SBML Model Report

Model name: "Maurya2005_GTPaseCycle_reducedOrder"

May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by Enuo He[1] at November 29th 2006 at 5:40 p. m. and last time modified at February thirteenth 2014 at 3:47 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	1
species types	0	species	17
events	0	constraints	0
reactions	17	function definitions	0
global parameters	2	unit definitions	0
rules	2	initial assignments	0

Model Notes

This model is according to the paper Reduced-order modeling of biochemical networks: application to the GTPase-cycle signalling module by Maurya et al 2006.The figure 4c is reproduced by Copasi 4.0.19 (development) .It is three-dimensional logarithmic plots show the output of simulations of Z at various concentrations of R and GAP.

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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 Compartment

This model contains one compartment.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
compartment_0	cell		3	1	litre	☑	

3.1 Compartment compartment_0

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

Name cell

4 Species

This model contains 17 species. Section 8 provides further details and the derived rates of change of each species.

Table 3: Properties of each species.

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
species_0	A	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_1	G	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_2	GA	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_3	T	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_4	R	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_5	G*T	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_6	GD	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_7	Pi	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_8	D	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_9	RG	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_10	RG*T	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_11	G*AT	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_12	GAD	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_13	RGD	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_14	RGA	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_15	RG*AT	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_16	RGAD	compartment_0	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟

5 Parameters

This model contains two global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
parameter_0	Z		0.0		⊟
parameter_1	v		0.0		⊟

6 Rules

This is an overview of two rules.

6.1 Rule parameter_0

Rule parameter_0 is an assignment rule for parameter parameter_0:

$$\text{parameter\_0} = \frac{[\text{species\_5}] + [\text{species\_10}] + [\text{species\_15}] + [\text{species\_11}]}{1.0E - 8} \tag{1}$$

6.2 Rule parameter_1

Rule parameter_1 is an assignment rule for parameter parameter_1:

$$\text{parameter\_1} = \frac{25 \cdot [\text{species\_15}] + 25 \cdot [\text{species\_11}] + 0.013 \cdot [\text{species\_10}] + 0.013 \cdot [\text{species\_5}]}{1.0E - 8} \tag{2}$$

7 Reactions

This model contains 17 reactions. All reactions are listed in the following table and are subsequently described in detail. If a reaction is affected by a modifier, the identifier of this species is written above the reaction arrow.

Table 5: Overview of all reactions

№	Id	Name	Reaction Equation	SBO
1	reaction_1	G protein binding GTP	species_1 + species_3 $\rightleftharpoons$ species_5	
2	reaction_3	G*T hydrolysis	species_5 $\rightleftharpoons$ species_6 + species_7	
3	reaction_4	GD dissociation	species_6 $\rightleftharpoons$ species_1 + species_8	
4	reaction_5	RG binding GTP	species_9 + species_3 $\rightleftharpoons$ species_10	
5	reaction_6	G*T binding Receptor	species_5 + species_4 $\rightleftharpoons$ species_10	
6	reaction_7	G*T binding GAP	species_5 + species_0 $\rightleftharpoons$ species_11	
7	reaction_8	GD binding GAP	species_6 + species_0 $\rightleftharpoons$ species_12	
8	reaction_9	GD binding Receptor	species_6 + species_4 $\rightleftharpoons$ species_13	
9	reaction_10	RG*T hydrolysis	species_10 $\rightleftharpoons$ species_13 + species_7	
10	reaction_11	RGD dissociation	species_13 $\rightleftharpoons$ species_9 + species_8	
11	reaction_13	G*AT hydrolysis	species_11 $\rightleftharpoons$ species_12 + species_7	
12	reaction_14	GAD dissociation	species_12 $\rightleftharpoons$ species_2 + species_8	
13	reaction_16	GA binding Receptor	species_2 + species_4 $\rightleftharpoons$ species_14	
14	reaction_17	RGA binding GTP	species_14 + species_3 $\rightleftharpoons$ species_15	
15	reaction_19	RG*T binding GAP	species_10 + species_0 $\rightleftharpoons$ species_15	
16	reaction_20	RG*AT hydrolysis	species_15 $\rightleftharpoons$ species_16 + species_7	
17	reaction_23	RGAD dissociation	species_16 $\rightleftharpoons$ species_14 + species_8	

7.1 Reaction reaction_1

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

Name G protein binding GTP

Reaction equation

$$\text{species\_1} + \text{species\_3} \rightleftharpoons \text{species\_5} \tag{3}$$

Reactants

Table 6: Properties of each reactant.

