	EGF-EGFRi*$\hat{2}$-GAP-Shc*-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{83} = \mathrm{k41} \cdot \mathrm{x30} \cdot \mathrm{x64} - \mathrm{kr41} \cdot \mathrm{x66} \tag{174}$$

7.84 Reaction v84

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

Name v84

Reaction equation

$$\mathrm{x44} + \mathrm{x72} \rightleftharpoons \mathrm{x73} \tag{175}$$

Reactants

Table 173: Properties of each reactant.

Id	Name	SBO
x44	Phosphotase1	
x72	Rafi*	

Product

Table 174: Properties of each product.

Id	Name	SBO
x73	Rafi*-P'ase	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{84} = \mathrm{k42} \cdot \mathrm{x44} \cdot \mathrm{x72} - \mathrm{kr42} \cdot \mathrm{x73} \tag{176}$$

7.85 Reaction v85

This is a reversible reaction of one reactant forming two products.

Name v85

Reaction equation

$$\mathrm{x73} \rightleftharpoons \mathrm{x41} + \mathrm{x44} \tag{177}$$

Reactant

Table 175: Properties of each reactant.

Id	Name	SBO
x73	Rafi*-P'ase	

Products

Table 176: Properties of each product.

Id	Name	SBO
x41	Raf	
x44	Phosphotase1	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{85} = \mathrm{k43} \cdot \mathrm{x73} \tag{178}$$

7.86 Reaction v86

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

Name v86

Reaction equation

$$\mathrm{x47} + \mathrm{x72} \rightleftharpoons \mathrm{x74} \tag{179}$$

Reactants

Table 177: Properties of each reactant.

Id	Name	SBO
x47	MEK	
x72	Rafi*	

Product

Table 178: Properties of each product.

Id	Name	SBO
x74	MEKi-Rafi*	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{86} = \mathrm{k44} \cdot \mathrm{x47} \cdot \mathrm{x72} - \mathrm{kr44} \cdot \mathrm{x74} \tag{180}$$

7.87 Reaction v87

This is a reversible reaction of one reactant forming two products.

Name v87

Reaction equation

$$\mathrm{x74} \rightleftharpoons \mathrm{x75} + \mathrm{x72} \tag{181}$$

Reactant

Table 179: Properties of each reactant.

Id	Name	SBO
x74	MEKi-Rafi*	

Products

Table 180: Properties of each product.

Id	Name	SBO
x75	MEKi-P	

Id	Name	SBO
x72	Rafi*	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{87} = \mathrm{k45} \cdot \mathrm{x74} \tag{182}$$

7.88 Reaction v88

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

Name v88

Reaction equation

$$\mathrm{x72} + \mathrm{x75} \rightleftharpoons \mathrm{x76} \tag{183}$$

Reactants

Table 181: Properties of each reactant.

Id	Name	SBO
x72	Rafi*	
x75	MEKi-P	

Product

Table 182: Properties of each product.

Id	Name	SBO
x76	MEKi-P-Rafi*	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{88} = \mathrm{k44} \cdot \mathrm{x72} \cdot \mathrm{x75} - \mathrm{kr44} \cdot \mathrm{x76} \tag{184}$$

7.89 Reaction v89

This is a reversible reaction of one reactant forming two products.

Name v89

Reaction equation

$$\mathrm{x76} \rightleftharpoons \mathrm{x72} + \mathrm{x77} \tag{185}$$

Reactant

Table 183: Properties of each reactant.

Id	Name	SBO
x76	MEKi-P-Rafi*	

Products

Table 184: Properties of each product.

Id	Name	SBO
x72	Rafi*	
x77	MEKi-PP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{89} = \mathrm{k47} \cdot \mathrm{x76} \tag{186}$$

7.90 Reaction v90

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

Name v90

Reaction equation

$$\mathrm{x77} + \mathrm{x53} \rightleftharpoons \mathrm{x78} \tag{187}$$

Reactants

Table 185: Properties of each reactant.

Id	Name	SBO
x77	MEKi-PP	
x53	Phosphatase2	

Product

Table 186: Properties of each product.

Id	Name	SBO
x78	MEKi-PP-P'ase2i	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{90} = \mathrm{k48} \cdot \mathrm{x77} \cdot \mathrm{x53} - \mathrm{kr48} \cdot \mathrm{x78} \tag{188}$$

7.91 Reaction v91

This is a reversible reaction of one reactant forming two products.

Name v91

Reaction equation

$$\mathrm{x78} \rightleftharpoons \mathrm{x75} + \mathrm{x53} \tag{189}$$

Reactant

Table 187: Properties of each reactant.

Id	Name	SBO
x78	MEKi-PP-P'ase2i	

Products

Table 188: Properties of each product.

Id	Name	SBO
x75	MEKi-P	

Id	Name	SBO
x53	Phosphatase2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{91} = \mathrm{k49} \cdot \mathrm{x78} \tag{190}$$

7.92 Reaction v92

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

Name v92

Reaction equation

$$\mathrm{x53} + \mathrm{x75} \rightleftharpoons \mathrm{x79} \tag{191}$$

Reactants

Table 189: Properties of each reactant.

Id	Name	SBO
x53	Phosphatase2	
x75	MEKi-P	

Product

Table 190: Properties of each product.

Id	Name	SBO
x79	MEKi-P-P'ase2i	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{92} = \mathrm{k50} \cdot \mathrm{x53} \cdot \mathrm{x75} - \mathrm{kr50} \cdot \mathrm{x79} \tag{192}$$

7.93 Reaction v93

This is a reversible reaction of one reactant forming two products.

Name v93

Reaction equation

$$\mathrm{x79} \rightleftharpoons \mathrm{x47} + \mathrm{x53} \tag{193}$$

Reactant

Table 191: Properties of each reactant.

Id	Name	SBO
x79	MEKi-P-P'ase2i	

Products

Table 192: Properties of each product.

Id	Name	SBO
x47	MEK	
x53	Phosphatase2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{93} = \mathrm{k49} \cdot \mathrm{x79} \tag{194}$$

7.94 Reaction v94

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

Name v94

Reaction equation

$$\mathrm{x55} + \mathrm{x77} \rightleftharpoons \mathrm{x80} \tag{195}$$

Reactants

Table 193: Properties of each reactant.

