SBML Model Report

Model name: “Mandlik2015 - Tristable genetic circuit of Leishmania”

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: Shailza Singh[1] and Vijayalakshmi Chelliah[2] at October 26th 2015 at 12:57 a. m. and last time modified at February twelveth 2016 at 3:21 p. m. Table 1 gives 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	35
events	0	constraints	0
reactions	14	function definitions	0
global parameters	34	unit definitions	0
rules	14	initial assignments	0

2 Unit Definitions

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

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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
DefaultCompartment	DefaultCompartment		3	1	litre	☑	

3.1 Compartment DefaultCompartment

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

Name DefaultCompartment

4 Species

This model contains 35 species. The boundary condition of 14 of these species is set to `true` so that these species' amount cannot be changed by any reaction. Section 8 provides further details and the derived rates of change of each species.

Table 3: Properties of each species.

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
AUR1	AUR1	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	☑
IPTG	IPTG	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
LACI	LACI	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	☑
LAMDAR	LAMDAR	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	☑
SLS1	SLS1	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	☑
SLS4	SLS4	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	☑
TETR	TETR	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	☑
as1	as1	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	☑
ia1_ActiveTF	ia1_ActiveTF	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
ia1_InactiveTF	ia1_InactiveTF	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
ope1	ope1	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	☑
p1	p1	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
p2	p2	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
p3	p3	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
pAUR1	pAUR1	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
pSLS1	pSLS1	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
pSLS4	pSLS4	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
proAUR1	proAUR1	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
proLACI	proLACI	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
proLAMDAR	proLAMDAR	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
proSLS1	proSLS1	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
proSLS4	proSLS4	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
proTETR	proTETR	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
rs1	rs1	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
rs2	rs2	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
rs3	rs3	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
rs4	rs4	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
rs5	rs5	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
rs6	rs6	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
ter1	ter1	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
ter2	ter2	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
ter3	ter3	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
ter4	ter4	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
ter5	ter5	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐
ter6	ter6	DefaultCompartment	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☐

5 Parameters

This model contains 34 global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
tr3_Kd	tr3_Kd		1.000		☑
tr3_h	tr3_h		2.000		☑
tr4_Kd	tr4_Kd		1.000		☑
tr4_h	tr4_h		2.000		☑
pSLS4-_strength	pSLS4_strength		2.570		☑
tr5_Kd	tr5_Kd		1.000		☑
tr5_h	tr5_h		2.000		☑
tr6_Kd	tr6_Kd		1.000		☑
tr6_h	tr6_h		2.000		☑
p1_strength	p1_strength		2.500		☑
p2_strength	p2_strength		2.400		☑
proLACI-_degradation-_rate	proLACI-_degradation_rate		0.070		☑
p3_strength	p3_strength		2.500		☑
proSLS1-_degradation-_rate	proSLS1-_degradation_rate		0.070		☑
proSLS4-_degradation-_rate	proSLS4-_degradation_rate		0.040		☑
proLAMDAR-_degradation-_rate	proLAMDAR-_degradation_rate		0.042		☑
proAUR1-_degradation-_rate	proAUR1-_degradation_rate		0.100		☑
ia1_Kd	ia1_Kd		0.001		☑
ia1-_repression-_Kd	ia1_repression_Kd		1.000		☑
ia1-_repression_h	ia1_repression_h		2.000		☑
pAUR1-_strength	pAUR1_strength		2.014		☑

Id	Name	SBO	Value	Unit	Constant
proTETR-_degradation-_rate	proTETR-_degradation_rate		0.080		☑
ta1_Kd	ta1_Kd		1.000		☑
ta1_h	ta1_h		2.000		☑
pp2-_translation-_rate	pp2_translation-_rate		1.000		☑
pp3-_translation-_rate	pp3_translation-_rate		1.000		☑
pp4-_translation-_rate	pp4_translation-_rate		1.000		☑
pp5-_translation-_rate	pp5_translation-_rate		1.000		☑
pp6-_translation-_rate	pp6_translation-_rate		1.000		☑
tr1_Kd	tr1_Kd		1.000		☑
tr1_h	tr1_h		2.000		☑
pSLS1-_strength	pSLS1_strength		2.500		☑
tr2_Kd	tr2_Kd		1.000		☑
tr2_h	tr2_h		2.000		☑

6 Rules

This is an overview of 14 rules.