Id	Name	SBO
species_1	G	
species_3	T	

Product

Table 7: Properties of each product.

Id	Name	SBO
species_5	G*T	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \text{vol}(\text{compartment\_0}) \cdot (\text{k1} \cdot [\text{species\_1}] \cdot [\text{species\_3}] - \text{k2} \cdot [\text{species\_5}]) \tag{4}$$

Table 8: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			529000.000		☑
k2			$8.38 \cdot 10^{-6}$		☑

7.2 Reaction reaction_3

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

Name G*T hydrolysis

Reaction equation

$$\text{species\_5} \rightleftharpoons \text{species\_6} + \text{species\_7} \tag{5}$$

Reactant

Table 9: Properties of each reactant.

Id	Name	SBO
species_5	G*T	

Products

Table 10: Properties of each product.

Id	Name	SBO
species_6	GD	
species_7	Pi	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \text{vol}(\text{compartment\_0}) \cdot (\text{k1} \cdot [\text{species\_5}] - \text{k2} \cdot [\text{species\_6}] \cdot [\text{species\_7}]) \tag{6}$$

Table 11: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			0.013		☑
k2			$9.03 \cdot 10^{-7}$		☑

7.3 Reaction reaction_4

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

Name GD dissociation

Reaction equation

$$\text{species\_6} \rightleftharpoons \text{species\_1} + \text{species\_8} \tag{7}$$

Reactant

Table 12: Properties of each reactant.

Id	Name	SBO
species_6	GD	

Products

Table 13: Properties of each product.

Id	Name	SBO
species_1	G	
species_8	D	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \mathrm{vol}\,(\mathrm{compartment\_0}) \cdot (\mathrm{k1} \cdot [\mathrm{species\_6}] - \mathrm{k2} \cdot [\mathrm{species\_1}] \cdot [\mathrm{species\_8}]) \tag{8}$$

Table 14: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			10^{-4}		☑
k2			62.300		☑

7.4 Reaction reaction_5

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

Name RG binding GTP

Reaction equation

$$\mathrm{species\_9} + \mathrm{species\_3} \rightleftharpoons \mathrm{species\_10} \tag{9}$$

Reactants

Table 15: Properties of each reactant.

Id	Name	SBO
species_9	RG	
species_3	T	

Product

Table 16: Properties of each product.

Id	Name	SBO
species_10	RG*T	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \mathrm{vol}\,(\mathrm{compartment\_0}) \cdot (\mathrm{k1} \cdot [\mathrm{species\_9}] \cdot [\mathrm{species\_3}] - \mathrm{k2} \cdot [\mathrm{species\_10}]) \qquad (10)$$

Table 17: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			853000.000		☑
k2			0.005		☑

7.5 Reaction reaction_6

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

Name G*T binding Receptor

Reaction equation

$$\mathrm{species\_5} + \mathrm{species\_4} \rightleftharpoons \mathrm{species\_10} \qquad (11)$$

Reactants

Table 18: Properties of each reactant.

Id	Name	SBO
species_5	G*T	

Id	Name	SBO
species_4	R	

Product

Table 19: Properties of each product.

Id	Name	SBO
species_10	RG*T	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \mathrm{vol}\,(\mathrm{compartment\_0}) \cdot (\mathrm{k1} \cdot [\mathrm{species\_5}] \cdot [\mathrm{species\_4}] - \mathrm{k2} \cdot [\mathrm{species\_10}]) \tag{12}$$

Table 20: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			$1.32 \cdot 10^8$		☑
k2			1.280		☑

7.6 Reaction reaction_7

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

Name G*T binding GAP

Reaction equation

$$\mathrm{species\_5} + \mathrm{species\_0} \rightleftharpoons \mathrm{species\_11} \tag{13}$$

Reactants

Table 21: Properties of each reactant.

Id	Name	SBO
species_5	G*T	
species_0	A	

Product

Table 22: Properties of each product.