Id	Name	SBO
x55	ERK	
x77	MEKi-PP	

Product

Table 194: Properties of each product.

Id	Name	SBO
x80	ERKi-MEKi-PP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{94} = \mathrm{k52} \cdot \mathrm{x55} \cdot \mathrm{x77} - \mathrm{kr52} \cdot \mathrm{x80} \tag{196}$$

7.95 Reaction v95

This is a reversible reaction of one reactant forming two products.

Name v95

Reaction equation

$$\mathrm{x80} \rightleftharpoons \mathrm{x81} + \mathrm{x77} \tag{197}$$

Reactant

Table 195: Properties of each reactant.

Id	Name	SBO
x80	ERKi-MEKi-PP	

Products

Table 196: Properties of each product.

Id	Name	SBO
x81	ERKi-P	

Id	Name	SBO
x77	MEKi-PP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{95} = \mathrm{k53} \cdot \mathrm{x80} \tag{198}$$

7.96 Reaction v96

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

Name v96

Reaction equation

$$\mathrm{x77} + \mathrm{x81} \rightleftharpoons \mathrm{x82} \tag{199}$$

Reactants

Table 197: Properties of each reactant.

Id	Name	SBO
x77	MEKi-PP	
x81	ERKi-P	

Product

Table 198: Properties of each product.

Id	Name	SBO
x82	ERKi-P-MEKi-PP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{96} = \mathrm{k52} \cdot \mathrm{x77} \cdot \mathrm{x81} - \mathrm{kr52} \cdot \mathrm{x82} \tag{200}$$

7.97 Reaction v97

This is a reversible reaction of one reactant forming two products.

Name v97

Reaction equation

$$\mathrm{x82} \rightleftharpoons \mathrm{x83} + \mathrm{x77} \tag{201}$$

Reactant

Table 199: Properties of each reactant.

Id	Name	SBO
x82	ERKi-P-MEKi-PP	

Products

Table 200: Properties of each product.

Id	Name	SBO
x83	ERKi-PP	
x77	MEKi-PP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{97} = \mathrm{k55} \cdot \mathrm{x82} \tag{202}$$

7.98 Reaction v98

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

Name v98

Reaction equation

$$\mathrm{x83} + \mathrm{x60} \rightleftharpoons \mathrm{x84} \tag{203}$$

Reactants

Table 201: Properties of each reactant.

Id	Name	SBO
x83	ERKi-PP	
x60	Phosphotase3	

Product

Table 202: Properties of each product.

Id	Name	SBO
x84	ERKi-PP-P'ase3i	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{98} = \mathrm{k56} \cdot \mathrm{x83} \cdot \mathrm{x60} - \mathrm{kr56} \cdot \mathrm{x84} \tag{204}$$

7.99 Reaction v99

This is a reversible reaction of one reactant forming two products.

Name v99

Reaction equation

$$\mathrm{x84} \rightleftharpoons \mathrm{x81} + \mathrm{x60} \tag{205}$$

Reactant

Table 203: Properties of each reactant.

Id	Name	SBO
x84	ERKi-PP-P'ase3i	

Products

Table 204: Properties of each product.

Id	Name	SBO
x81	ERKi-P	

Id	Name	SBO
x60	Phosphotase3	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{99} = \mathrm{k57} \cdot \mathrm{x84} \tag{206}$$

7.100 Reaction v100

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

Name v100

Reaction equation

$$\mathrm{x60} + \mathrm{x81} \rightleftharpoons \mathrm{x85} \tag{207}$$

Reactants

Table 205: Properties of each reactant.

Id	Name	SBO
x60	Phosphotase3	
x81	ERKi-P	

Product

Table 206: Properties of each product.

Id	Name	SBO
x85	ERKi-P-P'ase3i	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{100} = \mathrm{k58} \cdot \mathrm{x60} \cdot \mathrm{x81} - \mathrm{kr58} \cdot \mathrm{x85} \tag{208}$$

7.101 Reaction v101

This is a reversible reaction of one reactant forming two products.

Name v101

Reaction equation

$$\mathrm{x85} \rightleftharpoons \mathrm{x55} + \mathrm{x60} \tag{209}$$

Reactant

Table 207: Properties of each reactant.

Id	Name	SBO
x85	ERKi-P-P'ase3i	

Products

Table 208: Properties of each product.

Id	Name	SBO
x55	ERK	
x60	Phosphotase3	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{101} = \mathrm{k59} \cdot \mathrm{x85} \tag{210}$$

7.102 Reaction v102

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

Name v102

Reaction equation

$$\mathrm{x15} \rightleftharpoons \mathrm{x17} \tag{211}$$

Reactant

Table 209: Properties of each reactant.

Id	Name	SBO
x15	EGF-EGFR*2̂-GAP	

Product

Table 210: Properties of each product.

Id	Name	SBO
x17	EGF-EGFRi*2̂-GAP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{102} = \mathrm{k6} \cdot \mathrm{x15} - \mathrm{kr6} \cdot \mathrm{x17} \tag{212}$$

7.103 Reaction v103

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

Name v103

Reaction equation

$$\mathrm{x32} \rightleftharpoons \mathrm{x63} \tag{213}$$

Reactant

Table 211: Properties of each reactant.

Id	Name	SBO
x32	EGF-EGFR*2̂-GAP-Shc	

Product

Table 212: Properties of each product.

Id	Name	SBO
x63	EGF-EGFRi*2̂-GAP-Shc	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{103} = \mathrm{k6} \cdot \mathrm{x32} - \mathrm{kr6} \cdot \mathrm{x63} \tag{214}$$

7.104 Reaction v104

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

Name v104

Reaction equation

$$\mathrm{x33} \rightleftharpoons \mathrm{x64} \tag{215}$$

Reactant

Table 213: Properties of each reactant.

Id	Name	SBO
x33	EGF-EGFR*2̂-GAP-Shc*	

Product

Table 214: Properties of each product.

Id	Name	SBO
x64	EGF-EGFRi*2̂-GAP-Shc*	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{104} = \mathrm{k6} \cdot \mathrm{x33} - \mathrm{kr6} \cdot \mathrm{x64} \tag{216}$$

7.105 Reaction v105

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

Name v105

Reaction equation

$$\mathrm{x25} \rightleftharpoons \mathrm{x19} \tag{217}$$

Reactant

Table 215: Properties of each reactant.