6.1 Rule rs6

Rule rs6 is an assignment rule for species rs6:

$$\mathrm{rs6} = \frac{1}{1 + \left(\frac{[\mathrm{proTETR}]}{\mathrm{tr4\_Kd}}\right)^{\mathrm{tr4\_h}}} \tag{1}$$

6.2 Rule rs3

Rule rs3 is an assignment rule for species rs3:

$$\mathrm{rs3} = \frac{1}{1 + \left(\frac{[\mathrm{proLACI}]}{\mathrm{tr6\_Kd}}\right)^{\mathrm{tr6\_h}}} \tag{2}$$

6.3 Rule rs4

Rule rs4 is an assignment rule for species rs4:

$$\mathrm{rs4} = \frac{1}{1 + \left(\frac{[\mathrm{proLAMDAR}]}{\mathrm{tr5\_Kd}}\right)^{\mathrm{tr5\_h}}} \tag{3}$$

6.4 Rule rs5

Rule rs5 is an assignment rule for species rs5:

$$\mathrm{rs5} = \frac{1}{1 + \left(\frac{[\mathrm{proLACI}]}{\mathrm{tr3\_Kd}}\right)^{\mathrm{tr3\_h}}} \tag{4}$$

6.5 Rule LAMDAR

Rule LAMDAR is an assignment rule for species LAMDAR:

$$\mathrm{LAMDAR} = \mathrm{p1\_strength} \cdot [\mathrm{rs6}] \tag{5}$$

6.6 Rule LACI

Rule LACI is an assignment rule for species LACI:

$$\mathrm{LACI} = \mathrm{p2\_strength} \cdot [\mathrm{rs4}] \tag{6}$$

6.7 Rule TETR

Rule TETR is an assignment rule for species TETR:

$$\mathrm{TETR} = \mathrm{p3\_strength} \cdot [\mathrm{rs5}] \tag{7}$$

6.8 Rule rs1

Rule rs1 is an assignment rule for species rs1:

$$\mathrm{rs1} = \frac{1}{1 + \left(\frac{[\mathrm{proSLS1}]}{\mathrm{tr1\_Kd}}\right)^{\mathrm{tr1\_h}}} \tag{8}$$

6.9 Rule rs2

Rule rs2 is an assignment rule for species rs2:

$$\mathrm{rs2} = \frac{1}{1 + \left(\frac{[\mathrm{proAUR1}]}{\mathrm{tr2\_Kd}}\right)^{\mathrm{tr2\_h}}} \tag{9}$$

6.10 Rule ope1

Rule ope1 is an assignment rule for species ope1:

$$\mathrm{ope1} = \frac{1}{1 + \left(\frac{[\mathrm{ia1\_ActiveTF}]}{\mathrm{ia1\_repression\_Kd}}\right)^{\mathrm{ia1\_repression\_h}}} \tag{10}$$

6.11 Rule as1

Rule as1 is an assignment rule for species as1:

$$\mathrm{as1} = \frac{1 + \left(\frac{[\mathrm{proSLS4}]}{\mathrm{ta1\_Kd}}\right)^{\mathrm{ta1\_h}} - 1}{1 + \left(\frac{[\mathrm{proSLS4}]}{\mathrm{ta1\_Kd}}\right)^{\mathrm{ta1\_h}}} \tag{11}$$

6.12 Rule SLS1

Rule SLS1 is an assignment rule for species SLS1:

$$\mathrm{SLS1} = \mathrm{pSLS1\_strength} \cdot [\mathrm{as1}] \cdot [\mathrm{ope1}] \cdot [\mathrm{rs3}] \tag{12}$$

