

SBML Model Report

Model name: “Carbo2013 - Mucosal Immune Response during H.pylori Infection”



May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 4 format. This model was created by the following two authors: Vijayalakshmi Chelliah¹ and Adria Carbo² at September 17th 2013 at 12:08 a. m. and last time modified at April eighth 2016 at 5:37 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	4
species types	0	species	41
events	2	constraints	0
reactions	88	function definitions	13
global parameters	109	unit definitions	3
rules	54	initial assignments	4

Model Notes

2 Unit Definitions

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

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2.1 Unit volume

Name volume

Definition ml

2.2 Unit time

Name time

Definition 86400 s

2.3 Unit substance

Name substance

Definition item

2.4 Unit area

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

Definition m²

2.5 Unit length

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

Definition m

3 Compartments

This model contains four compartments.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
c1	Lumen	0000290	3	1	litre	✓	
c2	Lamina Propia	0000290	3	1	litre	✓	
c4	Epithelium	0000290	3	1	litre	✓	
c3	Gastric Lymph Node	0000290	3	1	litre	✓	

3.1 Compartment c1

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

Name Lumen

SBO:0000290 physical compartment

3.2 Compartment c2

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

Name Lamina Propia

SBO:0000290 physical compartment

3.3 Compartment c4

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

Name Epithelium

SBO:0000290 physical compartment

3.4 Compartment c3

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

Name Gastric Lymph Node

SBO:0000290 physical compartment

4 Species

This model contains 41 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 11 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
s1	HP	c1	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
species_7	HP Dose	c1	item · ml ⁻¹	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
species_10	LB	c1	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
species_11	LB Dose	c1	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
species_12	nTh1	c1	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
species_13	nTh1_LP	c1	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
species_14	nTh17	c1	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
species_15	nTh17_LP	c1	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
species_16	nTreg	c1	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
species_17	nTreg_LP	c1	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s9	eDC	c2	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s13	Th1	c2	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s15	iTreg	c2	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s16	Th17	c2	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s19	M1	c2	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s21	M2	c2	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s22	M0	c2	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s25	tDC	c2	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s17	emT	c2	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s6	HP	c2	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
species_1	iDC	c2	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>

Id	Name	Compartment	Derived Unit	Constant	Boundary Condi- tion
species_2	TotalDC	c2	item · ml ⁻¹	<input type="checkbox"/>	<input checked="" type="checkbox"/>
species_3	TotalM	c2	item · ml ⁻¹	<input type="checkbox"/>	<input checked="" type="checkbox"/>
species_4	TotalT	c2	item · ml ⁻¹	<input type="checkbox"/>	<input checked="" type="checkbox"/>
species_18	eDCLB	c2	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
species_19	pEC	c2	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s2	E	c4	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s3	Ep	c4	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
species_5	Edead	c4	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s4	iDC	c4	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s26	eDC	c3	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s27	tDC	c3	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s28	nT	c3	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s29	cmT	c3	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s30	Th17	c3	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s31	Th1	c3	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
s33	iTreg	c3	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>
species_6	TotalDC	c3	item · ml ⁻¹	<input type="checkbox"/>	<input checked="" type="checkbox"/>
species_8	TotalT	c3	item · ml ⁻¹	<input type="checkbox"/>	<input checked="" type="checkbox"/>
species_9	TotalT-s	c3	item · ml ⁻¹	<input type="checkbox"/>	<input checked="" type="checkbox"/>
species_20	eDCLB	c3	item · ml ⁻¹	<input type="checkbox"/>	<input type="checkbox"/>

5 Parameters

This model contains 109 global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
parameter_1	vHP		0.500		<input checked="" type="checkbox"/>
parameter_2	vHP2		0.500		<input type="checkbox"/>
parameter_3	aTreg		1.000		<input checked="" type="checkbox"/>
parameter_4	aTh17		0.300		<input checked="" type="checkbox"/>
parameter_5	aTh1		0.700		<input type="checkbox"/>
parameter_7	kEB		10^{-6}		<input checked="" type="checkbox"/>
parameter_8	@eIE		0.500		<input checked="" type="checkbox"/>
parameter_9	@eEI		1.000		<input checked="" type="checkbox"/>
parameter_10	atreg		10^{-6}		<input checked="" type="checkbox"/>
parameter_11	ath1		$7 \cdot 10^{-7}$		<input type="checkbox"/>
parameter_12	ath17		$3 \cdot 10^{-7}$		<input checked="" type="checkbox"/>
parameter_13	@uT		0.143		<input checked="" type="checkbox"/>
parameter_14	@vT		0.100		<input checked="" type="checkbox"/>
parameter_15	toemT		0.006		<input type="checkbox"/>
parameter_16	tcmT		0.009		<input type="checkbox"/>
parameter_17	pt		512.000		<input type="checkbox"/>
parameter_18	pT		128.000		<input type="checkbox"/>
parameter_19	uHP		1.000		<input checked="" type="checkbox"/>
parameter_20	lHP		2.000		<input checked="" type="checkbox"/>
parameter_21	@uE		1.000		<input checked="" type="checkbox"/>
parameter_22	Stim_emT_Th17		$3 \cdot 10^{-7}$		<input type="checkbox"/>
parameter_23	Stim_emT_Th1		$7 \cdot 10^{-7}$		<input type="checkbox"/>
parameter_24	Stim_emT_iTreg		10^{-6}		<input type="checkbox"/>
parameter_25	Stim_cmT_Th1		$7 \cdot 10^{-7}$		<input type="checkbox"/>
parameter_26	Stim_cmT_Th17		$3 \cdot 10^{-7}$		<input type="checkbox"/>
parameter_27	Stim_cmT_iTreg		10^{-6}		<input type="checkbox"/>
parameter_28	Stim_t_Th1		$7 \cdot 10^{-13}$		<input type="checkbox"/>
parameter_29	Stim_t_Th17		$3 \cdot 10^{-13}$		<input type="checkbox"/>
parameter_30	Stim_t_iTreg		10^{-12}		<input type="checkbox"/>
parameter_31	Bc		1000.000		<input checked="" type="checkbox"/>
parameter_32	uCE		10^{-4}		<input checked="" type="checkbox"/>
parameter_33	@et		100.000		<input checked="" type="checkbox"/>
parameter_34	@ut		1.000		<input checked="" type="checkbox"/>
parameter_35	@lt		10^8		<input checked="" type="checkbox"/>
parameter_36	Bp		1.000		<input checked="" type="checkbox"/>
parameter_37	cyto_change		10^{-6}		<input type="checkbox"/>
parameter_38	uM1		10^{-4}		<input checked="" type="checkbox"/>

Id	Name	SBO	Value	Unit	Constant
parameter_39	Bd		1.000		<input checked="" type="checkbox"/>
parameter_40	Br		1000.000		<input checked="" type="checkbox"/>
parameter_41	er		1000.000		<input checked="" type="checkbox"/>
parameter_42	kTD		10^{-6}		<input checked="" type="checkbox"/>
parameter_44	udi_LP		1.000		<input checked="" type="checkbox"/>
parameter_45	um		1.000		<input checked="" type="checkbox"/>
parameter_47	k_lumen		10^{-6}		<input checked="" type="checkbox"/>
parameter_48	k_LP		10^{-6}		<input checked="" type="checkbox"/>
parameter_49	@pt_0		512.000		<input checked="" type="checkbox"/>
parameter_50	@pT_0		128.000		<input checked="" type="checkbox"/>
parameter_51	m_reg		0.010		<input checked="" type="checkbox"/>
parameter_52	m_HP		0.010		<input checked="" type="checkbox"/>
parameter_53	kGLN		10^{-6}		<input checked="" type="checkbox"/>
parameter_54	HP_Ep_Lumen		10^{-6}		<input type="checkbox"/>
parameter_55	iDCtoeDC_Lumen		0.313		<input type="checkbox"/>
parameter_56	iDCtotDC_Lumen		$5 \cdot 10^{-7}$		<input type="checkbox"/>
parameter_57	iDCtoeDC_LP		0.313		<input type="checkbox"/>
parameter_58	iDCtotDC_LP		$5 \cdot 10^{-7}$		<input type="checkbox"/>
parameter_59	M0toM1_LP		$5 \cdot 10^{-7}$		<input type="checkbox"/>
parameter_60	M0toM2_LP		$5 \cdot 10^{-7}$		<input type="checkbox"/>
parameter_61	vm		1.000		<input checked="" type="checkbox"/>
parameter_62	uMA		0.022		<input checked="" type="checkbox"/>
parameter_63	n		2.000		<input checked="" type="checkbox"/>
parameter_64	T_deactivation		0.129		<input type="checkbox"/>
parameter_43	iDC percentage		0.010		<input checked="" type="checkbox"/>
parameter_65	lm		100000.000		<input checked="" type="checkbox"/>
parameter_66	ld		1000000.000		<input checked="" type="checkbox"/>
parameter_6	HP Dose Response		10^{-6}		<input checked="" type="checkbox"/>
parameter_67	iTreg NS (rel)		0.000		<input type="checkbox"/>
parameter_68	Th1 NS (rel)		0.000		<input type="checkbox"/>
parameter_69	Th17 NS (rel)		0.000		<input type="checkbox"/>
parameter_70	Stimulation		10.000		<input checked="" type="checkbox"/>
parameter_71	iTreg S (rel)		0.000		<input type="checkbox"/>
parameter_72	Th1 S (rel)		0.000		<input type="checkbox"/>
parameter_73	Th17 S (rel)		0.000		<input type="checkbox"/>
parameter_46	@ud		0.500		<input checked="" type="checkbox"/>
parameter_74	vLB		0.500		<input checked="" type="checkbox"/>
parameter_75	vLB2		0.500		<input type="checkbox"/>
parameter_76	k_LB		1.000		<input checked="" type="checkbox"/>
parameter_77	iDCtotDC_LB		0.500		<input type="checkbox"/>
parameter_78	iDCtoeDC_LB		0.313		<input type="checkbox"/>
parameter_79	new iTreg_GLN		0.000		<input type="checkbox"/>