Id	Name	SBO
x25	EGF-EGFR*2̂-GAP-Grb2-Sos	

Product

Table 216: Properties of each product.

Id	Name	SBO
x19	EGF-EGFRi*2̂-GAP-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{105} = \mathrm{k6} \cdot \mathrm{x25} - \mathrm{kr6} \cdot \mathrm{x19} \tag{218}$$

7.106 Reaction v106

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

Name v106

Reaction equation

$$\mathrm{x25} + \mathrm{x12} \rightleftharpoons \mathrm{x88} \tag{219}$$

Reactants

Table 217: Properties of each reactant.

Id	Name	SBO
x25	EGF-EGFR*2̂-GAP-Grb2-Sos	
x12	Prot	

Product

Table 218: Properties of each product.

Id	Name	SBO
x88	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Prot	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{106} = \mathrm{k4} \cdot \mathrm{x25} \cdot \mathrm{x12} - \mathrm{kr4} \cdot \mathrm{x88} \tag{220}$$

7.107 Reaction v107

This is a reversible reaction of one reactant forming two products.

Name v107

Reaction equation

$$\mathrm{x88} \rightleftharpoons \mathrm{x9} + \mathrm{x19} \tag{221}$$

Reactant

Table 219: Properties of each reactant.

Id	Name	SBO
x88	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Prot	

Products

Table 220: Properties of each product.

Id	Name	SBO
x9	Proti	
x19	EGF-EGFRi*$\hat{2}$-GAP-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{107} = \mathrm{k5} \cdot \mathrm{x88} \tag{222}$$

7.108 Reaction v108

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

Name v108

Reaction equation

$$\mathrm{x27} \rightleftharpoons \mathrm{x20} \tag{223}$$

Reactant

Table 221: Properties of each reactant.

Id	Name	SBO
x27	EGF-EGFR*2̂-GAP-Grb2-Sos-Ras-GDP	

Product

Table 222: Properties of each product.

Id	Name	SBO
x20	EGF-EGFRi*2̂-GAP-Grb2-Sos-Ras-GDP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{108} = \mathrm{k6} \cdot \mathrm{x27} - \mathrm{kr6} \cdot \mathrm{x20} \tag{224}$$

7.109 Reaction v109

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

Name v109

Reaction equation

$$\mathrm{x27} + \mathrm{x12} \rightleftharpoons \mathrm{x89} \tag{225}$$

Reactants

Table 223: Properties of each reactant.

Id	Name	SBO
x27	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Ras-GDP	
x12	Prot	

Product

Table 224: Properties of each product.

Id	Name	SBO
x89	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Ras-GDP-Prot	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{109} = \mathrm{k4} \cdot \mathrm{x27} \cdot \mathrm{x12} - \mathrm{kr4} \cdot \mathrm{x89} \tag{226}$$

7.110 Reaction v110

This is a reversible reaction of one reactant forming two products.

Name v110

Reaction equation

$$\mathrm{x89} \rightleftharpoons \mathrm{x9} + \mathrm{x20} \tag{227}$$

Reactant

Table 225: Properties of each reactant.

Id	Name	SBO
x89	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Ras-GDP-Prot	

Products

Table 226: Properties of each product.

Id	Name	SBO
x9	Proti	

Id	Name	SBO
x20	EGF-EGFRi*2̂-GAP-Grb2-Sos-Ras-GDP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{110} = \mathrm{k5} \cdot \mathrm{x89} \tag{228}$$

7.111 Reaction v111

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

Name v111

Reaction equation

$$\mathrm{x29} \rightleftharpoons \mathrm{x21} \tag{229}$$

Reactant

Table 227: Properties of each reactant.

Id	Name	SBO
x29	EGF-EGFR*2̂-GAP-Grb2-Sos-Ras-GTP	

Product

Table 228: Properties of each product.

Id	Name	SBO
x21	EGF-EGFRi*2̂-GAP-Grb2-Sos-Ras-GTP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{111} = \mathrm{k6} \cdot \mathrm{x29} - \mathrm{kr6} \cdot \mathrm{x21} \tag{230}$$

7.112 Reaction v112

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

Name v112

Reaction equation

$$\mathrm{x29} + \mathrm{x12} \rightleftharpoons \mathrm{x90} \tag{231}$$

Reactants

Table 229: Properties of each reactant.

Id	Name	SBO
x29	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Ras-GTP	
x12	Prot	

Product

Table 230: Properties of each product.

Id	Name	SBO
x90	EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Ras-GTP-Prot	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{112} = \mathrm{k4} \cdot \mathrm{x29} \cdot \mathrm{x12} - \mathrm{kr4} \cdot \mathrm{x90} \tag{232}$$

7.113 Reaction v113

This is a reversible reaction of one reactant forming two products.

Name v113

Reaction equation

$$\mathrm{x90} \rightleftharpoons \mathrm{x9} + \mathrm{x21} \tag{233}$$

Reactant

Table 231: Properties of each reactant.

Id	Name	SBO
x90	EGF-EGFR*2̂-GAP-Grb2-Sos-Ras-GTP-Prot	

Products

Table 232: Properties of each product.

Id	Name	SBO
x9	Proti	
x21	EGF-EGFRi*2̂-GAP-Grb2-Sos-Ras-GTP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{113} = \mathrm{k5} \cdot \mathrm{x90} \tag{234}$$

7.114 Reaction v114

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

Name v114

Reaction equation

$$\mathrm{x34} \rightleftharpoons \mathrm{x65} \tag{235}$$

Reactant

Table 233: Properties of each reactant.

Id	Name	SBO
x34	EGF-EGFR*2̂-GAP-Shc*-Grb2	

Product

Table 234: Properties of each product.

Id	Name	SBO
x65	EGF-EGFRi*2̂-GAP-Shc*-Grb2	

Id	Name	SBO

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{114} = \mathrm{k6} \cdot \mathrm{x34} - \mathrm{kr6} \cdot \mathrm{x65} \tag{236}$$

7.115 Reaction v115

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

Name v115

Reaction equation

$$\mathrm{x34} + \mathrm{x12} \rightleftharpoons \mathrm{x91} \tag{237}$$

Reactants

Table 235: Properties of each reactant.

