SBML Model Report

Model name: "Sivakumar2011 - EGF Receptor Signaling Pathway"

May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by the following two authors: Vijayalakshmi Chelliah[1] and KC Sivakumar[2] at November second 2011 at 2:44 p. m. and last time modified at April eighth 2016 at 5:15 p. m. Table 1 provides an overview of the quantities of all components of this model.

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

Element	Quantity	Element	Quantity
compartment types	0	compartments	2
species types	0	species	23
events	0	constraints	0
reactions	10	function definitions	0
global parameters	38	unit definitions	0
rules	0	initial assignments	0

Model Notes

Sivakumar2011 - EGF Receptor Signaling Pathway

EGFR belongs to the human epidermal receptor (HER) family of receptor tyrosine kinases, which consists of four closely related receptors (EGFR (HER1, erbB1), HER2 (neu, erbB2), HER3 (erbB3), and HER4 (erbB4)) that mediate cellular signaling pathways involved in growth

[1]EMBL-EBI, viji@ebi.ac.uk
[2]Rajiv Gandhi Centre for Biotechnology, sivakumar.kc@gmail.com

and proliferation in response to the binding of a variety of growth factor ligands. There are currently six known endogenous ligands for EGFR: EGF, transforming growth factor- (TGF-), amphiregulin, betacellulin, heparin-binding EGF (HB-EGF), and epiregulin.Upon ligand binding, the EGFR forms homo- or heterodimeric complexes (usually with HER2), which leads to activation of the receptor tyrosine kinase, via autophosphorylation.

References:

- The EGF receptor family–multiple roles in proliferation, differentiation, and neoplasia with an emphasis on HER4.
- An open-and-shut case? Recent insights into the activation of EGF/ErbB receptors.
- EGF receptor signaling: putting a new spin on eye development.
- Epidermal growth factor receptor: a promising target in solid tumours.

This model is described in the article:A systems biology approach to model neural stem cell regulation by notch, shh, wnt, and EGF signaling pathways.Sivakumar KC, Dhanesh SB, Shobana S, James J, Mundayoor S.Omics: a Journal of Integrative Biology. 2011; 15(10):729-737

Abstract:

The Notch, Sonic Hedgehog (Shh), Wnt, and EGF pathways have long been known to influence cell fate specification in the developing nervous system. Here we attempted to evaluate the contemporary knowledge about neural stem cell differentiation promoted by various drug-based regulations through a systems biology approach. Our model showed the phenomenon of DAPT-mediated antagonism of Enhancer of split [E(spl)] genes and enhancement of Shh target genes by a SAG agonist that were effectively demonstrated computationally and were consistent with experimental studies. However, in the case of model simulation of Wnt and EGF pathways, the model network did not supply any concurrent results with experimental data despite the fact that drugs were added at the appropriate positions. This paves insight into the potential of crosstalks between pathways considered in our study. Therefore, we manually developed a map of signaling crosstalk, which included the species connected by representatives from Notch, Shh, Wnt, and EGF pathways and highlighted the regulation of a single target gene, Hes-1, based on drug-induced simulations. These simulations provided results that matched with experimental studies. Therefore, these signaling crosstalk models complement as a tool toward the discovery of novel regulatory processes involved in neural stem cell maintenance, proliferation, and differentiation during mammalian central nervous system development. To our knowledge, this is the first report of a simple crosstalk map that highlights the differential regulation of neural stem cell differentiation and underscores the flow of positive and negative regulatory signals modulated by drugs.

This model is hosted on BioModels Database and identified by: BIOMD0000000394.

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

2 Unit Definitions

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

2.1 Unit `substance`

Notes Mole is the predefined SBML unit for `substance`.

Definition mol

2.2 Unit `volume`

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

Definition l

2.3 Unit `area`

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

Definition m^2

2.4 Unit `length`

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

Definition m

2.5 Unit `time`

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

Definition s

3 Compartments

This model contains two compartments.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
`default`			3	1	litre	☑	
`c2`	Cytosol		3	1	litre	☑	`default`

3.1 Compartment `default`

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

3.2 Compartment `c2`

This is a three dimensional compartment with a constant size of one litre, which is surrounded by `default`.

Name Cytosol

4 Species

This model contains 23 species. Section 7 provides further details and the derived rates of change of each species.

Table 3: Properties of each species.