Id	Name	SBO	Value	Unit	Constant
parameter_80	new_Th1_GLN		14972.236		<input type="checkbox"/>
parameter_81	new_Th17_GLN		6416.673		<input type="checkbox"/>
parameter_82	new_emT iTreg		0.000		<input type="checkbox"/>
parameter_83	new_emT_Th1		214.717		<input type="checkbox"/>
parameter_84	new_emT_Th17		92.022		<input type="checkbox"/>
parameter_85	er_i		10000.000		<input checked="" type="checkbox"/>
parameter_86	et_i		10000.000		<input checked="" type="checkbox"/>
parameter_87	K_r17		1.000		<input checked="" type="checkbox"/>
parameter_88	K_17r		2.500		<input checked="" type="checkbox"/>
parameter_89	v21		2.000		<input checked="" type="checkbox"/>
parameter_90	v12		1.000		<input checked="" type="checkbox"/>
parameter_91	ri_I		100000.000		<input checked="" type="checkbox"/>
parameter_92	ir_I		100000.000		<input checked="" type="checkbox"/>
parameter_93	phi_HP		0.001		<input checked="" type="checkbox"/>
parameter_94	uLB		0.071		<input checked="" type="checkbox"/>
parameter_95	ath17LB		$3 \cdot 10^{-7}$		<input checked="" type="checkbox"/>
parameter_96	ath1LB		$7 \cdot 10^{-7}$		<input type="checkbox"/>
parameter_97	aTh17LB		0.300		<input checked="" type="checkbox"/>
parameter_98	aTh1LB		0.700		<input type="checkbox"/>
parameter_99	Stim_emT- _Th17LB		$3 \cdot 10^{-7}$		<input type="checkbox"/>
parameter- _100	Stim_emT_Th1LB		$7 \cdot 10^{-7}$		<input type="checkbox"/>
parameter- _101	Stim_cmT_Th1LB		$7 \cdot 10^{-7}$		<input type="checkbox"/>
parameter- _102	Stim_cmT- _Th17LB		$3 \cdot 10^{-7}$		<input type="checkbox"/>
parameter- _103	Stim_t_Th1LB		$7 \cdot 10^{-13}$		<input type="checkbox"/>
parameter- _104	Stim_t_Th17LB		$3 \cdot 10^{-13}$		<input type="checkbox"/>
parameter- _105	vEC		0.000		<input checked="" type="checkbox"/>
parameter- _106	Bc2		1.000		<input checked="" type="checkbox"/>
parameter- _107	k_LP1		0.627		<input checked="" type="checkbox"/>
ModelValue_3	Initial for aTh17		0.300		<input checked="" type="checkbox"/>
ModelValue- _10	Initial for ath17		$3 \cdot 10^{-7}$		<input checked="" type="checkbox"/>

6 Initialassignments

This is an overview of four initialassignments.

6.1 Initialassignment s1

Derived unit contains undeclared units

Math $\text{parameter_6} \cdot [\text{species_7}]$

6.2 Initialassignment species_10

Derived unit $\text{item} \cdot \text{ml}^{-1}$

Math $[\text{species_11}]$

6.3 Initialassignment ModelValue_3

Derived unit contains undeclared units

Math parameter_4

6.4 Initialassignment ModelValue_10

Derived unit contains undeclared units

Math parameter_12

7 Function definitions

This is an overview of 13 function definitions.

7.1 Function definition function_13

Name Constant flux (irreversible)

Argument v

Mathematical Expression

v

(1)

7.2 Function definition [function_1](#)

Name 1 reactant, 3 activators, KVV

Arguments $V_f, r_1, A_1, n_1, A_2, n_2, A_3, n_3$

Mathematical Expression

$$V_f \cdot r_1 \cdot (n_1 \cdot A_1 + n_2 \cdot A_2 + n_3 \cdot A_3) \quad (2)$$

7.3 Function definition [function_3](#)

Name 1sub 1 activator 1 parameter

Arguments substrate, a_1, k_1

Mathematical Expression

$$\text{substrate} \cdot a_1 \cdot k_1 \quad (3)$$

7.4 Function definition [function_8](#)

Name 1sub 2 activators 2 parameters

Arguments substrate, k_1, a_1, k_2, a_2

Mathematical Expression

$$\text{substrate} \cdot (k_1 \cdot a_1 + k_2 \cdot a_2) \quad (4)$$

7.5 Function definition [function_10](#)

Name Constant Flux, 3 activators

Arguments $c, k, A, n, k_A, B, k_B, C, k_C$

Mathematical Expression

$$c + k \cdot \left(\frac{A^n}{A^n + k_A^n} + \frac{B^n}{B^n + k_B^n} + \frac{C^n}{C^n + k_C^n} \right) \quad (5)$$

7.6 Function definition [function_7](#)

Name Constant Flux, 1 activator

Arguments k, A, n, k_A, c

Mathematical Expression

$$c + k \cdot \frac{A^n}{A^n + k_A^n} \quad (6)$$

7.7 Function definition [function_2](#)

Name 1 sub 5 activators

Arguments k, substrate, A, n, kA, B, kB, C, kC, D, kD, E, kE

Mathematical Expression

$$k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} + \frac{D^n}{D^n + kD^n} + \frac{E^n}{E^n + kE^n} \right) \quad (7)$$

7.8 Function definition [function_4](#)

Name 1 sub 3 activators

Arguments k, substrate, A, n, kA, B, kB, C, kC

Mathematical Expression

$$k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} \right) \quad (8)$$

7.9 Function definition [function_11](#)

Name 1 sub 2 activators

Arguments k, substrate, A, n, kA, B, kB

Mathematical Expression

$$k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} \right) \quad (9)$$

7.10 Function definition [function_5](#)

Name bact repo

Arguments k, sub, c

Mathematical Expression

$$\frac{k \cdot \text{sub}}{c + \text{sub}} \quad (10)$$

7.11 Function definition [function_12](#)

Name iDC.Ep replenishment

Arguments V, s, k, P

Mathematical Expression

$$V \cdot (s - k \cdot P) \quad (11)$$

7.12 Function definition `function_9`

Name 1 sub 2 act 2 params 1 const

Arguments substrate, k, k1, a1, k2, a2

Mathematical Expression

$$\text{substrate} \cdot k \cdot (k1 \cdot a1 + k2 \cdot a2) \quad (12)$$

7.13 Function definition `function_6`

Name 1 sub 3 activators 3 parameters

Arguments substrate, k1, a1, k2, a2, k3, a3

Mathematical Expression

$$\text{substrate} \cdot (k1 \cdot a1 + k2 \cdot a2 + k3 \cdot a3) \quad (13)$$

8 Rules

This is an overview of 54 rules.

8.1 Rule `parameter_2`

Rule `parameter_2` is an assignment rule for parameter `parameter_2`:

$$\text{parameter_2} = 1 - \text{parameter_1} \quad (14)$$

8.2 Rule `parameter_5`

Rule `parameter_5` is an assignment rule for parameter `parameter_5`:

$$\text{parameter_5} = 1 - \text{ModelValue_3} \quad (15)$$

8.3 Rule `parameter_11`

Rule `parameter_11` is an assignment rule for parameter `parameter_11`:

$$\text{parameter_11} = 1.0E - 6 - \text{ModelValue_10} \quad (16)$$

8.4 Rule `parameter_16`

Rule `parameter_16` is an assignment rule for parameter `parameter_16`:

$$\text{parameter_16} = \text{parameter_13} \cdot \text{parameter_14} \cdot 0.6 \quad (17)$$

8.5 Rule `parameter_15`

Rule `parameter_15` is an assignment rule for parameter `parameter_15`:

$$\text{parameter_15} = \text{parameter_13} \cdot 0.4 \cdot \text{parameter_14} \quad (18)$$

8.6 Rule `species_2`

Rule `species_2` is an assignment rule for species `species_2`:

$$\text{species_2} = [\text{s9}] + [\text{species_1}] + [\text{s25}] + [\text{s4}] \quad (19)$$

Derived unit $\text{item} \cdot \text{ml}^{-1}$

8.7 Rule `species_3`

Rule `species_3` is an assignment rule for species `species_3`:

$$\text{species_3} = [\text{s22}] + [\text{s19}] + [\text{s21}] \quad (20)$$

Derived unit $\text{item} \cdot \text{ml}^{-1}$

8.8 Rule `species_4`

Rule `species_4` is an assignment rule for species `species_4`:

$$\text{species_4} = [\text{s13}] + [\text{s16}] + [\text{s15}] + [\text{s17}] \quad (21)$$

Derived unit $\text{item} \cdot \text{ml}^{-1}$

8.9 Rule `species_6`

Rule `species_6` is an assignment rule for species `species_6`:

$$\text{species_6} = [\text{s26}] + [\text{s27}] \quad (22)$$

Derived unit $\text{item} \cdot \text{ml}^{-1}$

8.10 Rule `species_8`

Rule `species_8` is an assignment rule for species `species_8`:

$$\text{species_8} = [\text{s31}] + [\text{s30}] + [\text{s33}] + [\text{s29}] + [\text{s28}] \quad (23)$$

Derived unit $\text{item} \cdot \text{ml}^{-1}$

8.11 Rule `species_9`

Rule `species_9` is an assignment rule for species `species_9`:

$$\text{species_9} = 0.01 \cdot \left([\text{s31}] + [\text{s30}] + [\text{s33}] + \frac{[\text{s28}] + [\text{s29}]}{\text{parameter_70}} \right) \quad (24)$$

8.12 Rule `parameter_17`

Rule `parameter_17` is an assignment rule for parameter `parameter_17`:

$$\text{parameter_17} = \text{parameter_49} \cdot \frac{1}{1 + \text{parameter_51} \cdot [\text{s33}]} \quad (25)$$

8.13 Rule `parameter_18`

Rule `parameter_18` is an assignment rule for parameter `parameter_18`:

$$\text{parameter_18} = \text{parameter_50} \cdot \frac{1}{1 + \text{parameter_51} \cdot [\text{s15}] + \text{parameter_52} \cdot [\text{s6}]} \quad (26)$$

8.14 Rule `parameter_22`

Rule `parameter_22` is an assignment rule for parameter `parameter_22`:

$$\text{parameter_22} = \text{parameter_4} \cdot \text{parameter_48} \quad (27)$$

8.15 Rule `parameter_23`

Rule `parameter_23` is an assignment rule for parameter `parameter_23`:

$$\text{parameter_23} = \text{parameter_48} \cdot \text{parameter_5} \quad (28)$$

8.16 Rule `parameter_24`

Rule `parameter_24` is an assignment rule for parameter `parameter_24`:

$$\text{parameter_24} = \text{parameter_3} \cdot \text{parameter_48} \quad (29)$$

8.17 Rule `parameter_25`

Rule `parameter_25` is an assignment rule for parameter `parameter_25`:

$$\text{parameter_25} = \text{parameter_5} \cdot \text{parameter_53} \quad (30)$$

8.18 Rule `parameter_26`

Rule `parameter_26` is an assignment rule for parameter `parameter_26`:

$$\text{parameter_26} = \text{parameter_4} \cdot \text{parameter_53} \quad (31)$$

8.19 Rule `parameter_27`

Rule `parameter_27` is an assignment rule for parameter `parameter_27`:

$$\text{parameter_27} = \text{parameter_3} \cdot \text{parameter_53} \quad (32)$$

8.20 Rule `parameter_28`

Rule `parameter_28` is an assignment rule for parameter `parameter_28`:

$$\text{parameter_28} = \text{parameter_11} \cdot \text{parameter_53} \quad (33)$$