Id	Name	SBO
x34	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2	
x12	Prot	

Product

Table 236: Properties of each product.

Id	Name	SBO
x91	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Prot	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{115} = \mathrm{k4} \cdot \mathrm{x34} \cdot \mathrm{x12} - \mathrm{kr4} \cdot \mathrm{x91} \tag{238}$$

7.116 Reaction v116

This is a reversible reaction of one reactant forming two products.

Name v116

Reaction equation

$$\mathrm{x91} \rightleftharpoons \mathrm{x9} + \mathrm{x65} \tag{239}$$

Reactant

Table 237: Properties of each reactant.

Id	Name	SBO
x91	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Prot	

Products

Table 238: Properties of each product.

Id	Name	SBO
x9	Proti	
x65	EGF-EGFRi*$\hat{2}$-GAP-Shc*-Grb2	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{116} = \mathrm{k5} \cdot \mathrm{x91} \tag{240}$$

7.117 Reaction v117

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

Name v117

Reaction equation

$$\mathrm{x35} \rightleftharpoons \mathrm{x66} \tag{241}$$

Reactant

Table 239: Properties of each reactant.

Id	Name	SBO
x35	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos	

Product

Table 240: Properties of each product.

Id	Name	SBO
x66	EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{117} = \mathrm{k6} \cdot \mathrm{x35} - \mathrm{kr6} \cdot \mathrm{x66} \tag{242}$$

7.118 Reaction v118

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

Name v118

Reaction equation

$$\mathrm{x35} + \mathrm{x12} \rightleftharpoons \mathrm{x92} \tag{243}$$

Reactants

Table 241: Properties of each reactant.

Id	Name	SBO
x35	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos	
x12	Prot	

Product

Table 242: Properties of each product.

Id	Name	SBO
x92	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos-Prot	

Id	Name	SBO

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{118} = \mathrm{k4} \cdot \mathrm{x35} \cdot \mathrm{x12} - \mathrm{kr4} \cdot \mathrm{x92} \tag{244}$$

7.119 Reaction v119

This is a reversible reaction of one reactant forming two products.

Name v119

Reaction equation

$$\mathrm{x92} \rightleftharpoons \mathrm{x9} + \mathrm{x66} \tag{245}$$

Reactant

Table 243: Properties of each reactant.

Id	Name	SBO
x92	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos-Prot	

Products

Table 244: Properties of each product.

Id	Name	SBO
x9	Proti	
x66	EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{119} = \mathrm{k5} \cdot \mathrm{x92} \tag{246}$$

7.120 Reaction v120

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

Name v120

Reaction equation

$$\mathrm{x36} \rightleftharpoons \mathrm{x67} \tag{247}$$

Reactant

Table 245: Properties of each reactant.

Id	Name	SBO
x36	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GDP	

Product

Table 246: Properties of each product.

Id	Name	SBO
x67	EGF-EGFRi*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GDP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{120} = \mathrm{k6} \cdot \mathrm{x36} - \mathrm{kr6} \cdot \mathrm{x67} \tag{248}$$

7.121 Reaction v121

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

Name v121

Reaction equation

$$\mathrm{x36} + \mathrm{x12} \rightleftharpoons \mathrm{x93} \tag{249}$$

Reactants

Table 247: Properties of each reactant.

Id	Name	SBO
x36	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GDP	
x12	Prot	

Product

Table 248: Properties of each product.

Id	Name	SBO
x93	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos-Ras-GDP-Prot	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{121} = \mathrm{k4} \cdot \mathrm{x36} \cdot \mathrm{x12} - \mathrm{kr4} \cdot \mathrm{x93} \tag{250}$$

7.122 Reaction v122

This is a reversible reaction of one reactant forming two products.

Name v122

Reaction equation

$$\mathrm{x93} \rightleftharpoons \mathrm{x9} + \mathrm{x67} \tag{251}$$

Reactant

Table 249: Properties of each reactant.

Id	Name	SBO
x93	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos-Ras-GDP-Prot	

Products

Table 250: Properties of each product.

Id	Name	SBO
x9	Proti	
x67	EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos-Ras-GDP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{122} = \mathrm{k5} \cdot \mathrm{x93} \tag{252}$$

7.123 Reaction v123

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

Name v123

Reaction equation

$$\mathrm{x37} \rightleftharpoons \mathrm{x68} \tag{253}$$

Reactant

Table 251: Properties of each reactant.

Id	Name	SBO
x37	EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GTP	

Product

Table 252: Properties of each product.

Id	Name	SBO
x68	EGF-EGFRi*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GTP	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{123} = \mathrm{k6} \cdot \mathrm{x37} - \mathrm{kr6} \cdot \mathrm{x68} \tag{254}$$

7.124 Reaction v124

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

Name v124

Reaction equation

$$\mathrm{x37} + \mathrm{x12} \rightleftharpoons \mathrm{x94} \tag{255}$$

Reactants

Table 253: Properties of each reactant.

Id	Name	SBO
x37	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos-Ras-GTP	
x12	Prot	

Product

Table 254: Properties of each product.

Id	Name	SBO
x94	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos-Ras-GTP-Prot	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{124} = \mathrm{k4} \cdot \mathrm{x37} \cdot \mathrm{x12} - \mathrm{kr4} \cdot \mathrm{x94} \tag{256}$$

7.125 Reaction v125

This is a reversible reaction of one reactant forming two products.

Name v125

Reaction equation

$$\mathrm{x94} \rightleftharpoons \mathrm{x68} + \mathrm{x9} \tag{257}$$

Reactant

Table 255: Properties of each reactant.

Id	Name	SBO
x94	EGF-EGFR*2̂-GAP-Shc*-Grb2-Sos-Ras-GTP-Prot	

Products

Table 256: Properties of each product.