6.13 Rule SLS4

Rule SLS4 is an assignment rule for species SLS4:

$$\mathrm{SLS4} = \mathrm{pSLS4\_strength} \cdot [\mathrm{rs2}] \tag{13}$$

6.14 Rule AUR1

Rule AUR1 is an assignment rule for species AUR1:

$$\mathrm{AUR1} = \mathrm{pAUR1\_strength} \cdot [\mathrm{rs1}] \tag{14}$$

7 Reactions

This model contains 14 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	pp1_v1	pp1_v1	$\emptyset \longrightarrow \text{proSLS1}$	
2	pp1_v2	pp1_v2	$\text{proSLS1} \xrightarrow{\text{proSLS1}} \emptyset$	
3	pp5_v1	pp5_v1	$\emptyset \xrightarrow{\text{LAMDAR, LAMDAR}} \text{proLAMDAR}$	
4	pp5_v2	pp5_v2	$\text{proLAMDAR} \xrightarrow{\text{proLAMDAR}} \emptyset$	
5	ia1_bind_forward	ia1_bind_forward	$\text{IPTG} + \text{ia1\_ActiveTF} \xrightarrow{\text{IPTG, ia1\_ActiveTF}} \text{ia1\_InactiveTF}$	
6	ia1_bind_reverse	ia1_bind_reverse	$\text{ia1\_InactiveTF} \xrightarrow{\text{ia1\_InactiveTF}} \text{IPTG} + \text{ia1\_ActiveTF}$	
7	pp2_v1	pp2_v1	$\emptyset \xrightarrow{\text{AUR1, AUR1}} \text{proAUR1}$	
8	pp2_v2	pp2_v2	$\text{proAUR1} \xrightarrow{\text{proAUR1}} \emptyset$	
9	pp6_v1	pp6_v1	$\emptyset \xrightarrow{\text{TETR, TETR}} \text{proTETR}$	
10	pp6_v2	pp6_v2	$\text{proTETR} \xrightarrow{\text{proTETR}} \emptyset$	
11	pp3_v1	pp3_v1	$\emptyset \xrightarrow{\text{SLS4, SLS4}} \text{proSLS4}$	
12	pp3_v2	pp3_v2	$\text{proSLS4} \xrightarrow{\text{proSLS4}} \emptyset$	
13	pp4_v1	pp4_v1	$\emptyset \xrightarrow{\text{LACI, LACI}} \text{proLACI}$	
14	pp4_v2	pp4_v2	$\text{proLACI} \xrightarrow{\text{proLACI}} \emptyset$	

7.1 Reaction pp1_v1

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

Name pp1_v1

Reaction equation

$$\emptyset \longrightarrow \text{proSLS1} \tag{15}$$

Product

Table 6: Properties of each product.

Id	Name	SBO
proSLS1	proSLS1	

Kinetic Law

Derived unit not available

$$v_1 = 1 \tag{16}$$

7.2 Reaction pp1_v2

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

Name pp1_v2

Reaction equation

$$\text{proSLS1} \xrightarrow{\text{proSLS1}} \emptyset \tag{17}$$

Reactant

Table 7: Properties of each reactant.

Id	Name	SBO
proSLS1	proSLS1	

Modifier

Table 8: Properties of each modifier.

Id	Name	SBO
proSLS1	proSLS1	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \text{proSLS1\_degradation\_rate} \cdot [\text{proSLS1}] \tag{18}$$

7.3 Reaction pp5_v1

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

Name pp5_v1

Reaction equation

$$\emptyset \xrightarrow{\text{LAMDAR, LAMDAR}} \text{proLAMDAR} \tag{19}$$

Modifiers

Table 9: Properties of each modifier.

Id	Name	SBO
LAMDAR	LAMDAR	
LAMDAR	LAMDAR	

Product

Table 10: Properties of each product.

Id	Name	SBO
proLAMDAR	proLAMDAR	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \text{pp5\_translation\_rate} \cdot \text{p1\_strength} \cdot [\text{LAMDAR}] \tag{20}$$

7.4 Reaction pp5_v2

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

Name pp5_v2

Reaction equation

$$\text{proLAMDAR} \xrightarrow{\text{proLAMDAR}} \emptyset \tag{21}$$

Reactant

Table 11: Properties of each reactant.

Id	Name	SBO
proLAMDAR	proLAMDAR	

Modifier

Table 12: Properties of each modifier.