8.21 Rule `parameter_29`

Rule `parameter_29` is an assignment rule for parameter `parameter_29`:

$$\text{parameter_29} = \text{parameter_12} \cdot \text{parameter_53} \quad (34)$$

8.22 Rule `parameter_30`

Rule `parameter_30` is an assignment rule for parameter `parameter_30`:

$$\text{parameter_30} = \text{parameter_10} \cdot \text{parameter_53} \quad (35)$$

8.23 Rule `parameter_37`

Rule `parameter_37` is an assignment rule for parameter `parameter_37`:

$$\text{parameter_37} = \text{parameter_7} \cdot \text{parameter_36} \quad (36)$$

8.24 Rule `parameter_54`

Rule `parameter_54` is an assignment rule for parameter `parameter_54`:

$$\text{parameter_54} = \text{parameter_7} \cdot \text{parameter_39} \quad (37)$$

8.25 Rule `parameter_55`

Rule `parameter_55` is an assignment rule for parameter `parameter_55`:

$$\text{parameter_55} = \text{parameter_1} \cdot \text{parameter_107} \quad (38)$$

8.26 Rule `parameter_56`

Rule `parameter_56` is an assignment rule for parameter `parameter_56`:

$$\text{parameter_56} = \text{parameter_2} \cdot \text{parameter_47} \quad (39)$$

8.27 Rule `parameter_57`

Rule `parameter_57` is an assignment rule for parameter `parameter_57`:

$$\text{parameter_57} = \text{parameter_1} \cdot \text{parameter_107} \quad (40)$$

8.28 Rule `parameter_58`

Rule `parameter_58` is an assignment rule for parameter `parameter_58`:

$$\text{parameter_58} = \text{parameter_2} \cdot \text{parameter_48} \quad (41)$$

8.29 Rule `parameter_59`

Rule `parameter_59` is an assignment rule for parameter `parameter_59`:

$$\text{parameter_59} = \text{parameter_1} \cdot \text{parameter_48} \quad (42)$$

8.30 Rule `parameter_60`

Rule `parameter_60` is an assignment rule for parameter `parameter_60`:

$$\text{parameter_60} = \text{parameter_2} \cdot \text{parameter_48} \quad (43)$$

8.31 Rule `parameter_79`

Rule `parameter_79` is an assignment rule for parameter `parameter_79`:

$$\text{parameter_79} = \text{parameter_17} \cdot (\text{parameter_27} \cdot [\text{s29}] + \text{parameter_30} \cdot [\text{s28}]) \cdot [\text{s27}] \quad (44)$$

8.32 Rule `parameter_64`

Rule `parameter_64` is an assignment rule for parameter `parameter_64`:

$$\text{parameter_64} = (1 - \text{parameter_14}) \cdot \text{parameter_13} \quad (45)$$

8.33 Rule `parameter_67`

Rule `parameter_67` is an assignment rule for parameter `parameter_67`:

$$\text{parameter_67} = \frac{[\text{s33}]}{[\text{species_8}]} \quad (46)$$

Derived unit dimensionless

8.34 Rule `parameter_68`

Rule `parameter_68` is an assignment rule for parameter `parameter_68`:

$$\text{parameter_68} = \frac{[\text{s31}]}{[\text{species_8}]} \quad (47)$$

Derived unit dimensionless

8.35 Rule parameter_69

Rule parameter_69 is an assignment rule for parameter parameter_69:

$$\text{parameter_69} = \frac{[\text{s30}]}{[\text{species_8}]} \quad (48)$$

Derived unit dimensionless

8.36 Rule parameter_71

Rule parameter_71 is an assignment rule for parameter parameter_71:

$$\text{parameter_71} = \frac{[\text{s33}]}{[\text{species_9}]} \quad (49)$$

Derived unit dimensionless

8.37 Rule parameter_72

Rule parameter_72 is an assignment rule for parameter parameter_72:

$$\text{parameter_72} = \frac{[\text{s31}]}{[\text{species_9}]} \quad (50)$$

Derived unit dimensionless

8.38 Rule parameter_73

Rule parameter_73 is an assignment rule for parameter parameter_73:

$$\text{parameter_73} = \frac{[\text{s30}]}{[\text{species_9}]} \quad (51)$$

Derived unit dimensionless

8.39 Rule parameter_75

Rule parameter_75 is an assignment rule for parameter parameter_75:

$$\text{parameter_75} = 1 - \text{parameter_74} \quad (52)$$

8.40 Rule parameter_77

Rule parameter_77 is an assignment rule for parameter parameter_77:

$$\text{parameter_77} = \text{parameter_75} \cdot \text{parameter_76} \quad (53)$$

8.41 Rule `parameter_78`

Rule `parameter_78` is an assignment rule for parameter `parameter_78`:

$$\text{parameter_78} = \text{parameter_74} \cdot \text{parameter_107} \quad (54)$$

8.42 Rule `parameter_82`

Rule `parameter_82` is an assignment rule for parameter `parameter_82`:

$$\text{parameter_82} = \text{parameter_18} \cdot \text{parameter_24} \cdot ([s25] + [s21]) \cdot [s17] \quad (55)$$

8.43 Rule `parameter_96`

Rule `parameter_96` is an assignment rule for parameter `parameter_96`:

$$\text{parameter_96} = 1.0E - 6 - \text{parameter_95} \quad (56)$$

8.44 Rule `parameter_98`

Rule `parameter_98` is an assignment rule for parameter `parameter_98`:

$$\text{parameter_98} = 1 - \text{parameter_97} \quad (57)$$

8.45 Rule `parameter_100`

Rule `parameter_100` is an assignment rule for parameter `parameter_100`:

$$\text{parameter_100} = \text{parameter_48} \cdot \text{parameter_98} \quad (58)$$

8.46 Rule `parameter_83`

Rule `parameter_83` is an assignment rule for parameter `parameter_83`:

$$\begin{aligned} \text{parameter_83} = & \text{parameter_18} \\ & \cdot (\text{parameter_23} \cdot ([s19] + [s9]) \cdot [s17] + [s17] \cdot [\text{species_18}] \cdot \text{parameter_100}) \end{aligned} \quad (59)$$

8.47 Rule `parameter_99`

Rule `parameter_99` is an assignment rule for parameter `parameter_99`:

$$\text{parameter_99} = \text{parameter_48} \cdot \text{parameter_97} \quad (60)$$

8.48 Rule `parameter_84`

Rule `parameter_84` is an assignment rule for parameter `parameter_84`:

$$\begin{aligned} \text{parameter_84} = & \text{parameter_18} \\ & \cdot (\text{parameter_22} \cdot ([s19] + [s9]) \cdot [s17] + [s17] \cdot [\text{species_18}] \cdot \text{parameter_99}) \end{aligned} \quad (61)$$

8.49 Rule `parameter_101`

Rule `parameter_101` is an assignment rule for parameter `parameter_101`:

$$\text{parameter_101} = \text{parameter_53} \cdot \text{parameter_98} \quad (62)$$

8.50 Rule `parameter_102`

Rule `parameter_102` is an assignment rule for parameter `parameter_102`:

$$\text{parameter_102} = \text{parameter_53} \cdot \text{parameter_97} \quad (63)$$

8.51 Rule `parameter_103`

Rule `parameter_103` is an assignment rule for parameter `parameter_103`:

$$\text{parameter_103} = \text{parameter_53} \cdot \text{parameter_96} \quad (64)$$

8.52 Rule `parameter_80`

Rule `parameter_80` is an assignment rule for parameter `parameter_80`:

$$\begin{aligned} \text{parameter_80} = & \text{parameter_17} \cdot ((\text{parameter_25} \cdot [\text{s29}] + \text{parameter_28} \cdot [\text{s28}]) \cdot [\text{s26}] \\ & + ([\text{s29}] \cdot \text{parameter_101} + [\text{s28}] \cdot \text{parameter_103}) \cdot [\text{species_20}]) \end{aligned} \quad (65)$$

8.53 Rule `parameter_104`

Rule `parameter_104` is an assignment rule for parameter `parameter_104`:

$$\text{parameter_104} = \text{parameter_95} \cdot \text{parameter_53} \quad (66)$$

8.54 Rule `parameter_81`

Rule `parameter_81` is an assignment rule for parameter `parameter_81`:

$$\begin{aligned} \text{parameter_81} = & \text{parameter_17} \cdot ((\text{parameter_26} \cdot [\text{s29}] + \text{parameter_29} \cdot [\text{s28}]) \cdot [\text{s26}] \\ & + [\text{species_20}] \cdot ([\text{s29}] \cdot \text{parameter_102} + [\text{s28}] \cdot \text{parameter_104})) \end{aligned} \quad (67)$$

9 Events

This is an overview of two events. Each event is initiated whenever its trigger condition switches from false to true. A delay function postpones the effects of an event to a later time point. At the time of execution, an event can assign values to species, parameters or compartments if these are not set to constant.

9.1 Event `event_1`

Name 2nd Dose

Trigger condition

$$\text{time} \geq 2 \quad (68)$$

Assignments

$$s1 = [s1] + [\text{species_7}] \cdot \text{parameter_6} \quad (69)$$

$$\text{species_10} = [\text{species_10}] + [\text{species_11}] \quad (70)$$

9.2 Event `event_2`

Name 3rd Dose

Trigger condition

$$\text{time} \geq 4 \quad (71)$$

Assignments

$$s1 = [s1] + [\text{species_7}] \cdot \text{parameter_6} \quad (72)$$

$$\text{species_10} = [\text{species_10}] + [\text{species_11}] \quad (73)$$

10 Reactions

This model contains 88 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

Nº	Id	Name	Reaction Equation	SBO
1	re2	re055	$s2 \xrightarrow{s1, s2, s1} s3$	
2	re3	re066	$s1 \xrightarrow{\text{species_5}, s1, \text{species_5}} s6$	
3	re4	re059	$s3 \xrightarrow{s13, s16, s19, s3, s13, s16, s19} \text{species_5}$	
4	re6	re105	$\text{species_1} + s6 \xrightarrow{\text{species_1}, s6} s9$	
5	re11	re074	$s17 \xrightarrow{s21, s25, s17, s21, s25} s15$	
6	re13	re063	$s4 + s1 \xrightarrow{s4, s1} s9$	
7	re15	re058	$s2 \xrightarrow{s13, s16, s19, s2, s13, s16, s19} \text{species_5}$	
8	re16	re070	$s22 \xrightarrow{s19, s9, s13, s16, s3, s22, s19, s9, s13, s16, s3} s19$	
9	re17	re073	$s22 \xrightarrow{s21, s15, s25, s22, s21, s15, s25} s21$	
10	re18	re072	$s21 \xrightarrow{s13, s19, s9, s16, s3, s21, s13, s19, s9, s16, s3} s19$	
11	re20	re077	$\text{species_1} + s6 \xrightarrow{\text{species_1}, s6} s25$	
12	re21	re078	$s9 \xrightarrow{s9} s26$	
13	re22	re079	$s25 \xrightarrow{s25} s27$	
14	re23	re080	$s28 \xrightarrow{s26, \text{species_20}, s28, s26, \text{species_20}} s30$	
15	re24	re081	$s28 \xrightarrow{s26, s28, s26} s31$	
16	re27	re082	$s28 \xrightarrow{s27, s28, s27} s33$	