Id	Name	SBO
species_11	G*AT	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \mathrm{vol}\,(\mathrm{compartment\_0}) \cdot (\mathrm{k1} \cdot [\mathrm{species\_5}] \cdot [\mathrm{species\_0}] - \mathrm{k2} \cdot [\mathrm{species\_11}]) \qquad (14)$$

Table 23: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			386000.000		☑
k2			0.041		☑

7.7 Reaction reaction_8

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

Name GD binding GAP

Reaction equation

$$\mathrm{species\_6} + \mathrm{species\_0} \rightleftharpoons \mathrm{species\_12} \qquad (15)$$

Reactants

Table 24: Properties of each reactant.

Id	Name	SBO
species_6	GD	
species_0	A	

Product

Table 25: Properties of each product.

Id	Name	SBO
species_12	GAD	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \mathrm{vol}\,(\mathrm{compartment\_0}) \cdot (\mathrm{k1} \cdot [\mathrm{species\_6}] \cdot [\mathrm{species\_0}] - \mathrm{k2} \cdot [\mathrm{species\_12}]) \tag{16}$$

Table 26: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			64100.00		☑
k2			0.95		☑

7.8 Reaction reaction_9

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

Name GD binding Receptor

Reaction equation

$$\mathrm{species\_6} + \mathrm{species\_4} \rightleftharpoons \mathrm{species\_13} \tag{17}$$

Reactants

Table 27: Properties of each reactant.

Id	Name	SBO
species_6	GD	
species_4	R	

Product

Table 28: Properties of each product.

Id	Name	SBO
species_13	RGD	

Kinetic Law

Derived unit contains undeclared units

$$v_8 = \mathrm{vol}\,(\mathrm{compartment\_0}) \cdot (\mathrm{k1} \cdot [\mathrm{species\_6}] \cdot [\mathrm{species\_4}] - \mathrm{k2} \cdot [\mathrm{species\_13}]) \tag{18}$$

Table 29: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			$9.47 \cdot 10^7$		☑
k2			0.002		☑

7.9 Reaction reaction_10

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

Name RG*T hydrolysis

Reaction equation

$$\mathrm{species\_10} \rightleftharpoons \mathrm{species\_13} + \mathrm{species\_7} \tag{19}$$

Reactant

Table 30: Properties of each reactant.

Id	Name	SBO
species_10	RG*T	

Products

Table 31: Properties of each product.

Id	Name	SBO
species_13	RGD	
species_7	Pi	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \mathrm{vol}\,(\mathrm{compartment\_0}) \cdot (\mathrm{k1} \cdot [\mathrm{species\_10}] - \mathrm{k2} \cdot [\mathrm{species\_13}] \cdot [\mathrm{species\_7}]) \tag{20}$$

Table 32: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			0.013		☑
k2			$2.22 \cdot 10^{-9}$		☑

7.10 Reaction reaction_11

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

Name RGD dissociation

Reaction equation

$$\text{species\_13} \rightleftharpoons \text{species\_9} + \text{species\_8} \tag{21}$$

Reactant

Table 33: Properties of each reactant.

Id	Name	SBO
species_13	RGD	

Products

Table 34: Properties of each product.

Id	Name	SBO
species_9	RG	
species_8	D	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \text{vol}\,(\text{compartment\_0}) \cdot (\text{k1} \cdot [\text{species\_13}] - \text{k2} \cdot [\text{species\_9}] \cdot [\text{species\_8}]) \tag{22}$$

Table 35: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			2.0		☑
k2			1470000.0		☑

7.11 Reaction reaction_13

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

Name G*AT hydrolysis

Reaction equation

$$\text{species\_11} \rightleftharpoons \text{species\_12} + \text{species\_7} \tag{23}$$

Reactant

Table 36: Properties of each reactant.

Id	Name	SBO
species_11	G*AT	

Products

Table 37: Properties of each product.

Id	Name	SBO
species_12	GAD	
species_7	Pi	

Kinetic Law

Derived unit contains undeclared units

$$v_{11} = \text{vol}(\text{compartment\_0}) \cdot (\text{k1} \cdot [\text{species\_11}] - \text{k2} \cdot [\text{species\_12}] \cdot [\text{species\_7}]) \tag{24}$$

Table 38: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			25.000		☑
k2			0.244		☑

7.12 Reaction reaction_14

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

Name GAD dissociation

Reaction equation

$$\text{species\_12} \rightleftharpoons \text{species\_2} + \text{species\_8} \tag{25}$$

Reactant

Table 39: Properties of each reactant.