Id	Name	SBO
proLAMDAR	proLAMDAR	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \text{proLAMDAR\_degradation\_rate} \cdot [\text{proLAMDAR}] \tag{22}$$

7.5 Reaction ia1_bind_forward

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

Name ia1_bind_forward

Reaction equation

$$\text{IPTG} + \text{ia1\_ActiveTF} \xrightarrow{\text{IPTG, ia1\_ActiveTF}} \text{ia1\_InactiveTF} \tag{23}$$

Reactants

Table 13: Properties of each reactant.

Id	Name	SBO
IPTG	IPTG	
ia1_ActiveTF	ia1_ActiveTF	

Modifiers

Table 14: Properties of each modifier.

Id	Name	SBO
IPTG	IPTG	
ia1_ActiveTF	ia1_ActiveTF	

Product

Table 15: Properties of each product.

Id	Name	SBO
ia1_InactiveTF	ia1_InactiveTF	

Kinetic Law

Derived unit $\mathrm{mol}^2 \cdot \mathrm{l}^{-2}$

$$v_5 = [\mathrm{IPTG}] \cdot [\mathrm{ia1\_ActiveTF}] \tag{24}$$

7.6 Reaction ia1_bind_reverse

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

Name ia1_bind_reverse

Reaction equation

$$\mathrm{ia1\_InactiveTF} \xrightarrow{\mathrm{ia1\_InactiveTF}} \mathrm{IPTG} + \mathrm{ia1\_ActiveTF} \tag{25}$$

Reactant

Table 16: Properties of each reactant.

Id	Name	SBO
ia1_InactiveTF	ia1_InactiveTF	

Modifier

Table 17: Properties of each modifier.

Id	Name	SBO
ia1_InactiveTF	ia1_InactiveTF	

Products

Table 18: Properties of each product.

Id	Name	SBO
IPTG	IPTG	
ia1_ActiveTF	ia1_ActiveTF	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \text{ia1\_Kd} \cdot [\text{ia1\_InactiveTF}] \tag{26}$$

7.7 Reaction pp2_v1

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

Name pp2_v1

Reaction equation

$$\emptyset \xrightarrow{\text{AUR1, AUR1}} \text{proAUR1} \tag{27}$$

Modifiers

Table 19: Properties of each modifier.

Id	Name	SBO
AUR1	AUR1	
AUR1	AUR1	

Product

Table 20: Properties of each product.

Id	Name	SBO
proAUR1	proAUR1	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \text{pp2\_translation\_rate} \cdot \text{pAUR1\_strength} \cdot [\text{AUR1}] \tag{28}$$

7.8 Reaction pp2_v2

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

Name pp2_v2

Reaction equation

$$\text{proAUR1} \xrightarrow{\text{proAUR1}} \emptyset \tag{29}$$

Reactant

Table 21: Properties of each reactant.

Id	Name	SBO
proAUR1	proAUR1	

Modifier

Table 22: Properties of each modifier.

Id	Name	SBO
proAUR1	proAUR1	

Kinetic Law

Derived unit contains undeclared units

$$v_8 = \text{proAUR1\_degradation\_rate} \cdot [\text{proAUR1}] \tag{30}$$

7.9 Reaction pp6_v1

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

Name pp6_v1

Reaction equation

$$\emptyset \xrightarrow{\text{TETR, TETR}} \text{proTETR} \tag{31}$$

Modifiers

Table 23: Properties of each modifier.

Id	Name	SBO
TETR	TETR	
TETR	TETR	

Product

Table 24: Properties of each product.

Id	Name	SBO
proTETR	proTETR	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \text{pp6\_translation\_rate} \cdot \text{p3\_strength} \cdot [\text{TETR}] \tag{32}$$

7.10 Reaction pp6_v2

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

Name pp6_v2

Reaction equation

$$\text{proTETR} \xrightarrow{\text{proTETR}} \emptyset \tag{33}$$

Reactant

Table 25: Properties of each reactant.

Id	Name	SBO
proTETR	proTETR	

Modifier

Table 26: Properties of each modifier.

Id	Name	SBO
proTETR	proTETR	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \text{proTETR\_degradation\_rate} \cdot [\text{proTETR}] \tag{34}$$

7.11 Reaction pp3_v1

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

Name pp3_v1

Reaction equation

$$\emptyset \xrightarrow{\text{SLS4, SLS4}} \text{proSLS4} \tag{35}$$

Modifiers

Table 27: Properties of each modifier.