Nº	Id	Name	Reaction Equation	SBO
17	re28	re083	$s_{29} \xrightarrow{s_{26}, \text{species_20}, s_{29}, s_{26}, \text{species_20}} s_{30}$	
18	re29	re084	$s_{29} \xrightarrow{s_{26}, \text{species_20}, s_{29}, s_{26}, \text{species_20}} s_{31}$	
19	re31	re085	$s_{29} \xrightarrow{s_{27}, s_{29}, s_{27}} s_{33}$	
20	re32	re087	$s_{30} \xrightarrow{s_{30}} s_{16}$	
21	re33	re088	$s_{31} \xrightarrow{s_{31}} s_{13}$	
22	re35	re089	$s_{33} \xrightarrow{s_{33}} s_{15}$	
23	re41	re091	$s_{33} \xrightarrow{s_{31}, s_{26}, s_{30}, s_{33}, s_{31}, s_{26}, s_{30}} s_{30}$	
24	re42	re093	$s_{15} \xrightarrow{s_{16}, s_9, s_{19}, s_{13}, s_3, s_{15}, s_{16}, s_9, s_{19}, s_{13}, s_3} s_{16}$	
25	re43	re095	$s_{16} \xrightarrow{s_{16}} s_{17}$	
26	re44	re096	$s_{13} \xrightarrow{s_{13}} s_{17}$	
27	re45	re097	$s_{15} \xrightarrow{s_{15}} s_{17}$	
28	re46	re098	$s_{16} \xrightarrow{s_{16}} s_{29}$	
29	re47	re099	$s_{13} \xrightarrow{s_{13}} s_{29}$	
30	re49	re100	$s_{15} \xrightarrow{s_{15}} s_{29}$	
31	reaction_1	re060	$s_3 \xrightarrow{s_3} s_2$	
32	reaction_2	re057	$\text{species_5} \xrightarrow{\text{species_5}} s_2$	
33	reaction_3	re102	$s_6 \xrightarrow{s_6} 2 s_6$	
34	reaction_4	re101	$s_6 \xrightarrow{s_6} \emptyset$	
35	reaction_5	re052	$s_1 \xrightarrow{s_1} 2 s_1$	
36	reaction_6	re065	$s_1 \xrightarrow{s_1} \emptyset$	

Nº	Id	Name	Reaction Equation	SBO
37	reaction_10	re103	$s17 \xrightarrow{s19, s9, \text{species_18}, s17, s19, s9, \text{species_18}} s13$	
38	reaction_11	re104	$s17 \xrightarrow{s19, s9, \text{species_18}, s17, s19, s9, \text{species_18}} s16$	
39	reaction_12	re119	$s16 \xrightarrow{s16} \emptyset$	
40	reaction_13	re106	$\emptyset \xrightarrow{s26, s26} s28$	
41	reaction_14	re107	$s28 \xrightarrow{s28} \emptyset$	
42	reaction_16	re061	$s1 \xrightarrow{s3, s1, s3} s6$	
43	reaction_17	re062	$s4 + s1 \xrightarrow{s4, s1} s25$	
44	reaction_19	re067	$s6 \xrightarrow{s3, s19, s6, s3, s19} \emptyset$	
45	reaction_20	re053	$s1 \xrightarrow{s3, s1, s3} \emptyset$	
46	reaction_24	re068	$\emptyset \xrightarrow{s3, s19, s9, s3, s19, s9} \text{species_1}$	
47	reaction_27	re069	$\emptyset \xrightarrow{s19, s3, s9, s19, s3, s9} s22$	
48	reaction_31	re111	$\text{species_1} \xrightarrow{\text{species_1}} \emptyset$	
49	reaction_32	re112	$s22 \xrightarrow{s22} \emptyset$	
50	reaction_37	re117	$s19 \xrightarrow{s19} \emptyset$	
51	reaction_38	re118	$s21 \xrightarrow{s21} \emptyset$	
52	reaction_39	re120	$s13 \xrightarrow{s13} \emptyset$	
53	reaction_40	re121	$s15 \xrightarrow{s15} \emptyset$	
54	reaction_7	re071	$s19 \xrightarrow{s15, s21, s25, s19, s15, s21, s25} s21$	
55	reaction_8	re094	$s16 \xrightarrow{s15, s25, s21, s16, s15, s25, s21} s15$	
56	reaction_9	re092	$s30 \xrightarrow{s33, s27, s30, s33, s27} s33$	

Nº	Id	Name	Reaction Equation	SBO
57	reaction_15	re122	$s_{22} + s_6 \xrightarrow{s_{22}, s_6} s_{19}$	
58	reaction_18	re123	$s_{22} + s_6 \xrightarrow{s_{22}, s_6} s_{21}$	
59	reaction_21	re116	$s_{26} \xrightarrow{s_{26}} \emptyset$	
60	reaction_22	re124	$s_{27} \xrightarrow{s_{27}} \emptyset$	
61	reaction_23	re127	$\text{species}_1 \xrightleftharpoons[\text{species}_1, s_4]{s_4} s_4$	
62	reaction_25	re128	$s_4 \xrightarrow{\text{species}_{10}, s_4, \text{species}_{10}} s_{25}$	
63	reaction_26	re129	$s_4 \xrightarrow{\text{species}_{10}, s_4, \text{species}_{10}} s_9$	
64	reaction_28	re130	$\text{species}_{10} \xrightarrow{\text{species}_{10}} \emptyset$	
65	reaction_29	re131	$\emptyset \longrightarrow s_{15}$	
66	reaction_30	re132	$\emptyset \longrightarrow s_{13}$	
67	reaction_33	re133	$\emptyset \longrightarrow s_{16}$	
68	reaction_34	re134	$\emptyset \longrightarrow s_{33}$	
69	reaction_35	re135	$\emptyset \longrightarrow s_{31}$	
70	reaction_36	re136	$\emptyset \longrightarrow s_{30}$	
71	reaction_41	re137	$\text{species}_{18} \xrightarrow{\text{species}_{18}} \text{species}_{20}$	
72	reaction_42	re138	$\text{species}_{20} \xrightarrow{\text{species}_{20}} \emptyset$	
73	reaction_43	re139	$s_2 \xrightarrow{s_{13}, s_{16}, s_9, s_{19}, s_3, s_2, s_{13}, s_{16}, s_9, s_{19}, s_3}} s_3$	
74	reaction_44	re140	$\text{species}_{20} \xrightarrow{\text{species}_{20}} \emptyset$	
75	reaction_45	nTh1 creation	$s_{28} \xrightarrow{s_{28}} \text{species}_{12}$	
76	reaction_46	nTh1 trans	$\text{species}_{12} \xrightarrow{\text{species}_{12}} \text{species}_{13}$	
77	reaction_47	nTh1_LP deg	$\text{species}_{13} \xrightarrow{\text{species}_{13}} \emptyset$	
78	reaction_48	nTh1_LP expansion	$\text{species}_{13} \xrightarrow{\text{species}_{13}} 2 \text{ species}_{13}$	

Nº	Id	Name	Reaction Equation	SBO
79	reaction_49	nTh1 deg	$\text{species_12} \xrightarrow{\text{species_12}} \emptyset$	
80	reaction_50	nTh17 creation	$s28 \xrightarrow{s28} \text{species_14}$	
81	reaction_51	nTh17 trans	$\text{species_14} \xrightarrow{\text{species_14}} \text{species_15}$	
82	reaction_52	nTh17_LP deg	$\text{species_15} \xrightarrow{\text{species_15}} \emptyset$	
83	reaction_53	nTh17 deg	$\text{species_14} \xrightarrow{\text{species_14}} \emptyset$	
84	reaction_54	nTreg creation	$s28 \xrightarrow{s28} \text{species_16}$	
85	reaction_55	nTreg trans	$\text{species_16} \xrightarrow{\text{species_16}} \text{species_17}$	
86	reaction_56	nTreg_LP deg	$\text{species_17} \xrightarrow{\text{species_17}} \emptyset$	
87	reaction_57	nTreg deg	$\text{species_16} \xrightarrow{\text{species_16}} \emptyset$	
88	reaction_58	Th17 to Treg	$\text{species_15} \xrightarrow{\text{species_15}} \text{species_17}$	

10.1 Reaction re2

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

Name re055

Reaction equation



Reactant

Table 6: Properties of each reactant.

Id	Name	SBO
s2	E	

Modifiers

Table 7: Properties of each modifier.

Id	Name	SBO
s1	HP	
s2	E	
s1	HP	

Product

Table 8: Properties of each product.

Id	Name	SBO
s3	Ep	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \text{vol}(c4) \cdot \text{function_3}([s2], [s1], \text{parameter_7}) \quad (75)$$

$$\text{function_3}(\text{substrate}, a1, k1) = \text{substrate} \cdot a1 \cdot k1 \quad (76)$$

$$\text{function_3}(\text{substrate}, a1, k1) = \text{substrate} \cdot a1 \cdot k1 \quad (77)$$

10.2 Reaction re3

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

Name re066

Reaction equation



Reactant

Table 9: Properties of each reactant.

Id	Name	SBO
s1	HP	

Modifiers

Table 10: Properties of each modifier.

Id	Name	SBO
species_5	Edead	
s1	HP	
species_5	Edead	

Product

Table 11: Properties of each product.

Id	Name	SBO
s6	HP	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \text{function_3}([s1], [\text{species_5}], \text{parameter_7}) \quad (79)$$

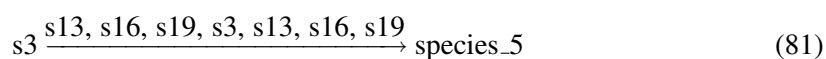
$$\text{function_3}(\text{substrate}, a1, k1) = \text{substrate} \cdot a1 \cdot k1 \quad (80)$$

10.3 Reaction re4

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

Name re059

Reaction equation



Reactant

Table 12: Properties of each reactant.

Id	Name	SBO
s3	Ep	

Modifiers

Table 13: Properties of each modifier.

Id	Name	SBO
s13	Th1	
s16	Th17	
s19	M1	
s3	Ep	
s13	Th1	
s16	Th17	
s19	M1	

Product

Table 14: Properties of each product.