Id	Name	SBO
x68	EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos-Ras-GTP	

Id	Name	SBO
x9	Proti	

Kinetic Law

Derived unit $(60\ \mathrm{s})^{-1} \cdot \mathrm{item}$

$$v_{125} = \mathrm{k5} \cdot \mathrm{x94} \tag{258}$$

8 Derived Rate Equations

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

8.1 Species x1

Name EGF

Notes 4962 molecules correspond roughly to 50 ng/ml, concentration used throughout the article (MW˜6045 Da, vol=1e-12l)

Initial amount 4962 item

This species takes part in one reaction (as a reactant in v1), which does not influence its rate of change because this species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x1} = 0 \tag{259}$$

8.2 Species x2

Name EGFR

Initial amount 50000 item

This species takes part in three reactions (as a reactant in v1, v6 and as a product in v13).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x2} = v_{13} - v_1 - v_6 \tag{260}$$

8.3 Species x3

Name EGF-EGFR

Initial amount 0 item

This species takes part in two reactions (as a reactant in v2 and as a product in v1).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x3} = v_1 - 2v_2 \tag{261}$$

8.4 Species x4

Name EGF-EGFR$\hat{2}$

Initial amount 0 item

This species takes part in two reactions (as a reactant in v3 and as a product in v2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x4} = v_2 - v_3 \tag{262}$$

8.5 Species x5

Name EGF-EGFR*$\hat{2}$

Initial amount 0 item

This species takes part in three reactions (as a reactant in v7, v8 and as a product in v3).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x5} = v_3 - v_7 - v_8 \tag{263}$$

8.6 Species x6

Name EGFRi

Initial amount 0 item

This species takes part in three reactions (as a reactant in v10, v60 and as a product in v6).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x6} = v_6 - v_{10} - v_{60} \tag{264}$$

8.7 Species x7

Name EGF-EGFR*$\hat{2}$-GAP-Grb2-Prot

Initial amount 0 item

This species takes part in two reactions (as a reactant in v5 and as a product in v4).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x7} = v_4 - v_5 \tag{265}$$

8.8 Species x8

Name EGF-EGFRi*$\hat{2}$

Initial amount 0 item

This species takes part in four reactions (as a reactant in v14, v62 and as a product in v7, v12).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x8} = v_7 + v_{12} - v_{14} - v_{62} \tag{266}$$

8.9 Species x9

Name Proti

Initial amount 0 item

This species takes part in nine reactions (as a reactant in v15 and as a product in v5, v107, v110, v113, v116, v119, v122, v125).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x9} = v_5 + v_{107} + v_{110} + v_{113} + v_{116} + v_{119} + v_{122} + v_{125} - v_{15} \tag{267}$$

8.10 Species x10

Name EGF-EGFRi

Initial amount 0 item

This species takes part in two reactions (as a reactant in v11 and as a product in v10).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x10} = v_{10} - 2v_{11} \tag{268}$$

8.11 Species x11

Name EGF-EGFRi$\hat{2}$

Initial amount 0 item

This species takes part in two reactions (as a reactant in v12 and as a product in v11).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x11} = v_{11} - v_{12} \tag{269}$$

8.12 Species x12

Name Prot

Initial amount 81000 item

This species takes part in nine reactions (as a reactant in v4, v106, v109, v112, v115, v118, v121, v124 and as a product in v15).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x12} = v_{15} - v_4 - v_{106} - v_{109} - v_{112} - v_{115} - v_{118} - v_{121} - v_{124} \tag{270}$$

8.13 Species x13

Name EGFideg

Initial amount 0 item

This species takes part in one reaction (as a product in v61).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x13} = v_{61} \tag{271}$$

8.14 Species x14

Name GAP

Initial amount 12000 item

This species takes part in two reactions (as a reactant in v8, v14).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x14} = -v_{8} - v_{14} \tag{272}$$

8.15 Species x15

Name EGF-EGFR*$\hat{2}$-GAP

Initial amount 0 item

This species takes part in eight reactions (as a reactant in v16, v22, v102 and as a product in v8, v32, v34, v37, v39).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x15} = v_{8} + v_{32} + v_{34} + v_{37} + v_{39} - v_{16} - v_{22} - v_{102} \tag{273}$$

8.16 Species x16

Name EGFi

Initial amount 0 item

This species takes part in two reactions (as a reactant in v10, v61).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x16} = -v_{10} - v_{61} \tag{274}$$

8.17 Species x17

Name EGF-EGFRi*2̂-GAP

Initial amount 0 item

This species takes part in eight reactions (as a reactant in v63, v69 and as a product in v14, v79, v80, v81, v82, v102).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x17} = v_{14} + v_{79} + v_{80} + v_{81} + v_{82} + v_{102} - v_{63} - v_{69} \tag{275}$$

8.18 Species x18

Name EGF-EGFRi*2̂-GAP-Grb2

Initial amount 0 item

This species takes part in four reactions (as a reactant in v64 and as a product in v5, v9, v63).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x18} = v_{5} + v_{9} + v_{63} - v_{64} \tag{276}$$

8.19 Species x19

Name EGF-EGFRi*2̂-GAP-Grb2-Sos

Initial amount 0 item

This species takes part in eight reactions (as a reactant in v65, v67, v80 and as a product in v64, v66, v68, v105, v107).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x19} = v_{64} + v_{66} + v_{68} + v_{105} + v_{107} - v_{65} - v_{67} - v_{80} \tag{277}$$

8.20 Species x20

Name EGF-EGFRi*2̂-GAP-Grb2-Sos-Ras-GDP

Initial amount 0 item

This species takes part in four reactions (as a reactant in v66 and as a product in v65, v108, v110).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x20} = v_{65} + v_{108} + v_{110} - v_{66} \tag{278}$$

8.21 Species x21

Name EGF-EGFRi*$\hat{2}$-GAP-Grb2-Sos-Ras-GTP

Initial amount 0 item

This species takes part in four reactions (as a reactant in v68 and as a product in v67, v111, v113).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x21} = v_{67} + v_{111} + v_{113} - v_{68} \tag{279}$$

8.22 Species x22

Name Grb2

Initial amount 11000 item

This species takes part in six reactions (as a reactant in v16, v24, v38, v63, v71 and as a product in v35).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x22} = v_{35} - v_{16} - v_{24} - v_{38} - v_{63} - v_{71} \tag{280}$$

8.23 Species x23

Name EGF-EGFR*$\hat{2}$-GAP-Grb2

Initial amount 0 item

This species takes part in four reactions (as a reactant in v4, v9, v17 and as a product in v16).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x23} = v_{16} - v_{4} - v_{9} - v_{17} \tag{281}$$