Id	Name	SBO
SLS4	SLS4	
SLS4	SLS4	

Product

Table 28: Properties of each product.

Id	Name	SBO
proSLS4	proSLS4	

Kinetic Law

Derived unit contains undeclared units

$$v_{11} = \text{pp3\_translation\_rate} \cdot \text{pSLS4\_strength} \cdot [\text{SLS4}] \tag{36}$$

7.12 Reaction pp3_v2

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

Name pp3_v2

Reaction equation

$$\text{proSLS4} \xrightarrow{\text{proSLS4}} \emptyset \tag{37}$$

Reactant

Table 29: Properties of each reactant.

Id	Name	SBO
proSLS4	proSLS4	

Modifier

Table 30: Properties of each modifier.

Id	Name	SBO
proSLS4	proSLS4	

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = \text{proSLS4\_degradation\_rate} \cdot [\text{proSLS4}] \tag{38}$$

7.13 Reaction pp4_v1

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

Name pp4_v1

Reaction equation

$$\emptyset \xrightarrow{\text{LACI, LACI}} \text{proLACI} \tag{39}$$

Modifiers

Table 31: Properties of each modifier.

Id	Name	SBO
LACI	LACI	
LACI	LACI	

Product

Table 32: Properties of each product.

Id	Name	SBO
proLACI	proLACI	

Kinetic Law

Derived unit contains undeclared units

$$v_{13} = \text{pp4\_translation\_rate} \cdot \text{p2\_strength} \cdot [\text{LACI}] \tag{40}$$

7.14 Reaction pp4_v2

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

Name pp4_v2

Reaction equation

$$\text{proLACI} \xrightarrow{\text{proLACI}} \emptyset \tag{41}$$

Reactant

Table 33: Properties of each reactant.

Id	Name	SBO
proLACI	proLACI	

Modifier

Table 34: Properties of each modifier.

Id	Name	SBO
proLACI	proLACI	

Kinetic Law

Derived unit contains undeclared units

$$v_{14} = \text{proLACI\_degradation\_rate} \cdot [\text{proLACI}] \tag{42}$$

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 AUR1

Name AUR1

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

Involved in rule AUR1

This species takes part in two reactions (as a modifier in pp2_v1, pp2_v1). Not these but one rule determines the species' quantity because this species is on the boundary of the reaction system.

8.2 Species IPTG

Name IPTG

Initial concentration $10000\ \mathrm{mol} \cdot \mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in ia1_bind_forward and as a product in ia1_bind_reverse and as a modifier in ia1_bind_forward).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IPTG} = v_6 - v_5 \tag{43}$$

8.3 Species LACI

Name LACI

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

Involved in rule LACI

This species takes part in two reactions (as a modifier in pp4_v1, pp4_v1). Not these but one rule determines the species' quantity because this species is on the boundary of the reaction system.

8.4 Species LAMDAR

Name LAMDAR

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

Involved in rule LAMDAR

This species takes part in two reactions (as a modifier in pp5_v1, pp5_v1). Not these but one rule determines the species' quantity because this species is on the boundary of the reaction system.

8.5 Species SLS1

Name SLS1

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

Involved in rule SLS1

One rule determines the species' quantity.

8.6 Species SLS4

Name SLS4

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

Involved in rule SLS4

This species takes part in two reactions (as a modifier in pp3_v1, pp3_v1). Not these but one rule determines the species' quantity because this species is on the boundary of the reaction system.

8.7 Species TETR

Name TETR

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

Involved in rule TETR

This species takes part in two reactions (as a modifier in pp6_v1, pp6_v1). Not these but one rule determines the species' quantity because this species is on the boundary of the reaction system.

8.8 Species as1

Name as1

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

Involved in rule as1

One rule determines the species' quantity.

8.9 Species ia1_ActiveTF

Name ia1_ActiveTF

Initial concentration $100\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in ia1_bind_forward and as a product in ia1_bind_reverse and as a modifier in ia1_bind_forward).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ia1\_ActiveTF} = v_6 - v_5 \tag{44}$$

8.10 Species ia1_InactiveTF

Name ia1_InactiveTF

Initial concentration $100\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in ia1_bind_reverse and as a product in ia1_bind_forward and as a modifier in ia1_bind_reverse).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ia1\_InactiveTF} = v_5 - v_6 \tag{45}$$

8.11 Species ope1

Name ope1

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

Involved in rule ope1

One rule determines the species' quantity.