Id	Name	SBO
species_5	Edead	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \text{vol}(c4) \cdot \text{function_1}(\text{parameter_48}, [s3], [s13], \text{parameter_32}, [s16], \text{parameter_32}, [s19], \text{parameter_38}) \quad (82)$$

$$\text{function_1}(Vf, r1, A1, n1, A2, n2, A3, n3) = Vf \cdot r1 \cdot (n1 \cdot A1 + n2 \cdot A2 + n3 \cdot A3) \quad (83)$$

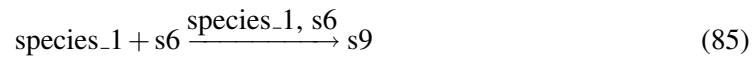
$$\text{function_1}(Vf, r1, A1, n1, A2, n2, A3, n3) = Vf \cdot r1 \cdot (n1 \cdot A1 + n2 \cdot A2 + n3 \cdot A3) \quad (84)$$

10.4 Reaction re6

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

Name re105

Reaction equation



Reactants

Table 15: Properties of each reactant.

Id	Name	SBO
species_1	iDC	
s6	HP	

Modifiers

Table 16: Properties of each modifier.

Id	Name	SBO
species_1	iDC	
s6	HP	

Product

Table 17: Properties of each product.

Id	Name	SBO
s9	eDC	

Kinetic Law

Derived unit contains undeclared units

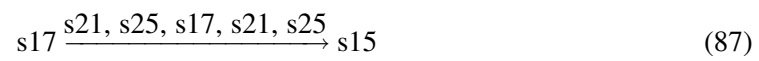
$$v_4 = \text{vol}(c2) \cdot \text{parameter_57} \cdot [\text{species_1}] \cdot [s6] \quad (86)$$

10.5 Reaction `re11`

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

Name `re074`

Reaction equation



Reactant

Table 18: Properties of each reactant.

Id	Name	SBO
s17	emT	

Modifiers

Table 19: Properties of each modifier.

Id	Name	SBO
s21	M2	
s25	tDC	
s17	emT	
s21	M2	
s25	tDC	

Product

Table 20: Properties of each product.

Id	Name	SBO
s15	iTreg	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \text{vol}(c_2) \cdot \text{function_8}([s_{17}], \text{parameter_24}, [s_{21}], \text{parameter_24}, [s_{25}]) \quad (88)$$

$$\text{function_8}(\text{substrate}, k_1, a_1, k_2, a_2) = \text{substrate} \cdot (k_1 \cdot a_1 + k_2 \cdot a_2) \quad (89)$$

$$\text{function_8}(\text{substrate}, k_1, a_1, k_2, a_2) = \text{substrate} \cdot (k_1 \cdot a_1 + k_2 \cdot a_2) \quad (90)$$

10.6 Reaction re13

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

Name re063

Reaction equation



Reactants

Table 21: Properties of each reactant.

Id	Name	SBO
s4	iDC	
s1	HP	

Modifiers

Table 22: Properties of each modifier.

Id	Name	SBO
s4	iDC	
s1	HP	

Product

Table 23: Properties of each product.

Id	Name	SBO
s9	eDC	

Kinetic Law

Derived unit contains undeclared units

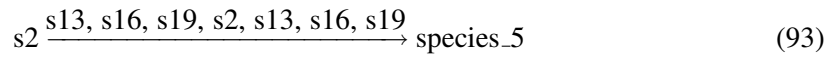
$$v_6 = \text{parameter_55} \cdot [s4] \cdot [s1] \quad (92)$$

10.7 Reaction re15

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

Name re058

Reaction equation



Reactant

Table 24: Properties of each reactant.

Id	Name	SBO
s2	E	

Modifiers

Table 25: Properties of each modifier.

Id	Name	SBO
s13	Th1	
s16	Th17	
s19	M1	
s2	E	
s13	Th1	
s16	Th17	
s19	M1	

Product

Table 26: Properties of each product.

Id	Name	SBO
species_5	Edead	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \text{vol}(c_4) \cdot \text{function_1}(\text{parameter_48}, [s_2], [s_{13}], \text{parameter_32}, [s_{16}], \text{parameter_32}, [s_{19}], \text{parameter_38}) \quad (94)$$

$$\text{function_1}(V_f, r_1, A_1, n_1, A_2, n_2, A_3, n_3) = V_f \cdot r_1 \cdot (n_1 \cdot A_1 + n_2 \cdot A_2 + n_3 \cdot A_3) \quad (95)$$

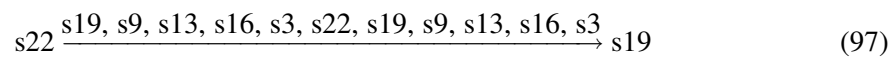
$$\text{function_1}(V_f, r_1, A_1, n_1, A_2, n_2, A_3, n_3) = V_f \cdot r_1 \cdot (n_1 \cdot A_1 + n_2 \cdot A_2 + n_3 \cdot A_3) \quad (96)$$

10.8 Reaction re16

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

Name re070

Reaction equation



Reactant

Table 27: Properties of each reactant.

Id	Name	SBO
s22	M0	

Modifiers

Table 28: Properties of each modifier.

Id	Name	SBO
s19	M1	
s9	eDC	
s13	Th1	
s16	Th17	
s3	Ep	
s22	M0	
s19	M1	
s9	eDC	
s13	Th1	
s16	Th17	
s3	Ep	

Product

Table 29: Properties of each product.

Id	Name	SBO
s19	M1	

Kinetic Law

Derived unit contains undeclared units

$$v_8 = \text{vol}(c2) \cdot \text{function_2}(\text{parameter_61}, [s22], [s19], \text{parameter_63}, \text{parameter_91}, [s9], \text{parameter_91}, [s13], \text{parameter_91}, [s16], \text{parameter_91}, [s3], \text{parameter_106}) \quad (98)$$

$$\begin{aligned} & \text{function_2}(k, \text{substrate}, A, n, kA, B, kB, C, kC, D, kD, E, kE) \\ &= k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} + \frac{D^n}{D^n + kD^n} + \frac{E^n}{E^n + kE^n} \right) \end{aligned} \quad (99)$$

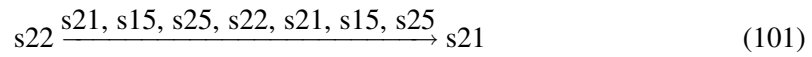
$$\begin{aligned} & \text{function_2}(k, \text{substrate}, A, n, kA, B, kB, C, kC, D, kD, E, kE) \\ &= k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} + \frac{D^n}{D^n + kD^n} + \frac{E^n}{E^n + kE^n} \right) \end{aligned} \quad (100)$$

10.9 Reaction re17

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

Name re073

Reaction equation



Reactant

Table 30: Properties of each reactant.

Id	Name	SBO
s22	M0	

Modifiers

Table 31: Properties of each modifier.

Id	Name	SBO
s21	M2	
s15	iTreg	
s25	tDC	
s22	M0	
s21	M2	
s15	iTreg	
s25	tDC	

Product

Table 32: Properties of each product.

Id	Name	SBO
s21	M2	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \text{vol}(c2) \cdot \text{function_4}(\text{parameter_61}, [s22], [s21], \text{parameter_63}, \text{parameter_92}, [s15], \text{parameter_92}, [s25], \text{parameter_92}) \quad (102)$$

$$\text{function_4}(k, \text{substrate}, A, n, kA, B, kB, C, kC) = k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} \right) \quad (103)$$

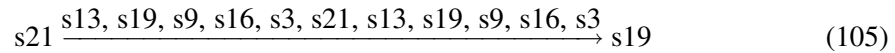
$$\text{function_4}(k, \text{substrate}, A, n, kA, B, kB, C, kC) = k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} \right) \quad (104)$$

10.10 Reaction re18

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

Name re072

Reaction equation



Reactant

Table 33: Properties of each reactant.

Id	Name	SBO
s21	M2	

Modifiers

Table 34: Properties of each modifier.

Id	Name	SBO
s13	Th1	
s19	M1	
s9	eDC	
s16	Th17	
s3	Ep	
s21	M2	
s13	Th1	
s19	M1	

Id	Name	SBO
s9	eDC	
s16	Th17	
s3	Ep	

Product

Table 35: Properties of each product.

Id	Name	SBO
s19	M1	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \text{vol}(c2) \cdot \text{function_2}(\text{parameter_89}, [s21], [s13], \text{parameter_63}, \text{parameter_91}, [s19], \text{parameter_91}, [s9], \text{parameter_91}, [s16], \text{parameter_91}, [s3], \text{parameter_31}) \quad (106)$$

$$\begin{aligned} & \text{function_2}(k, \text{substrate}, A, n, kA, B, kB, C, kC, D, kD, E, kE) \\ &= k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} + \frac{D^n}{D^n + kD^n} + \frac{E^n}{E^n + kE^n} \right) \end{aligned} \quad (107)$$

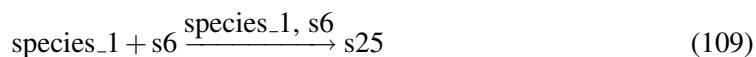
$$\begin{aligned} & \text{function_2}(k, \text{substrate}, A, n, kA, B, kB, C, kC, D, kD, E, kE) \\ &= k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} + \frac{D^n}{D^n + kD^n} + \frac{E^n}{E^n + kE^n} \right) \end{aligned} \quad (108)$$

10.11 Reaction re20

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

Name re077

Reaction equation



Reactants

Table 36: Properties of each reactant.

Id	Name	SBO
species_1	iDC	
s6	HP	

Modifiers

Table 37: Properties of each modifier.

Id	Name	SBO
species_1	iDC	
s6	HP	

Product

Table 38: Properties of each product.

Id	Name	SBO
s25	tDC	

Kinetic Law

Derived unit contains undeclared units

$$v_{11} = \text{vol}(c2) \cdot \text{parameter_58} \cdot [\text{species_1}] \cdot [s6] \quad (110)$$

10.12 Reaction re21

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

Name re078

Reaction equation



Reactant

Table 39: Properties of each reactant.

Id	Name	SBO
s9	eDC	

Modifier

Table 40: Properties of each modifier.

Id	Name	SBO
s9	eDC	

Product

Table 41: Properties of each product.

Id	Name	SBO
s26	eDC	

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = \text{parameter_9} \cdot [\text{s9}]$$

(112)

10.13 Reaction re22

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

Name re079

Reaction equation



Reactant

Table 42: Properties of each reactant.

Id	Name	SBO
s25	tDC	

Modifier

Table 43: Properties of each modifier.

Id	Name	SBO
s25	tDC	

Product

Table 44: Properties of each product.

Id	Name	SBO
s27	tDC	

Kinetic Law

Derived unit contains undeclared units

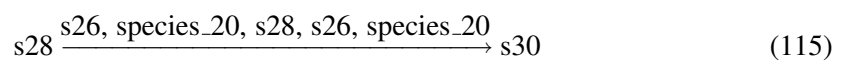
$$v_{13} = \text{parameter_9} \cdot [\text{s25}] \quad (114)$$

10.14 Reaction re23

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

Name re080

Reaction equation



Reactant

Table 45: Properties of each reactant.