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
s21	Akt	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s22	Akt	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s25	MEK1_minus_2	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s26	MEK1_minus_2	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s27	ERK1_minus_2	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s28	ERK1_minus_2	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s29	RKIP	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s30	RKIP	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s31	PP2A	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s33	14_minus_3_minus_3	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s34	Mitogenesis_br_Differentiation	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s23	Raf_minus_1	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s24	Raf_minus_1	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s3	EGF	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s123	EGFR	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s124	Ras	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s125	GDP	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s126	GTP	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s127	PKC	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s129	EGFR	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s142	erlotinib	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s144	Complex_br_(EGFR/../_br_GAP)	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
s147	Complex(Grb2/../PLC)	c2	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟

5 Parameters

This model contains 38 global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcatp_r8_s124			0.511		☑
kM_r8_s124_s23			0.470		☑
kcatn_r8_s124			1.083		☑
kM_r8_s124_s24			0.786		☑
kcatp_r8_s31			0.727		☑
kM_r8_s31_s23			0.614		☑
kcatn_r8_s31			0.636		☑
kM_r8_s31_s24			1.367		☑
kI_r8_s22			0.583		☑
kI_r8_s29			1.219		☑
kI_r8_s33			0.293		☑
kcatp_r9			2.000		☑
kM_r9_s25			0.626		☑
kcatn_r9			0.693		☑
kM_r9_s26			0.463		☑
kcatp_r11			0.787		☑
kM_r11_s29			1.459		☑
kcatn_r11			0.566		☑
kM_r11_s30			1.021		☑
kcatp_r14			0.558		☑
kM_r14_s27			0.038		☑
kcatn_r14			0.725		☑
kM_r14_s28			1.650		☑
kass_r15			2.000		☑
kdiss_r15			0.074		☑
kass_r17_s3			0.730		☑
kdiss_r17_s3			1.130		☑
kI_re11_s142			1.000		☑
kass_r6_s144			1.000		☑
kdiss_r6_s144			1.000		☑
kass_r7_s144			1.000		☑

Id	Name	SBO	Value	Unit	Constant
kdiss_r7-_s144			1.000		☑
kass_r4_s144			1.000		☑
kdiss_r4-_s144			1.000		☑
Vp_re11			1.000		☑
kM_re11_s129			1.000		☑
kM_re11_s147			1.000		☑
ki_re11_s129			1.000		☑

6 Reactions

This model contains ten reactions. All reactions are listed in the following table and are subsequently described in detail. If a reaction is affected by a modifier, the identifier of this species is written above the reaction arrow.

Table 5: Overview of all reactions

№	Id	Name	Reaction Equation	SBO
1	r8		$s23 \xrightleftharpoons{s22,\ s29,\ s124,\ s33,\ s31} s24$	
2	r9		$s25 \xrightleftharpoons{s24} s26$	
3	r11		$s29 \xrightleftharpoons{s127} s30$	
4	r14		$s27 \xrightleftharpoons{s26} s28$	
5	r15		$s28 \rightleftharpoons s34$	
6	r17		$2\,s123 \xrightleftharpoons{s3} s129$	
7	r6		$s127 \xrightleftharpoons{s144} s127$	
8	r7		$s21 \xrightleftharpoons{s144} s22$	
9	r4		$s124 + s125 \xrightleftharpoons{s144} s124 + s126$	
10	re11		$s129 + s147 \xrightarrow{s142} s144$	

6.1 Reaction r8

This is a reversible reaction of one reactant forming one product influenced by five modifiers.

Notes kinetics of unireactant enzymes

Reaction equation

$$\text{s23} \xrightleftharpoons{\text{s22, s29, s124, s33, s31}} \text{s24} \tag{1}$$

Reactant

Table 6: Properties of each reactant.

Id	Name	SBO
s23	Raf_minus_1	

Modifiers

Table 7: Properties of each modifier.

Id	Name	SBO
s22	Akt	
s29	RKIP	
s124	Ras	
s33	14_minus_3_minus_3	
s31	PP2A	

Product

Table 8: Properties of each product.