Id	Name	SBO
species_12	GAD	

Products

Table 40: Properties of each product.

Id	Name	SBO
species_2	GA	
species_8	D	

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = \text{vol}\,(\text{compartment\_0}) \cdot (\text{k1} \cdot [\text{species\_12}] - \text{k2} \cdot [\text{species\_2}] \cdot [\text{species\_8}]) \tag{26}$$

Table 41: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			10^{-4}		☑
k2			3.830		☑

7.13 Reaction reaction_16

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

Name GA binding Receptor

Reaction equation

$$\text{species\_2} + \text{species\_4} \rightleftharpoons \text{species\_14} \tag{27}$$

Reactants

Table 42: Properties of each reactant.

Id	Name	SBO
species_2	GA	
species_4	R	

Product

Table 43: Properties of each product.

Id	Name	SBO
species_14	RGA	

Kinetic Law

Derived unit contains undeclared units

$$v_{13} = \mathrm{vol}\,(\mathrm{compartment\_0}) \cdot (\mathrm{k1} \cdot [\mathrm{species\_2}] \cdot [\mathrm{species\_4}] - \mathrm{k2} \cdot [\mathrm{species\_14}]) \qquad (28)$$

Table 44: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			$3.96 \cdot 10^{9}$		☑
k2			$5.43 \cdot 10^{-5}$		☑

7.14 Reaction reaction_17

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

Name RGA binding GTP

Reaction equation

$$\mathrm{species\_14} + \mathrm{species\_3} \rightleftharpoons \mathrm{species\_15} \qquad (29)$$

Reactants

Table 45: Properties of each reactant.

Id	Name	SBO
species_14	RGA	
species_3	T	

Product

Table 46: Properties of each product.

Id	Name	SBO
species_15	RG*AT	

Kinetic Law

Derived unit contains undeclared units

$$v_{14} = \mathrm{vol}\,(\mathrm{compartment\_0}) \cdot (\mathrm{k1} \cdot [\mathrm{species\_14}] \cdot [\mathrm{species\_3}] - \mathrm{k2} \cdot [\mathrm{species\_15}]) \qquad (30)$$

Table 47: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			1620000.000		☑
k2			0.009		☑

7.15 Reaction reaction_19

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

Name RG*T binding GAP

Reaction equation

$$\mathrm{species\_10} + \mathrm{species\_0} \rightleftharpoons \mathrm{species\_15} \qquad (31)$$

Reactants

Table 48: Properties of each reactant.

Id	Name	SBO
species_10	RG*T	

Id	Name	SBO
species_0	A	

Product

Table 49: Properties of each product.

Id	Name	SBO
species_15	RG*AT	

Kinetic Law

Derived unit contains undeclared units

$$v_{15} = \mathrm{vol}\,(\mathrm{compartment\_0}) \cdot (\mathrm{k1} \cdot [\mathrm{species\_10}] \cdot [\mathrm{species\_0}] - \mathrm{k2} \cdot [\mathrm{species\_15}]) \qquad (32)$$

Table 50: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			6300000.000		☑
k2			0.478		☑

7.16 Reaction reaction_20

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

Name RG*AT hydrolysis

Reaction equation

$$\mathrm{species\_15} \rightleftharpoons \mathrm{species\_16} + \mathrm{species\_7} \qquad (33)$$

Reactant

Table 51: Properties of each reactant.

Id	Name	SBO
species_15	RG*AT	

Products

Table 52: Properties of each product.

Id	Name	SBO
species_16	RGAD	
species_7	Pi	

Kinetic Law

Derived unit contains undeclared units

$$v_{16} = \mathrm{vol}(\mathrm{compartment\_0}) \cdot (\mathrm{k1} \cdot [\mathrm{species\_15}] - \mathrm{k2} \cdot [\mathrm{species\_16}] \cdot [\mathrm{species\_7}]) \quad (34)$$

Table 53: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			25.000		☑
k2			0.003		☑

7.17 Reaction reaction_23

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

Name RGAD dissociation

Reaction equation

$$\mathrm{species\_16} \rightleftharpoons \mathrm{species\_14} + \mathrm{species\_8} \quad (35)$$

Reactant

Table 54: Properties of each reactant.