Id	Name	SBO
s28	nT	

Modifiers

Table 46: Properties of each modifier.

Id	Name	SBO
s26	eDC	
species_20	eDCLB	
s28	nT	
s26	eDC	
species_20	eDCLB	

Product

Table 47: Properties of each product.

Id	Name	SBO
s30	Th17	

Kinetic Law

Derived unit contains undeclared units

$$v_{14} = \text{vol}(c3) \cdot \text{function_8}([s28], \text{parameter_29}, [s26], \text{parameter_104}, [\text{species_20}]) \quad (116)$$

$$\text{function_8}(\text{substrate}, k1, a1, k2, a2) = \text{substrate} \cdot (k1 \cdot a1 + k2 \cdot a2) \quad (117)$$

$$\text{function_8}(\text{substrate}, k1, a1, k2, a2) = \text{substrate} \cdot (k1 \cdot a1 + k2 \cdot a2) \quad (118)$$

10.15 Reaction re24

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

Name re081

Reaction equation



Reactant

Table 48: Properties of each reactant.

Id	Name	SBO
s28	nT	

Modifiers

Table 49: Properties of each modifier.

Id	Name	SBO
s26	eDC	
s28	nT	
s26	eDC	

Product

Table 50: Properties of each product.

Id	Name	SBO
s31	Th1	

Kinetic Law

Derived unit contains undeclared units

$$v_{15} = \text{vol}(c3) \cdot \text{function_8}([s28], \text{parameter_28}, [s26], \text{parameter_103}, [s26]) \tag{120}$$

$$\text{function_8}(\text{substrate}, k1, a1, k2, a2) = \text{substrate} \cdot (k1 \cdot a1 + k2 \cdot a2) \tag{121}$$

$$\text{function_8}(\text{substrate}, k1, a1, k2, a2) = \text{substrate} \cdot (k1 \cdot a1 + k2 \cdot a2) \tag{122}$$

10.16 Reaction re27

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

Name re082

Reaction equation



Reactant

Table 51: Properties of each reactant.

Id	Name	SBO
s28	nT	

Modifiers

Table 52: Properties of each modifier.

Id	Name	SBO
s27	tDC	
s28	nT	
s27	tDC	

Product

Table 53: Properties of each product.

Id	Name	SBO
s33	iTreg	

Kinetic Law

Derived unit contains undeclared units

$$v_{16} = \text{vol}(c3) \cdot \text{function_3}([s28], [s27], \text{parameter_30}) \tag{124}$$

$$\text{function_3}(\text{substrate}, a1, k1) = \text{substrate} \cdot a1 \cdot k1 \tag{125}$$

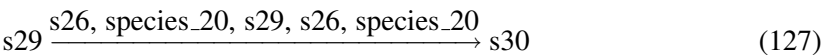
$$\text{function_3}(\text{substrate}, a1, k1) = \text{substrate} \cdot a1 \cdot k1 \tag{126}$$

10.17 Reaction re28

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

Name re083

Reaction equation



Reactant

Table 54: Properties of each reactant.

Id	Name	SBO
s29	cmT	

Modifiers

Table 55: Properties of each modifier.

Id	Name	SBO
s26	eDC	
species_20	eDCLB	
s29	cmT	
s26	eDC	
species_20	eDCLB	

Product

Table 56: Properties of each product.

Id	Name	SBO
s30	Th17	

Kinetic Law

Derived unit contains undeclared units

$$v_{17} = \text{vol}(c3) \cdot \text{function_8}([s29], \text{parameter_26}, [s26], \text{parameter_102}, [\text{species_20}]) \quad (128)$$

$$\text{function_8}(\text{substrate}, k1, a1, k2, a2) = \text{substrate} \cdot (k1 \cdot a1 + k2 \cdot a2) \quad (129)$$

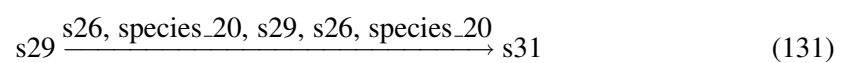
$$\text{function_8}(\text{substrate}, k1, a1, k2, a2) = \text{substrate} \cdot (k1 \cdot a1 + k2 \cdot a2) \quad (130)$$

10.18 Reaction re29

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

Name re084

Reaction equation



Reactant

Table 57: Properties of each reactant.

Id	Name	SBO
s29	cmT	

Modifiers

Table 58: Properties of each modifier.

Id	Name	SBO
s26	eDC	
species_20	eDCLB	
s29	cmT	
s26	eDC	
species_20	eDCLB	

Product

Table 59: Properties of each product.

Id	Name	SBO
s31	Th1	

Kinetic Law

Derived unit contains undeclared units

$$v_{18} = \text{vol}(c3) \cdot \text{function_8}([s29], \text{parameter_25}, [s26], \text{parameter_101}, [\text{species_20}]) \quad (132)$$

$$\text{function_8}(\text{substrate}, k1, a1, k2, a2) = \text{substrate} \cdot (k1 \cdot a1 + k2 \cdot a2) \quad (133)$$

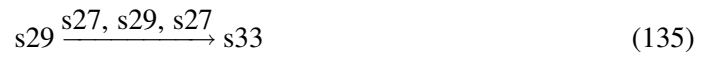
$$\text{function_8}(\text{substrate}, k1, a1, k2, a2) = \text{substrate} \cdot (k1 \cdot a1 + k2 \cdot a2) \quad (134)$$

10.19 Reaction re31

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

Name re085

Reaction equation



Reactant

Table 60: Properties of each reactant.

Id	Name	SBO
s29	cmT	

Modifiers

Table 61: Properties of each modifier.

Id	Name	SBO
s27	tDC	
s29	cmT	
s27	tDC	

Product

Table 62: Properties of each product.

Id	Name	SBO
s33	iTreg	

Kinetic Law

Derived unit contains undeclared units

$$v_{19} = \text{vol}(c3) \cdot \text{function_3}([s29], [s27], \text{parameter_27}) \quad (136)$$

$$\text{function_3}(\text{substrate}, a1, k1) = \text{substrate} \cdot a1 \cdot k1 \quad (137)$$

$$\text{function_3}(\text{substrate}, a1, k1) = \text{substrate} \cdot a1 \cdot k1 \quad (138)$$

10.20 Reaction re32

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

Name re087

Reaction equation



Reactant

Table 63: Properties of each reactant.

Id	Name	SBO
s30	Th17	

Modifier

Table 64: Properties of each modifier.

Id	Name	SBO
s30	Th17	

Product

Table 65: Properties of each product.

Id	Name	SBO
s16	Th17	

Kinetic Law

Derived unit contains undeclared units

$$v_{20} = \text{parameter.8} \cdot [s30]$$

(140)

10.21 Reaction re33

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

Name re088

Reaction equation



Reactant

Table 66: Properties of each reactant.

Id	Name	SBO
s31	Th1	

Modifier

Table 67: Properties of each modifier.

Id	Name	SBO
s31	Th1	

Product

Table 68: Properties of each product.

Id	Name	SBO
s13	Th1	

Kinetic Law

Derived unit contains undeclared units

$$v_{21} = \text{parameter_8} \cdot [s31] \tag{142}$$

10.22 Reaction re35

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

Name re089

Reaction equation



Reactant

Table 69: Properties of each reactant.

Id	Name	SBO
s33	iTreg	

Modifier

Table 70: Properties of each modifier.

Id	Name	SBO
s33	iTreg	

Product

Table 71: Properties of each product.

Id	Name	SBO
s15	iTreg	

Kinetic Law

Derived unit contains undeclared units

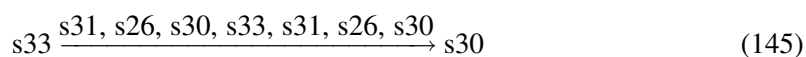
$$v_{22} = \text{parameter.8} \cdot [\text{s33}] \quad (144)$$

10.23 Reaction re41

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

Name re091

Reaction equation



Reactant

Table 72: Properties of each reactant.

Id	Name	SBO
s33	iTreg	

Modifiers

Table 73: Properties of each modifier.

Id	Name	SBO
s31	Th1	
s26	eDC	
s30	Th17	
s33	iTreg	
s31	Th1	
s26	eDC	
s30	Th17	

Product

Table 74: Properties of each product.

Id	Name	SBO
s30	Th17	

Kinetic Law

Derived unit contains undeclared units

$$v_{23} = \text{vol}(c3) \cdot \text{function_4}(\text{parameter_87}, [s33], [s31], \text{parameter_63}, \text{parameter_91}, [s26], \text{parameter_91}, [s30], \text{parameter_91}) \quad (146)$$

$$\text{function_4}(k, \text{substrate}, A, n, kA, B, kB, C, kC) = k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} \right) \quad (147)$$

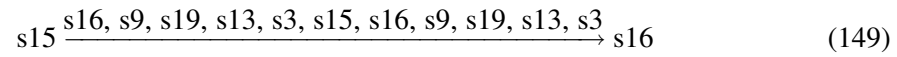
$$\text{function_4}(k, \text{substrate}, A, n, kA, B, kB, C, kC) = k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} \right) \quad (148)$$

10.24 Reaction re42

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

Name re093

Reaction equation



Reactant

Table 75: Properties of each reactant.

Id	Name	SBO
s15	iTreg	

Modifiers

Table 76: Properties of each modifier.

Id	Name	SBO
s16	Th17	
s9	eDC	
s19	M1	
s13	Th1	
s3	Ep	
s15	iTreg	
s16	Th17	
s9	eDC	
s19	M1	
s13	Th1	
s3	Ep	

Product

Table 77: Properties of each product.

Id	Name	SBO
s16	Th17	

Kinetic Law

Derived unit contains undeclared units

$$v_{24} = \text{vol}(c2) \cdot \text{function_2}(\text{parameter_87}, [s15], [s16], \text{parameter_63}, \text{parameter_91}, [s9], \text{parameter_91}, [s19], \text{parameter_91}, [s13], \text{parameter_91}, [s3], \text{parameter_31}) \quad (150)$$

$$\begin{aligned} & \text{function_2}(k, \text{substrate}, A, n, kA, B, kB, C, kC, D, kD, E, kE) \\ &= k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} + \frac{D^n}{D^n + kD^n} + \frac{E^n}{E^n + kE^n} \right) \end{aligned} \quad (151)$$

$$\begin{aligned} & \text{function_2}(k, \text{substrate}, A, n, kA, B, kB, C, kC, D, kD, E, kE) \\ &= k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} + \frac{D^n}{D^n + kD^n} + \frac{E^n}{E^n + kE^n} \right) \end{aligned} \quad (152)$$

10.25 Reaction re43

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

Name re095

Reaction equation



Reactant

Table 78: Properties of each reactant.