8.24 Species x24

Name Sos

Initial amount 26300 item

This species takes part in six reactions (as a reactant in v17, v25, v40, v64, v72 and as a product in v35).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x24} = v_{35} - v_{17} - v_{25} - v_{40} - v_{64} - v_{72} \tag{282}$$

8.25 Species x25

Name EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos

Initial amount 0 item

This species takes part in eight reactions (as a reactant in v18, v20, v34, v105, v106 and as a product in v17, v19, v21).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x25} = v_{17} + v_{19} + v_{21} - v_{18} - v_{20} - v_{34} - v_{105} - v_{106} \tag{283}$$

8.26 Species x26

Name Ras-GDP

Initial amount 72000 item

This species takes part in eight reactions (as a reactant in v18, v26, v65, v73 and as a product in v21, v31, v68, v78).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x26} = v_{21} + v_{31} + v_{68} + v_{78} - v_{18} - v_{26} - v_{65} - v_{73} \tag{284}$$

8.27 Species x27

Name EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Ras-GDP

Initial amount 0 item

This species takes part in four reactions (as a reactant in v19, v108, v109 and as a product in v18).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x27} = v_{18} - v_{19} - v_{108} - v_{109} \tag{285}$$

8.28 Species x28

Name Ras-GTP

Initial amount 0 item

This species takes part in three reactions (as a reactant in v28 and as a product in v19, v27).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x28} = v_{19} + v_{27} - v_{28} \tag{286}$$

8.29 Species x29

Name EGF-EGFR*$\hat{2}$-GAP-Grb2-Sos-Ras-GTP

Initial amount 0 item

This species takes part in four reactions (as a reactant in v21, v111, v112 and as a product in v20).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x29} = v_{20} - v_{21} - v_{111} - v_{112} \tag{287}$$

8.30 Species x30

Name Grb2-Sos

Initial amount 40000 item

This species takes part in six reactions (as a reactant in v35, v41, v83 and as a product in v33, v34, v80).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x30} = v_{33} + v_{34} + v_{80} - v_{35} - v_{41} - v_{83} \tag{288}$$

8.31 Species x31

Name Shc

Initial amount 101000 item

This species takes part in three reactions (as a reactant in v22, v69 and as a product in v36).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x31} = v_{36} - v_{22} - v_{69} \tag{289}$$

8.32 Species x32

Name EGF-EGFR*$\hat{2}$-GAP-Shc

Initial amount 0 item

This species takes part in three reactions (as a reactant in v23, v103 and as a product in v22).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x32} = v_{22} - v_{23} - v_{103} \tag{290}$$

8.33 Species x33

Name EGF-EGFR*$\hat{2}$-GAP-Shc*

Initial amount 0 item

This species takes part in five reactions (as a reactant in v24, v37, v41, v104 and as a product in v23).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x33} = v_{23} - v_{24} - v_{37} - v_{41} - v_{104} \tag{291}$$

8.34 Species x34

Name EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2

Initial amount 0 item

This species takes part in five reactions (as a reactant in v25, v39, v114, v115 and as a product in v24).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x34} = v_{24} - v_{25} - v_{39} - v_{114} - v_{115} \tag{292}$$

8.35 Species x35

Name EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos

Initial amount 0 item

This species takes part in nine reactions (as a reactant in v26, v30, v32, v117, v118 and as a product in v25, v27, v31, v41).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x35} = v_{25} + v_{27} + v_{31} + v_{41} - v_{26} - v_{30} - v_{32} - v_{117} - v_{118} \tag{293}$$

8.36 Species x36

Name EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GDP

Initial amount 0 item

This species takes part in four reactions (as a reactant in v27, v120, v121 and as a product in v26).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x36} = v_{26} - v_{27} - v_{120} - v_{121} \tag{294}$$

8.37 Species x37

Name EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GTP

Initial amount 0 item

This species takes part in four reactions (as a reactant in v31, v123, v124 and as a product in v30).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x37} = v_{30} - v_{31} - v_{123} - v_{124} \tag{295}$$

8.38 Species x38

Name Shc*-Grb2-Sos

Initial amount 0 item

This species takes part in four reactions (as a reactant in v33 and as a product in v32, v40, v79).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x38} = v_{32} + v_{40} + v_{79} - v_{33} \tag{296}$$

8.39 Species x39

Name Shc*-Grb2

Initial amount 0 item

This species takes part in four reactions (as a reactant in v40 and as a product in v38, v39, v82).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x39} = v_{38} + v_{39} + v_{82} - v_{40} \tag{297}$$

8.40 Species x40

Name Shc*

Initial amount 0 item

This species takes part in five reactions (as a reactant in v36, v38 and as a product in v33, v37, v81).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x40} = v_{33} + v_{37} + v_{81} - v_{36} - v_{38} \tag{298}$$

8.41 Species x41

Name Raf

Initial amount 40000 item

This species takes part in four reactions (as a reactant in v28, v75 and as a product in v43, v85).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x41} = v_{43} + v_{85} - v_{28} - v_{75} \tag{299}$$

8.42 Species x42

Name Raf-Ras-GTP

Initial amount 0 item

This species takes part in two reactions (as a reactant in v29 and as a product in v28).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x42} = v_{28} - v_{29} \tag{300}$$

8.43 Species x43

Name Ras-GTP*

Initial amount 0 item

This species takes part in three reactions (as a reactant in v20, v30 and as a product in v29).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x43} = v_{29} - v_{20} - v_{30} \tag{301}$$

8.44 Species x44

Name Phosphotase1

Initial amount 40000 item

This species takes part in four reactions (as a reactant in v42, v84 and as a product in v43, v85).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x44} = v_{43} + v_{85} - v_{42} - v_{84} \tag{302}$$

8.45 Species x45

Name Raf*

Initial amount 0 item

This species takes part in six reactions (as a reactant in v42, v44, v46 and as a product in v29, v45, v47).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x45} = v_{29} + v_{45} + v_{47} - v_{42} - v_{44} - v_{46} \tag{303}$$

8.46 Species x46

Name Raf*-P'ase

Initial amount 0 item

This species takes part in two reactions (as a reactant in v43 and as a product in v42).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x46} = v_{42} - v_{43} \tag{304}$$

8.47 Species x47

Name MEK

Initial amount $2.2 \cdot 10^7$ item

This species takes part in four reactions (as a reactant in v44, v86 and as a product in v51, v93).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x47} = v_{51} + v_{93} - v_{44} - v_{86} \tag{305}$$