Id	Name	SBO
species_16	RGAD	

Products

Table 55: Properties of each product.

Id	Name	SBO
species_14	RGA	

Id	Name	SBO
species_8	D	

Kinetic Law

Derived unit contains undeclared units

$$v_{17} = \mathrm{vol}\,(\mathrm{compartment\_0}) \cdot (\mathrm{k1} \cdot [\mathrm{species\_16}] - \mathrm{k2} \cdot [\mathrm{species\_14}] \cdot [\mathrm{species\_8}]) \quad (36)$$

Table 56: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1			2.75		☑
k2			2940.00		☑

8 Derived Rate Equations

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

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

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

8.1 Species species_0

Name A

Notes GAP

Initial concentration $0\ \mathrm{mol} \cdot \mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in reaction_7, reaction_8, reaction_19).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_0} = -v_6 - v_7 - v_{15} \quad (37)$$

8.2 Species species_1

Name G

Notes inactive G protein

Initial concentration $10^{-8}\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in reaction_1 and as a product in reaction_4).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_1} = v_3 - v_1 \tag{38}$$

8.3 Species species_2

Name GA

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in reaction_16 and as a product in reaction_14).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_2} = v_{12} - v_{13} \tag{39}$$

8.4 Species species_3

Name T

Notes GTP

Initial concentration $4.68\cdot 10^{-4}\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in reaction_1, reaction_5, reaction_17).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_3} = -v_1 - v_4 - v_{14} \tag{40}$$

8.5 Species species_4

Name R

Notes Receptor

Initial concentration $10^{-5}\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in reaction_6, reaction_9, reaction_16).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_4} = -v_5 - v_8 - v_{13} \tag{41}$$

8.6 Species species_5

Name G*T

Notes active G protein

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in four reactions (as a reactant in reaction_3, reaction_6, reaction_7 and as a product in reaction_1).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_5} = v_1 - v_2 - v_5 - v_6 \tag{42}$$

8.7 Species species_6

Name GD

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in four reactions (as a reactant in reaction_4, reaction_8, reaction_9 and as a product in reaction_3).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_6} = v_2 - v_3 - v_7 - v_8 \tag{43}$$

8.8 Species species_7

Name Pi

Initial concentration $0.0044\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in four reactions (as a product in reaction_3, reaction_10, reaction_13, reaction_20).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_7} = v_2 + v_9 + v_{11} + v_{16} \tag{44}$$

8.9 Species species_8

Name D

Notes GDP

Initial concentration $1.49\cdot10^{-4}\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in four reactions (as a product in reaction_4, reaction_11, reaction_14, reaction_23).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_8} = v_3 + v_{10} + v_{12} + v_{17} \tag{45}$$

8.10 Species species_9

Name RG

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in reaction_5 and as a product in reaction_11).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_9} = v_{10} - v_4 \tag{46}$$

8.11 Species species_10

Name RG*T

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in four reactions (as a reactant in reaction_10, reaction_19 and as a product in reaction_5, reaction_6).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_10} = v_4 + v_5 - v_9 - v_{15} \tag{47}$$

8.12 Species species_11

Name G*AT

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in reaction_13 and as a product in reaction_7).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_11} = v_6 - v_{11} \tag{48}$$

8.13 Species species_12

Name GAD

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in reaction_14 and as a product in reaction_8, reaction_13).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_12} = v_7 + v_{11} - v_{12} \tag{49}$$

8.14 Species species_13

Name RGD

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in reaction_11 and as a product in reaction_9, reaction_10).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_13} = v_8 + v_9 - v_{10} \tag{50}$$

8.15 Species species_14

Name RGA

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in reaction_17 and as a product in reaction_16, reaction_23).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_14} = v_{13} + v_{17} - v_{14} \tag{51}$$

8.16 Species species_15

Name RG*AT

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in reaction_20 and as a product in reaction_17, reaction_19).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_15} = v_{14} + v_{15} - v_{16} \tag{52}$$

8.17 Species species_16

Name RGAD

Initial concentration $0\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in reaction_23 and as a product in reaction_20).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_16} = v_{16} - v_{17} \tag{53}$$

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.

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