Id	Name	SBO
s16	Th17	

Modifier

Table 79: Properties of each modifier.

Id	Name	SBO
s16	Th17	

Product

Table 80: Properties of each product.

Id	Name	SBO
s17	emT	

Kinetic Law

Derived unit contains undeclared units

$$v_{25} = \text{vol}(c2) \cdot \text{parameter}_{.15} \cdot [s16]$$

(154)

10.26 Reaction `re44`

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

Name `re096`

Reaction equation



Reactant

Table 81: Properties of each reactant.

Id	Name	SBO
s13	Th1	

Modifier

Table 82: Properties of each modifier.

Id	Name	SBO
s13	Th1	

Product

Table 83: Properties of each product.

Id	Name	SBO
s17	emT	

Kinetic Law

Derived unit contains undeclared units

$$v_{26} = \text{vol}(c2) \cdot \text{parameter}_{.15} \cdot [s13]$$

(156)

10.27 Reaction re45

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

Name re097

Reaction equation



Reactant

Table 84: Properties of each reactant.

Id	Name	SBO
s15	iTreg	

Modifier

Table 85: Properties of each modifier.

Id	Name	SBO
s15	iTreg	

Product

Table 86: Properties of each product.

Id	Name	SBO
s17	emT	

Kinetic Law

Derived unit contains undeclared units

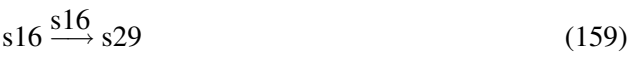
$$v_{27} = \text{vol}(c2) \cdot \text{parameter_15} \cdot [s15] \quad (158)$$

10.28 Reaction re46

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

Name re098

Reaction equation



Reactant

Table 87: Properties of each reactant.

Id	Name	SBO
s16	Th17	

Modifier

Table 88: Properties of each modifier.

Id	Name	SBO
s16	Th17	

Product

Table 89: Properties of each product.

Id	Name	SBO
s29	cmT	

Kinetic Law

Derived unit contains undeclared units

$$v_{28} = \text{parameter_16} \cdot [s16]$$

(160)

10.29 Reaction re47

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

Name re099

Reaction equation



Reactant

Table 90: Properties of each reactant.

Id	Name	SBO
s13	Th1	

Modifier

Table 91: Properties of each modifier.

Id	Name	SBO
s13	Th1	

Product

Table 92: Properties of each product.

Id	Name	SBO
s29	cmT	

Kinetic Law

Derived unit contains undeclared units

$$v_{29} = \text{parameter_16} \cdot [s13] \tag{162}$$

10.30 Reaction re49

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

Name re100

Reaction equation



Reactant

Table 93: Properties of each reactant.

Id	Name	SBO
s15	iTreg	

Modifier

Table 94: Properties of each modifier.

Id	Name	SBO
s15	iTreg	

Product

Table 95: Properties of each product.

Id	Name	SBO
s29	cmT	

Kinetic Law

Derived unit contains undeclared units

$$v_{30} = \text{parameter_16} \cdot [\text{s15}] \quad (164)$$

10.31 Reaction `reaction_1`

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

Name re060

Reaction equation



Reactant

Table 96: Properties of each reactant.

Id	Name	SBO
s3	Ep	

Modifier

Table 97: Properties of each modifier.

Id	Name	SBO
s3	Ep	

Product

Table 98: Properties of each product.

Id	Name	SBO
s2	E	

Kinetic Law

Derived unit contains undeclared units

$$v_{31} = \text{vol}(c4) \cdot \text{parameter_21} \cdot [s3] \quad (166)$$

10.32 Reaction `reaction_2`

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

Name `re057`

Reaction equation



Reactant

Table 99: Properties of each reactant.

Id	Name	SBO
species_5	Edead	

Modifier

Table 100: Properties of each modifier.

Id	Name	SBO
species_5	Edead	

Product

Table 101: Properties of each product.

Id	Name	SBO
s2	E	

Kinetic Law

Derived unit contains undeclared units

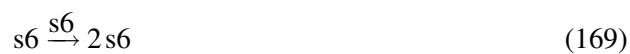
$$v_{32} = \text{vol}(c4) \cdot \text{parameter_21} \cdot [\text{species_5}] \quad (168)$$

10.33 Reaction [reaction_3](#)

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

Name re102

Reaction equation



Reactant

Table 102: Properties of each reactant.

Id	Name	SBO
s6	HP	

Modifier

Table 103: Properties of each modifier.

Id	Name	SBO
s6	HP	

Product

Table 104: Properties of each product.

Id	Name	SBO
s6	HP	

Kinetic Law

Derived unit contains undeclared units

$$v_{33} = \text{vol}(c2) \cdot \text{function_5}(\text{parameter_20}, [s6], \text{parameter_93}) \quad (170)$$

$$\text{function_5}(k, \text{sub}, c) = \frac{k \cdot \text{sub}}{c + \text{sub}} \quad (171)$$

$$\text{function_5}(k, \text{sub}, c) = \frac{k \cdot \text{sub}}{c + \text{sub}} \quad (172)$$

10.34 Reaction `reaction_4`

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

Name re101

Reaction equation



Reactant

Table 105: Properties of each reactant.

Id	Name	SBO
s6	HP	

Modifier

Table 106: Properties of each modifier.

Id	Name	SBO
s6	HP	

Kinetic Law

Derived unit contains undeclared units

$$v_{34} = \text{vol}(c2) \cdot \text{parameter_19} \cdot [s6] \quad (174)$$

10.35 Reaction `reaction_5`

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

Name re052

Reaction equation



Reactant

Table 107: Properties of each reactant.

Id	Name	SBO
s1	HP	

Modifier

Table 108: Properties of each modifier.

Id	Name	SBO
s1	HP	

Product

Table 109: Properties of each product.

Id	Name	SBO
s1	HP	

Kinetic Law

Derived unit contains undeclared units

$$v_{35} = \text{vol}(c1) \cdot \text{function_5}(\text{parameter_20}, [s1], \text{parameter_93}) \quad (176)$$

$$\text{function_5}(k, \text{sub}, c) = \frac{k \cdot \text{sub}}{c + \text{sub}} \quad (177)$$

$$\text{function_5}(k, \text{sub}, c) = \frac{k \cdot \text{sub}}{c + \text{sub}} \quad (178)$$

10.36 Reaction `reaction_6`

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

Name re065

Reaction equation



Reactant

Table 110: Properties of each reactant.

Id	Name	SBO
s1	HP	

Modifier

Table 111: Properties of each modifier.

Id	Name	SBO
s1	HP	

Kinetic Law

Derived unit contains undeclared units

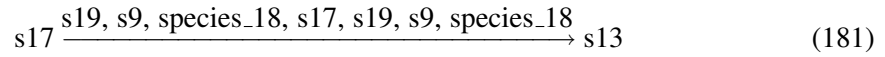
$$v_{36} = \text{vol}(c1) \cdot \text{parameter_19} \cdot [s1] \quad (180)$$

10.37 Reaction `reaction_10`

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

Name re103

Reaction equation



Reactant

Table 112: Properties of each reactant.

Id	Name	SBO
s17	emT	

Modifiers

Table 113: Properties of each modifier.

Id	Name	SBO
s19	M1	
s9	eDC	
species_18	eDCLB	
s17	emT	
s19	M1	
s9	eDC	
species_18	eDCLB	

Product

Table 114: Properties of each product.

Id	Name	SBO
s13	Th1	

Kinetic Law

Derived unit contains undeclared units

$$v_{37} = \text{vol}(c2) \cdot \text{function_6}([s17], \text{parameter_23}, [s19], \text{parameter_23}, [s9], \text{parameter_100}, [\text{species_18}]) \quad (182)$$

$$\text{function_6}(\text{substrate}, k1, a1, k2, a2, k3, a3) = \text{substrate} \cdot (k1 \cdot a1 + k2 \cdot a2 + k3 \cdot a3) \quad (183)$$

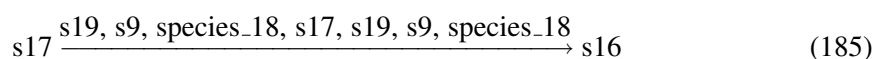
$$\text{function_6}(\text{substrate}, k1, a1, k2, a2, k3, a3) = \text{substrate} \cdot (k1 \cdot a1 + k2 \cdot a2 + k3 \cdot a3) \quad (184)$$

10.38 Reaction `reaction_11`

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

Name `re104`

Reaction equation



Reactant

Table 115: Properties of each reactant.

Id	Name	SBO
s17	emT	

Modifiers

Table 116: Properties of each modifier.

Id	Name	SBO
s19	M1	
s9	eDC	
species_18	eDCLB	
s17	emT	
s19	M1	
s9	eDC	
species_18	eDCLB	

Product

Table 117: Properties of each product.

Id	Name	SBO
s16	Th17	

Kinetic Law

Derived unit contains undeclared units

$$v_{38} = \text{vol}(c2) \cdot \text{function_6}([s17], \text{parameter_22}, [s19], \text{parameter_22}, [s9], \text{parameter_99}, [\text{spec}(186), 18]) \quad (186)$$

$$\text{function_6}(\text{substrate}, k1, a1, k2, a2, k3, a3) = \text{substrate} \cdot (k1 \cdot a1 + k2 \cdot a2 + k3 \cdot a3) \quad (187)$$

$$\text{function_6}(\text{substrate}, k1, a1, k2, a2, k3, a3) = \text{substrate} \cdot (k1 \cdot a1 + k2 \cdot a2 + k3 \cdot a3) \quad (188)$$

10.39 Reaction [reaction_12](#)

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

Name re119

Reaction equation



Reactant

Table 118: Properties of each reactant.

Id	Name	SBO
s16	Th17	

Modifier

Table 119: Properties of each modifier.

Id	Name	SBO
s16	Th17	

Kinetic Law

Derived unit contains undeclared units

$$v_{39} = \text{vol}(c2) \cdot \text{parameter_64} \cdot [s16] \quad (190)$$

10.40 Reaction [reaction_13](#)

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

Name re106

Reaction equation



Modifiers

Table 120: Properties of each modifier.

Id	Name	SBO
s26	eDC	
s26	eDC	

Product

Table 121: Properties of each product.

Id	Name	SBO
s28	nT	

Kinetic Law

Derived unit contains undeclared units

$$v_{40} = \text{vol}(c3) \cdot \text{function_7}(\text{parameter_33}, [s26], \text{parameter_63}, \text{parameter_86}, \text{parameter_35}) \quad (192)$$

$$\text{function_7}(k, A, n, kA, c) = c + k \cdot \frac{A^n}{A^n + kA^n} \quad (193)$$

$$\text{function_7}(k, A, n, kA, c) = c + k \cdot \frac{A^n}{A^n + kA^n} \quad (194)$$

10.41 Reaction [reaction_14](#)

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

Name re107

Reaction equation



Reactant

Table 122: Properties of each reactant.