Id	Name	SBO
s24	Raf_minus_1	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \frac{\mathrm{kI\_r8\_s22}}{\mathrm{kI\_r8\_s22} + [\mathrm{s22}]} \cdot \frac{\mathrm{kI\_r8\_s29}}{\mathrm{kI\_r8\_s29} + [\mathrm{s29}]} \cdot \frac{\mathrm{kI\_r8\_s33}}{\mathrm{kI\_r8\_s33} + [\mathrm{s33}]} \cdot \left([\mathrm{s124}] \cdot \frac{\frac{\mathrm{kcatp\_r8\_s124}}{\mathrm{kM\_r8\_s124\_s23}} \cdot [\mathrm{s23}] - \frac{\mathrm{kcatn\_r8\_s124}}{\mathrm{kM\_r8\_s124\_s24}} \cdot [\mathrm{s24}]}{1 + \frac{[\mathrm{s23}]}{\mathrm{kM\_r8\_s124\_s23}} + \frac{[\mathrm{s24}]}{\mathrm{kM\_r8\_s124\_s24}}} + [\mathrm{s31}] \cdot \frac{\frac{\mathrm{kcatp\_r8\_s31}}{\mathrm{kM\_r8\_s31\_s23}} \cdot [\mathrm{s23}] - \frac{\mathrm{kcatn\_r8\_s31}}{\mathrm{kM\_r8\_s31\_s24}} \cdot [\mathrm{s24}]}{1 + \frac{[\mathrm{s23}]}{\mathrm{kM\_r8\_s31\_s23}} + \frac{[\mathrm{s24}]}{\mathrm{kM\_r8\_s31\_s24}}} \right) \tag{2}$$

6.2 Reaction `r9`

This is a reversible reaction of one reactant forming one product influenced by one modifier.

Notes kinetics of non-modulated unireactant enzymes

Reaction equation

$$\mathrm{s25} \overset{\mathrm{s24}}{\rightleftharpoons} \mathrm{s26} \tag{3}$$

Reactant

Table 9: Properties of each reactant.

Id	Name	SBO
`s25`	MEK1_minus_2	

Modifier

Table 10: Properties of each modifier.

Id	Name	SBO
`s24`	Raf_minus_1	

Product

Table 11: Properties of each product.

Id	Name	SBO
`s26`	MEK1_minus_2	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = [\text{s24}] \cdot \frac{\frac{\text{kcatp\_r9}}{\text{kM\_r9\_s25}} \cdot [\text{s25}] - \frac{\text{kcatn\_r9}}{\text{kM\_r9\_s26}} \cdot [\text{s26}]}{1 + \frac{[\text{s25}]}{\text{kM\_r9\_s25}} + \frac{[\text{s26}]}{\text{kM\_r9\_s26}}} \tag{4}$$

6.3 Reaction `r11`

This is a reversible reaction of one reactant forming one product influenced by one modifier.

Notes kinetics of non-modulated unireactant enzymes

Reaction equation

$$\text{s29} \overset{\text{s127}}{\rightleftharpoons} \text{s30} \tag{5}$$

Reactant

Table 12: Properties of each reactant.

Id	Name	SBO
`s29`	RKIP	

Modifier

Table 13: Properties of each modifier.

Id	Name	SBO
`s127`	PKC	

Product

Table 14: Properties of each product.

Id	Name	SBO
`s30`	RKIP	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = [\text{s127}] \cdot \frac{\frac{\text{kcatp\_r11}}{\text{kM\_r11\_s29}} \cdot [\text{s29}] - \frac{\text{kcatn\_r11}}{\text{kM\_r11\_s30}} \cdot [\text{s30}]}{1 + \frac{[\text{s29}]}{\text{kM\_r11\_s29}} + \frac{[\text{s30}]}{\text{kM\_r11\_s30}}} \tag{6}$$

6.4 Reaction r14

This is a reversible reaction of one reactant forming one product influenced by one modifier.

Notes kinetics of non-modulated unireactant enzymes

Reaction equation

$$\text{s27} \overset{\text{s26}}{\rightleftharpoons} \text{s28} \tag{7}$$

Reactant

Table 15: Properties of each reactant.

Id	Name	SBO
s27	ERK1_minus_2	

Modifier

Table 16: Properties of each modifier.

Id	Name	SBO
s26	MEK1_minus_2	

Product

Table 17: Properties of each product.

Id	Name	SBO
s28	ERK1_minus_2	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = [\text{s26}] \cdot \frac{\frac{\text{kcatp\_r14}}{\text{kM\_r14\_s27}} \cdot [\text{s27}] - \frac{\text{kcatn\_r14}}{\text{kM\_r14\_s28}} \cdot [\text{s28}]}{1 + \frac{[\text{s27}]}{\text{kM\_r14\_s27}} + \frac{[\text{s28}]}{\text{kM\_r14\_s28}}} \tag{8}$$

6.5 Reaction r15

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

Notes mass action rate law for first order forward, first order reverse, reversible reactions, continuous scheme

Reaction equation

$$\mathrm{s28} \rightleftharpoons \mathrm{s34} \tag{9}$$

Reactant

Table 18: Properties of each reactant.