8.48 Species x48

Name MEK-Raf*

Initial amount 0 item

This species takes part in two reactions (as a reactant in v45 and as a product in v44).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x48} = v_{44} - v_{45} \tag{306}$$

8.49 Species x49

Name MEK-P

Initial amount 0 item

This species takes part in four reactions (as a reactant in v46, v50 and as a product in v45, v49).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x49} = v_{45} + v_{49} - v_{46} - v_{50} \tag{307}$$

8.50 Species x50

Name MEK-P-Raf*

Initial amount 0 item

This species takes part in two reactions (as a reactant in v47 and as a product in v46).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x50} = v_{46} - v_{47} \tag{308}$$

8.51 Species x51

Name MEK-PP

Initial amount 0 item

This species takes part in six reactions (as a reactant in v48, v52, v54 and as a product in v47, v53, v55).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x51} = v_{47} + v_{53} + v_{55} - v_{48} - v_{52} - v_{54} \tag{309}$$

8.52 Species x52

Name MEK-PP-P'ase2

Initial amount 0 item

This species takes part in two reactions (as a reactant in v49 and as a product in v48).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x52} = v_{48} - v_{49} \tag{310}$$

8.53 Species x53

Name Phosphatase2

Initial amount 40000 item

This species takes part in eight reactions (as a reactant in v48, v50, v90, v92 and as a product in v49, v51, v91, v93).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x53} = v_{49} + v_{51} + v_{91} + v_{93} - v_{48} - v_{50} - v_{90} - v_{92} \tag{311}$$

8.54 Species x54

Name MEK-P-P'ase2

Initial amount 0 item

This species takes part in two reactions (as a reactant in v51 and as a product in v50).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x54} = v_{50} - v_{51} \tag{312}$$

8.55 Species x55

Name ERK

Initial amount $2.1 \cdot 10^7$ item

This species takes part in four reactions (as a reactant in v52, v94 and as a product in v59, v101).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x55} = v_{59} + v_{101} - v_{52} - v_{94} \tag{313}$$

8.56 Species x56

Name ERK-MEK-PP

Initial amount 0 item

This species takes part in two reactions (as a reactant in v53 and as a product in v52).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x56} = v_{52} - v_{53} \tag{314}$$

8.57 Species x57

Name ERK-P

Initial amount 0 item

This species takes part in four reactions (as a reactant in v54, v58 and as a product in v53, v57).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x57} = v_{53} + v_{57} - v_{54} - v_{58} \tag{315}$$

8.58 Species x58

Name ERK-P-MEK-PP

Initial amount 0 item

This species takes part in two reactions (as a reactant in v55 and as a product in v54).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x58} = v_{54} - v_{55} \tag{316}$$

8.59 Species x59

Name ERK-PP

Initial amount 0 item

This species takes part in two reactions (as a reactant in v56 and as a product in v55).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x59} = v_{55} - v_{56} \tag{317}$$

8.60 Species x60

Name Phosphotase3

Initial amount 10^7 item

This species takes part in eight reactions (as a reactant in v56, v58, v98, v100 and as a product in v57, v59, v99, v101).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x60} = v_{57} + v_{59} + v_{99} + v_{101} - v_{56} - v_{58} - v_{98} - v_{100} \tag{318}$$

8.61 Species x61

Name ERK-PP-P'ase3

Initial amount 0 item

This species takes part in two reactions (as a reactant in v57 and as a product in v56).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x61} = v_{56} - v_{57} \tag{319}$$

8.62 Species x62

Name ERK-P-P'ase3

Initial amount 0 item

This species takes part in two reactions (as a reactant in v59 and as a product in v58).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x62} = v_{58} - v_{59} \tag{320}$$

8.63 Species x63

Name EGF-EGFRi*2̂-GAP-Shc

Initial amount 0 item

This species takes part in three reactions (as a reactant in v70 and as a product in v69, v103).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x63} = v_{69} + v_{103} - v_{70} \tag{321}$$

8.64 Species x64

Name EGF-EGFRi*2̂-GAP-Shc*

Initial amount 0 item

This species takes part in five reactions (as a reactant in v71, v81, v83 and as a product in v70, v104).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x64} = v_{70} + v_{104} - v_{71} - v_{81} - v_{83} \tag{322}$$

8.65 Species x65

Name EGF-EGFRi*2̂-GAP-Shc*-Grb2

Initial amount 0 item

This species takes part in five reactions (as a reactant in v72, v82 and as a product in v71, v114, v116).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x65} = v_{71} + v_{114} + v_{116} - v_{72} - v_{82} \tag{323}$$

8.66 Species x66

Name EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos

Initial amount 0 item

This species takes part in nine reactions (as a reactant in v73, v77, v79 and as a product in v72, v74, v78, v83, v117, v119).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x66} = v_{72} + v_{74} + v_{78} + v_{83} + v_{117} + v_{119} - v_{73} - v_{77} - v_{79} \tag{324}$$

8.67 Species x67

Name EGF-EGFRi*2̂-GAP-Shc*-Grb2-Sos-Ras-GDP

Initial amount 0 item

This species takes part in four reactions (as a reactant in v74 and as a product in v73, v120, v122).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x67} = v_{73} + v_{120} + v_{122} - v_{74} \tag{325}$$

8.68 Species x68

Name EGF-EGFRi*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GTP

Initial amount 0 item

This species takes part in four reactions (as a reactant in v78 and as a product in v77, v123, v125).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x68} = v_{77} + v_{123} + v_{125} - v_{78} \tag{326}$$

8.69 Species x69

Name Rasi-GTP

Initial amount 0 item

This species takes part in three reactions (as a reactant in v75 and as a product in v66, v74).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x69} = v_{66} + v_{74} - v_{75} \tag{327}$$

8.70 Species x70

Name Rafi-Rasi-GTP

Initial amount 0 item

This species takes part in two reactions (as a reactant in v76 and as a product in v75).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x70} = v_{75} - v_{76} \tag{328}$$

8.71 Species x71

Name Rasi-GTP*

Initial amount 0 item

This species takes part in three reactions (as a reactant in v67, v77 and as a product in v76).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x71} = v_{76} - v_{67} - v_{77} \tag{329}$$