8.12 Species p1

Name p1

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

This species does not take part in any reactions. Its quantity does hence not change over time:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{p1} = 0 \tag{46}$$

8.13 Species p2

Name p2

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

This species does not take part in any reactions. Its quantity does hence not change over time:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{p2} = 0 \tag{47}$$

8.14 Species p3

Name p3

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

This species does not take part in any reactions. Its quantity does hence not change over time:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{p3} = 0 \tag{48}$$

8.15 Species pAUR1

Name pAUR1

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

This species does not take part in any reactions. Its quantity does hence not change over time:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pAUR1} = 0 \tag{49}$$

8.16 Species pSLS1

Name pSLS1

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

This species does not take part in any reactions. Its quantity does hence not change over time:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pSLS1} = 0 \tag{50}$$

8.17 Species pSLS4

Name pSLS4

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

This species does not take part in any reactions. Its quantity does hence not change over time:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pSLS4} = 0 \tag{51}$$

8.18 Species proAUR1

Name proAUR1

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

This species takes part in three reactions (as a reactant in pp2_v2 and as a product in pp2_v1 and as a modifier in pp2_v2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{proAUR1} = v_7 - v_8 \tag{52}$$

8.19 Species proLACI

Name proLACI

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

This species takes part in three reactions (as a reactant in pp4_v2 and as a product in pp4_v1 and as a modifier in pp4_v2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{proLACI} = v_{13} - v_{14} \tag{53}$$

8.20 Species proLAMDAR

Name proLAMDAR

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

This species takes part in three reactions (as a reactant in pp5_v2 and as a product in pp5_v1 and as a modifier in pp5_v2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{proLAMDAR} = v_{3} - v_{4} \tag{54}$$

8.21 Species proSLS1

Name proSLS1

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

This species takes part in three reactions (as a reactant in pp1_v2 and as a product in pp1_v1 and as a modifier in pp1_v2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{proSLS1} = v_{1} - v_{2} \tag{55}$$

8.22 Species proSLS4

Name proSLS4

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

This species takes part in three reactions (as a reactant in pp3_v2 and as a product in pp3_v1 and as a modifier in pp3_v2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{proSLS4} = v_{11} - v_{12} \tag{56}$$

8.23 Species proTETR

Name proTETR

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

This species takes part in three reactions (as a reactant in pp6_v2 and as a product in pp6_v1 and as a modifier in pp6_v2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{proTETR} = v_9 - v_{10} \tag{57}$$

8.24 Species rs1

Name rs1

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

Involved in rule rs1

One rule determines the species' quantity.

8.25 Species rs2

Name rs2

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

Involved in rule rs2

One rule determines the species' quantity.

8.26 Species rs3

Name rs3

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

Involved in rule rs3

One rule determines the species' quantity.

8.27 Species rs4

Name rs4

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

Involved in rule rs4

One rule determines the species' quantity.

8.28 Species rs5

Name rs5

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

Involved in rule rs5

One rule determines the species' quantity.

8.29 Species rs6

Name rs6

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

Involved in rule rs6

One rule determines the species' quantity.

8.30 Species ter1

Name ter1

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

This species does not take part in any reactions. Its quantity does hence not change over time:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ter1} = 0 \tag{58}$$

8.31 Species ter2

Name ter2

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

This species does not take part in any reactions. Its quantity does hence not change over time:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ter2} = 0 \tag{59}$$

8.32 Species ter3

Name ter3

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

This species does not take part in any reactions. Its quantity does hence not change over time:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ter3} = 0 \tag{60}$$

8.33 Species ter4

Name ter4

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

This species does not take part in any reactions. Its quantity does hence not change over time:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ter4} = 0 \tag{61}$$

8.34 Species ter5

Name ter5

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

This species does not take part in any reactions. Its quantity does hence not change over time:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ter5} = 0 \tag{62}$$

8.35 Species ter6

Name ter6

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

This species does not take part in any reactions. Its quantity does hence not change over time:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ter6} = 0 \tag{63}$$

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