Id	Name	SBO
s28	ERK1_minus_2	

Product

Table 19: Properties of each product.

Id	Name	SBO
s34	Mitogenesis_br_Differentiation	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \mathrm{kass\_r15} \cdot [\mathrm{s28}] - \mathrm{kdiss\_r15} \cdot [\mathrm{s34}] \tag{10}$$

6.6 Reaction r17

This is a reversible reaction of one reactant forming one product influenced by one modifier.

Notes reversible rapid-equilibrium random order ternary-complex mechanism with one product

Reaction equation

$$2\,\mathrm{s123} \overset{\mathrm{s3}}{\rightleftharpoons} \mathrm{s129} \tag{11}$$

Reactant

Table 20: Properties of each reactant.

Id	Name	SBO
s123	EGFR	

Modifier

Table 21: Properties of each modifier.

Id	Name	SBO
s3	EGF	

Product

Table 22: Properties of each product.

Id	Name	SBO
s129	EGFR	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = [\text{s3}] \cdot \left(\text{kass\_r17\_s3} \cdot [\text{s123}]^2 - \text{kdiss\_r17\_s3} \cdot [\text{s129}]\right) \tag{12}$$

6.7 Reaction r6

This is a reversible reaction of one reactant forming one product influenced by one modifier.

Notes kinetics of non-modulated unireactant enzymes

Reaction equation

$$\text{s127} \overset{\text{s144}}{\rightleftharpoons} \text{s127} \tag{13}$$

Reactant

Table 23: Properties of each reactant.

Id	Name	SBO
s127	PKC	

Modifier

Table 24: Properties of each modifier.

Id	Name	SBO
s144	Complex_br_(EGFR/../_br_GAP)	

Product

Table 25: Properties of each product.

Id	Name	SBO
s127	PKC	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = [\text{s144}] \cdot (\text{kass\_r6\_s144} \cdot [\text{s127}] - \text{kdiss\_r6\_s144} \cdot [\text{s127}]) \tag{14}$$

6.8 Reaction r7

This is a reversible reaction of one reactant forming one product influenced by one modifier.

Notes kinetics of non-modulated unireactant enzymes

Reaction equation

$$\text{s21} \overset{\text{s144}}{\rightleftharpoons} \text{s22} \tag{15}$$

Reactant

Table 26: Properties of each reactant.

Id	Name	SBO
s21	Akt	

Modifier

Table 27: Properties of each modifier.

Id	Name	SBO
s144	Complex_br_(EGFR/../_br_GAP)	

Product

Table 28: Properties of each product.

Id	Name	SBO
s22	Akt	

Kinetic Law

Derived unit contains undeclared units

$$v_8 = [\text{s144}] \cdot (\text{kass\_r7\_s144} \cdot [\text{s21}] - \text{kdiss\_r7\_s144} \cdot [\text{s22}]) \tag{16}$$

6.9 Reaction r4

This is a reversible reaction of two reactants forming two products influenced by one modifier.

Notes reversible rapid-equilibrium random order ternary-complex mechanism with two products

Reaction equation

$$\text{s124} + \text{s125} \overset{\text{s144}}{\rightleftharpoons} \text{s124} + \text{s126} \tag{17}$$

Reactants

Table 29: Properties of each reactant.

Id	Name	SBO
s124	Ras	
s125	GDP	

Modifier

Table 30: Properties of each modifier.

Id	Name	SBO
s144	Complex_br_(EGFR/../_br_GAP)	

Products

Table 31: Properties of each product.

Id	Name	SBO
s124	Ras	
s126	GTP	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = [\text{s144}] \cdot (\text{kass\_r4\_s144} \cdot [\text{s124}] \cdot [\text{s125}] - \text{kdiss\_r4\_s144} \cdot [\text{s124}] \cdot [\text{s126}]) \tag{18}$$

6.10 Reaction re11

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

Notes mass action rate law for second order irreversible reactions, two reactants, continuous scheme

Reaction equation

$$\text{s129} + \text{s147} \xrightarrow{\text{s142}} \text{s144} \tag{19}$$

Reactants

Table 32: Properties of each reactant.