8.72 Species x72

Name Rafi*

Initial amount 0 item

This species takes part in six reactions (as a reactant in v84, v86, v88 and as a product in v76, v87, v89).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x72} = v_{76} + v_{87} + v_{89} - v_{84} - v_{86} - v_{88} \tag{330}$$

8.73 Species x73

Name Rafi*-P'ase

Initial amount 0 item

This species takes part in two reactions (as a reactant in v85 and as a product in v84).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x73} = v_{84} - v_{85} \tag{331}$$

8.74 Species x74

Name MEKi-Rafi*

Initial amount 0 item

This species takes part in two reactions (as a reactant in v87 and as a product in v86).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x74} = v_{86} - v_{87} \tag{332}$$

8.75 Species x75

Name MEKi-P

Initial amount 0 item

This species takes part in four reactions (as a reactant in v88, v92 and as a product in v87, v91).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x75} = v_{87} + v_{91} - v_{88} - v_{92} \tag{333}$$

8.76 Species x76

Name MEKi-P-Rafi*

Initial amount 0 item

This species takes part in two reactions (as a reactant in v89 and as a product in v88).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x76} = v_{88} - v_{89} \tag{334}$$

8.77 Species x77

Name MEKi-PP

Initial amount 0 item

This species takes part in six reactions (as a reactant in v90, v94, v96 and as a product in v89, v95, v97).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x77} = v_{89} + v_{95} + v_{97} - v_{90} - v_{94} - v_{96} \tag{335}$$

8.78 Species x78

Name MEKi-PP-P'ase2i

Initial amount 0 item

This species takes part in two reactions (as a reactant in v91 and as a product in v90).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x78} = v_{90} - v_{91} \tag{336}$$

8.79 Species x79

Name MEKi-P-P'ase2i

Initial amount 0 item

This species takes part in two reactions (as a reactant in v93 and as a product in v92).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x79} = v_{92} - v_{93} \tag{337}$$

8.80 Species x80

Name ERKi-MEKi-PP

Initial amount 0 item

This species takes part in two reactions (as a reactant in v95 and as a product in v94).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x80} = v_{94} - v_{95} \tag{338}$$

8.81 Species x81

Name ERKi-P

Initial amount 0 item

This species takes part in four reactions (as a reactant in v96, v100 and as a product in v95, v99).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x81} = v_{95} + v_{99} - v_{96} - v_{100} \tag{339}$$

8.82 Species x82

Name ERKi-P-MEKi-PP

Initial amount 0 item

This species takes part in two reactions (as a reactant in v97 and as a product in v96).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x82} = v_{96} - v_{97} \tag{340}$$

8.83 Species x83

Name ERKi-PP

Initial amount 0 item

This species takes part in two reactions (as a reactant in v98 and as a product in v97).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x83} = v_{97} - v_{98} \tag{341}$$

8.84 Species x84

Name ERKi-PP-P'ase3i

Initial amount 0 item

This species takes part in two reactions (as a reactant in v99 and as a product in v98).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x84} = v_{98} - v_{99} \tag{342}$$

8.85 Species x85

Name ERKi-P-P'ase3i

Initial amount 0 item

This species takes part in two reactions (as a reactant in v101 and as a product in v100).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x85} = v_{100} - v_{101} \tag{343}$$

8.86 Species x86

Name EGFRideg

Initial amount 0 item

This species takes part in one reaction (as a product in v60).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x86} = v_{60} \tag{344}$$

8.87 Species x87

Name EGF-EGFRi*2̂deg

Initial amount 0 item

This species takes part in one reaction (as a product in v62).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x87} = v_{62} \tag{345}$$

8.88 Species x88

Name EGF-EGFR*2̂-GAP-Grb2-Sos-Prot

Initial amount 0 item

This species takes part in two reactions (as a reactant in v107 and as a product in v106).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x88} = v_{106} - v_{107} \tag{346}$$

8.89 Species x89

Name EGF-EGFR*2̂-GAP-Grb2-Sos-Ras-GDP-Prot

Initial amount 0 item

This species takes part in two reactions (as a reactant in v110 and as a product in v109).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x89} = v_{109} - v_{110} \tag{347}$$

8.90 Species x90

Name EGF-EGFR*2̂-GAP-Grb2-Sos-Ras-GTP-Prot

Initial amount 0 item

This species takes part in two reactions (as a reactant in v113 and as a product in v112).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x90} = v_{112} - v_{113} \tag{348}$$

8.91 Species x91

Name EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Prot

Initial amount 0 item

This species takes part in two reactions (as a reactant in v116 and as a product in v115).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x91} = v_{115} - v_{116} \tag{349}$$

8.92 Species x92

Name EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos-Prot

Initial amount 0 item

This species takes part in two reactions (as a reactant in v119 and as a product in v118).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x92} = v_{118} - v_{119} \tag{350}$$

8.93 Species x93

Name EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GDP-Prot

Initial amount 0 item

This species takes part in two reactions (as a reactant in v122 and as a product in v121).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x93} = v_{121} - v_{122} \tag{351}$$

8.94 Species x94

Name EGF-EGFR*$\hat{2}$-GAP-Shc*-Grb2-Sos-Ras-GTP-Prot

Initial amount 0 item

This species takes part in two reactions (as a reactant in v125 and as a product in v124).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x94} = v_{124} - v_{125} \tag{352}$$

8.95 Species Raf_act

Name t_Raf*

Initial amount 0 item

Involved in rule Raf_act

One rule determines the species' quantity.

8.96 Species Ras_GTP

Name t_Ras_GTP

Initial amount 0 item

Involved in rule Ras_GTP

One rule determines the species' quantity.

8.97 Species MEK_PP

Name t_MEK_PP

Initial amount 0 item

Involved in rule MEK_PP

One rule determines the species' quantity.

8.98 Species ERK_PP

Name t_ERK_PP

Initial amount 0 item

Involved in rule ERK_PP

One rule determines the species' quantity.

8.99 Species SHC_P_t

Name t_SHC_P_t

Initial amount 0 item

Involved in rule SHC_P_t

One rule determines the species' quantity.

8.100 Species EGF_EGFR_act

Name t_EGF_EGFR*

Initial amount 0 item

Involved in rule EGF_EGFR_act

One rule determines the species' quantity.

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