Id	Name	SBO
s129	EGFR	
s147	Complex(Grb2/../PLC)	

Modifier

Table 33: Properties of each modifier.

Id	Name	SBO
s142	erlotinib	

Product

Table 34: Properties of each product.

Id	Name	SBO
s144	Complex_br_(EGFR/../_br_GAP)	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \frac{\text{kI\_re11\_s142}}{\text{kI\_re11\_s142} + [\text{s142}]} \cdot \frac{\text{Vp\_re11} \cdot [\text{s129}] \cdot [\text{s147}]}{\text{ki\_re11\_s129} \cdot \text{kM\_re11\_s147} + \text{kM\_re11\_s147} \cdot [\text{s129}] + \text{kM\_re11\_s129} \cdot [\text{s147}] + [\text{s129}] \cdot [\text{s147}]} \tag{20}$$

7 Derived Rate Equations

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

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

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

7.1 Species s21

Name Akt

Notes Long Name: Thymoma viral proto-oncogeneSynonym: PKB,RAC protein kinase,protein kinase BAccession: P00551

Initial amount 5 mol

Charge 0

This species takes part in one reaction (as a reactant in r7).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s21} = -v_8 \tag{21}$$

7.2 Species s22

Name Akt

Notes Long Name: Thymoma viral proto-oncogeneSynonym: PKB,RAC protein kinase,protein kinase BAccession: P00551

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a product in r7 and as a modifier in r8).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s22} = v_8 \tag{22}$$

7.3 Species s25

Name MEK1_minus_2

Notes Long Name: MAP/ERK kinaseSynonym: Dual specificity mitogen-activated protein kinase kinaseAccession: P00559

Initial amount 5 mol

Charge 0

This species takes part in one reaction (as a reactant in r9).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s25} = -v_2 \tag{23}$$

7.4 Species s26

Name MEK1_minus_2

Notes Long Name: MAP/ERK kinaseSynonym: Dual specificity mitogen-activated protein kinase kinaseAccession: P00559

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a product in r9 and as a modifier in r14).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s26} = v_2 \tag{24}$$

7.5 Species s27

Name ERK1_minus_2

Notes Long Name: Extracellular signal-regulated kinaseSynonym: MAPK,Mitogen-activated protein kinase,pp42/44Accession: P00543

Initial amount 5 mol

Charge 0

This species takes part in one reaction (as a reactant in r14).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s27} = -\,v_4 \tag{25}$$

7.6 Species s28

Name ERK1_minus_2

Notes Long Name: Extracellular signal-regulated kinaseSynonym: MAPK,Mitogen-activated protein kinase,pp42/44Accession: P00543

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a reactant in r15 and as a product in r14).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s28} = v_4 - v_5 \tag{26}$$

7.7 Species s29

Name RKIP

Notes Long Name: Raf-1 kinase inhibitor proteinSynonym: Hippocampal cholinergic stimulatory peptide precursor,PEBP,Phosphatidylethanolamine-binding protein,Terminal flower 1,neuropolypeptide h3,prostastic binding proteinAccession: P00548

Initial amount 5 mol

Charge 0

This species takes part in two reactions (as a reactant in r11 and as a modifier in r8).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s29} = -\,v_3 \tag{27}$$

7.8 Species s30

Name RKIP

Notes Long Name: Raf-1 kinase inhibitor proteinSynonym: Hippocampal cholinergic stimulatory peptide precursor,PEBP,Phosphatidylethanolamine-binding protein,Terminal flower 1,neuropolypeptide h3,prostastic binding proteinAccession: P00548

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a product in r11).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s30} = v_3 \tag{28}$$

7.9 Species s31

Name PP2A

Notes Long Name: protein phosphatase 2ASynonym: Serine/threonine protein phosphatase 2AAccession: P00547

Initial amount 5 mol

Charge 0

This species takes part in one reaction (as a modifier in r8).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s31} = 0 \tag{29}$$

7.10 Species s33

Name 14_minus_3_minus_3

Notes Long Name: 14-3-3Synonym: PAR-5,Stratifin,protein kinase C inhibitor protein-1 (KCIP-1)Accession: P00539

Initial amount 5 mol

Charge 0

This species takes part in one reaction (as a modifier in r8).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s33} = 0 \tag{30}$$

7.11 Species s34

Name Mitogenesis_br_Differentiation

Notes Long Name: Mitogenesis DifferentiationSynonym: Synonym not specifiedAccession: U02228

Initial amount 1 mol

Charge 0

This species takes part in one reaction (as a product in r15).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s34} = v_5 \tag{31}$$

7.12 Species s23

Name Raf_minus_1

Notes Long Name: RAF proto-oncogene serine/threonine-protein kinaseSynonym: C-Raf,MAP kinase kinase kinase,Raf-1Accession: P00560

Initial amount 5 mol

Charge 0

This species takes part in one reaction (as a reactant in r8).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s23} = -v_1 \tag{32}$$

7.13 Species s24

Name Raf_minus_1

Notes Long Name: RAF proto-oncogene serine/threonine-protein kinaseSynonym: C-Raf,MAP kinase kinase kinase,Raf-1Accession: P00560

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a product in r8 and as a modifier in r9).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s24} = v_1 \tag{33}$$

7.14 Species s3

Name EGF

Notes Long Name: Epidermal growth factorSynonym: gurken,transforming growth factor alphaAccession: P00549

Initial amount 5 mol

Charge 0

This species takes part in one reaction (as a modifier in r17).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s3} = 0 \tag{34}$$

7.15 Species s123

Name EGFR

Notes Long Name: EGFRSynonym: Gurken receptor, Erb, Neu, neuregulinAccession: P00542

Initial amount 5 mol

Charge 0

This species takes part in one reaction (as a reactant in r17).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s123} = -2\, v_6 \tag{35}$$

7.16 Species s124

Name Ras

Notes Long Name: RasSynonym: Synonym not specifiedAccession: P00552

Initial amount 5 mol

Charge 0

This species takes part in three reactions (as a reactant in r4 and as a product in r4 and as a modifier in r8).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s124} = v_9 - v_9 \tag{36}$$

7.17 Species s125

Name GDP

Notes Long Name: GDPSynonym: Synonym not specifiedAccession: S01652

Initial amount 0.5 mol

Charge 0

This species takes part in one reaction (as a reactant in r4).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s125} = -v_9 \tag{37}$$

7.18 Species s126

Name GTP

Notes Long Name: GTPSynonym: Synonym not specifiedAccession: S01653

Initial amount 0 mol

Charge 0

This species takes part in one reaction (as a product in r4).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s126} = v_9 \tag{38}$$

7.19 Species s127

Name PKC

Notes Long Name: PKCSynonym: Synonym not specifiedAccession: P00565

Initial amount 2 mol

Charge 0

This species takes part in three reactions (as a reactant in r6 and as a product in r6 and as a modifier in r11).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s127} = v_7 - v_7 \tag{39}$$

7.20 Species s129

Name EGFR

Notes Long Name: EGFRSynonym: Gurken receptor, Erb, Neu, neuregulinAccession: P00542

Initial amount 0 mol

Charge 0

This species takes part in two reactions (as a reactant in re11 and as a product in r17).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s129} = v_6 - v_{10} \tag{40}$$

7.21 Species s142

Name erlotinib

Initial amount 0.5 mol

Charge 0

This species takes part in one reaction (as a modifier in re11).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s142} = 0 \tag{41}$$

7.22 Species s144

Name Complex_br_(EGFR/../_br_GAP)

Initial amount 0 mol

Charge 0

This species takes part in four reactions (as a product in re11 and as a modifier in r6, r7, r4).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s144} = v_{10} \tag{42}$$

7.23 Species s147

Name Complex(Grb2/../PLC)

Initial amount 5 mol

Charge 0

This species takes part in one reaction (as a reactant in re11).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s147} = -v_{10} \tag{43}$$

SBML2LaTeX was developed by Andreas Dräger[a], Hannes Planatscher[a], Dieudonné M Wouamba[a], Adrian Schröder[a], Michael Hucka[b], Lukas Endler[c], Martin Golebiewski[d] and Andreas Zell[a]. Please see http://www.ra.cs.uni-tuebingen.de/software/SBML2LaTeX for more information.

[a]Center for Bioinformatics Tübingen (ZBIT), Germany
[b]California Institute of Technology, Beckman Institute BNMC, Pasadena, United States
[c]European Bioinformatics Institute, Wellcome Trust Genome Campus, Hinxton, United Kingdom
[d]EML Research gGmbH, Heidelberg, Germany