Id	Name	SBO
s28	nT	

Modifier

Table 123: Properties of each modifier.

Id	Name	SBO
s28	nT	

Kinetic Law

Derived unit contains undeclared units

$$v_{41} = \text{vol}(c3) \cdot \text{parameter}_{.34} \cdot [s28] \quad (196)$$

10.42 Reaction `reaction_16`

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

Name re061

Reaction equation



Reactant

Table 124: Properties of each reactant.

Id	Name	SBO
s1	HP	

Modifiers

Table 125: Properties of each modifier.

Id	Name	SBO
s3	Ep	

Id	Name	SBO
s1	HP	
s3	Ep	

Product

Table 126: Properties of each product.

Id	Name	SBO
s6	HP	

Kinetic Law

Derived unit contains undeclared units

$$v_{42} = \text{function_3}([s1], [s3], \text{parameter_37}) \quad (198)$$

$$\text{function_3}(\text{substrate}, a1, k1) = \text{substrate} \cdot a1 \cdot k1 \quad (199)$$

10.43 Reaction [reaction_17](#)

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

Name re062

Reaction equation



Reactants

Table 127: Properties of each reactant.

Id	Name	SBO
s4	iDC	
s1	HP	

Modifiers

Table 128: Properties of each modifier.

Id	Name	SBO
s4	iDC	
s1	HP	

Product

Table 129: Properties of each product.

Id	Name	SBO
s25	tDC	

Kinetic Law

Derived unit contains undeclared units

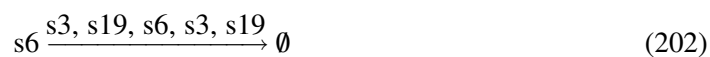
$$v_{43} = \text{parameter_56} \cdot [s4] \cdot [s1] \quad (201)$$

10.44 Reaction `reaction_19`

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

Name re067

Reaction equation



Reactant

Table 130: Properties of each reactant.

Id	Name	SBO
s6	HP	

Modifiers

Table 131: Properties of each modifier.

Id	Name	SBO
s3	Ep	
s19	M1	
s6	HP	
s3	Ep	
s19	M1	

Kinetic Law

Derived unit contains undeclared units

$$v_{44} = \text{vol}(c2) \cdot \text{function_9}([s6], \text{parameter_48}, \text{parameter_39}, [s3], \text{parameter_38}, [s19]) \quad (203)$$

$$\text{function_9}(\text{substrate}, k, k1, a1, k2, a2) = \text{substrate} \cdot k \cdot (k1 \cdot a1 + k2 \cdot a2) \quad (204)$$

$$\text{function_9}(\text{substrate}, k, k1, a1, k2, a2) = \text{substrate} \cdot k \cdot (k1 \cdot a1 + k2 \cdot a2) \quad (205)$$

10.45 Reaction `reaction_20`

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

Name re053

Reaction equation



Reactant

Table 132: Properties of each reactant.

Id	Name	SBO
s1	HP	

Modifiers

Table 133: Properties of each modifier.

Id	Name	SBO
s3	Ep	
s1	HP	
s3	Ep	

Kinetic Law

Derived unit contains undeclared units

$$v_{45} = \text{vol}(c1) \cdot \text{function_3}([s1], [s3], \text{parameter_54}) \quad (207)$$

$$\text{function_3}(\text{substrate}, a1, k1) = \text{substrate} \cdot a1 \cdot k1 \quad (208)$$

$$\text{function_3}(\text{substrate}, a1, k1) = \text{substrate} \cdot a1 \cdot k1 \quad (209)$$

10.46 Reaction [reaction_24](#)

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

Name re068

Reaction equation



Modifiers

Table 134: Properties of each modifier.

Id	Name	SBO
s3	Ep	
s19	M1	
s9	eDC	
s3	Ep	
s19	M1	
s9	eDC	

Product

Table 135: Properties of each product.

Id	Name	SBO
<code>species_1</code>	iDC	

Kinetic Law

Derived unit contains undeclared units

$$v_{46} = \text{vol}(c2) \cdot \text{function_10}(\text{parameter_66}, \text{parameter_41}, [s3], \text{parameter_63}, \text{parameter_40}, [s19], \text{parameter_85}, [s9], \text{parameter_85}) \quad (211)$$

$$\text{function_10}(c, k, A, n, kA, B, kB, C, kC) = c + k \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} \right) \quad (212)$$

$$\text{function_10}(c, k, A, n, kA, B, kB, C, kC) = c + k \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} \right) \quad (213)$$

10.47 Reaction `reaction_27`

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

Name `re069`

Reaction equation



Modifiers

Table 136: Properties of each modifier.

Id	Name	SBO
<code>s19</code>	M1	
<code>s3</code>	Ep	
<code>s9</code>	eDC	
<code>s19</code>	M1	
<code>s3</code>	Ep	
<code>s9</code>	eDC	

Product

Table 137: Properties of each product.

Id	Name	SBO
s22	M0	

Kinetic Law

Derived unit contains undeclared units

$$v_{47} = \text{vol}(c2) \cdot \text{function_10}(\text{parameter_65}, \text{parameter_41}, [s19], \text{parameter_63}, \text{parameter_85}, [s3], \text{parameter_40}, [s9], \text{parameter_85}) \quad (215)$$

$$\text{function_10}(c, k, A, n, kA, B, kB, C, kC) = c + k \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} \right) \quad (216)$$

$$\text{function_10}(c, k, A, n, kA, B, kB, C, kC) = c + k \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} \right) \quad (217)$$

10.48 Reaction [reaction_31](#)

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

Name re111

Reaction equation



Reactant

Table 138: Properties of each reactant.

Id	Name	SBO
species_1	iDC	

Modifier

Table 139: Properties of each modifier.

Id	Name	SBO
species_1	iDC	

Kinetic Law

Derived unit contains undeclared units

$$v_{48} = \text{vol}(c2) \cdot \text{parameter_44} \cdot [\text{species_1}] \quad (219)$$

10.49 Reaction `reaction_32`

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

Name `re112`

Reaction equation



Reactant

Table 140: Properties of each reactant.

Id	Name	SBO
s22	M0	

Modifier

Table 141: Properties of each modifier.

Id	Name	SBO
s22	M0	

Kinetic Law

Derived unit contains undeclared units

$$v_{49} = \text{vol}(c2) \cdot \text{parameter_45} \cdot [s22] \quad (221)$$

10.50 Reaction [reaction_37](#)

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

Name re117

Reaction equation



Reactant

Table 142: Properties of each reactant.

Id	Name	SBO
s19	M1	

Modifier

Table 143: Properties of each modifier.

Id	Name	SBO
s19	M1	

Kinetic Law

Derived unit contains undeclared units

$$v_{50} = \text{vol}(c2) \cdot \text{parameter_62} \cdot [s19]$$

(223)

10.51 Reaction [reaction_38](#)

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

Name re118

Reaction equation



Reactant

Table 144: Properties of each reactant.

Id	Name	SBO
s21	M2	

Modifier

Table 145: Properties of each modifier.

Id	Name	SBO
s21	M2	

Kinetic Law

Derived unit contains undeclared units

$$v_{51} = \text{vol}(c2) \cdot \text{parameter}.62 \cdot [s21] \quad (225)$$

10.52 Reaction `reaction_39`

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

Name re120

Reaction equation



Reactant

Table 146: Properties of each reactant.

Id	Name	SBO
s13	Th1	

Modifier

Table 147: Properties of each modifier.

Id	Name	SBO
s13	Th1	

Kinetic Law

Derived unit contains undeclared units

$$v_{52} = \text{vol}(c2) \cdot \text{parameter_64} \cdot [s13] \quad (227)$$

10.53 Reaction [reaction_40](#)

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

Name re121

Reaction equation



Reactant

Table 148: Properties of each reactant.

Id	Name	SBO
s15	iTreg	

Modifier

Table 149: Properties of each modifier.

Id	Name	SBO
s15	iTreg	

Kinetic Law

Derived unit contains undeclared units

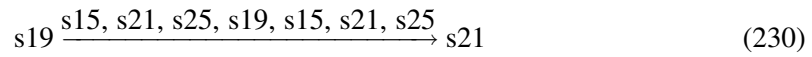
$$v_{53} = \text{vol}(c2) \cdot \text{parameter_64} \cdot [s15] \quad (229)$$

10.54 Reaction [reaction_7](#)

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

Name re071

Reaction equation



Reactant

Table 150: Properties of each reactant.

Id	Name	SBO
s19	M1	

Modifiers

Table 151: Properties of each modifier.

Id	Name	SBO
s15	iTreg	
s21	M2	
s25	tDC	
s19	M1	
s15	iTreg	
s21	M2	
s25	tDC	

Product

Table 152: Properties of each product.

Id	Name	SBO
s21	M2	

Kinetic Law

Derived unit contains undeclared units

$$v_{54} = \text{vol}(c2) \cdot \text{function_4}(\text{parameter_90}, [s_{19}], [s_{15}], \text{parameter_63}, \text{parameter_92}, [s_{21}], \text{parameter_92}, [s_{25}], \text{parameter_92}) \quad (231)$$

$$\begin{aligned} \text{function_4}(k, \text{substrate}, A, n, kA, B, kB, C, kC) = & k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} \right. \\ & \left. + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} \right) \end{aligned} \tag{232}$$

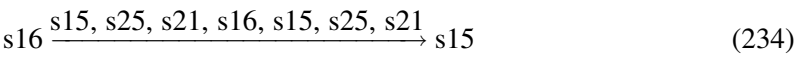
$$\begin{aligned} \text{function_4}(k, \text{substrate}, A, n, kA, B, kB, C, kC) = & k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} \right. \\ & \left. + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} \right) \end{aligned} \tag{233}$$

10.55 Reaction `reaction_8`

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

Name `re094`

Reaction equation



Reactant

Table 153: Properties of each reactant.

Id	Name	SBO
s16	Th17	

Modifiers

Table 154: Properties of each modifier.

Id	Name	SBO
s15	iTreg	
s25	tDC	
s21	M2	
s16	Th17	
s15	iTreg	
s25	tDC	
s21	M2	

Product

Table 155: Properties of each product.

Id	Name	SBO
s15	iTreg	

Kinetic Law

Derived unit contains undeclared units

$$v_{55} = \text{vol}(c2) \cdot \text{function_4}(\text{parameter_88}, [s16], [s15], \text{parameter_63}, \text{parameter_92}, [s25], \text{parameter_92}, [s21], \text{parameter_92}) \quad (235)$$

$$\text{function_4}(k, \text{substrate}, A, n, kA, B, kB, C, kC) = k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} \right) \quad (236)$$

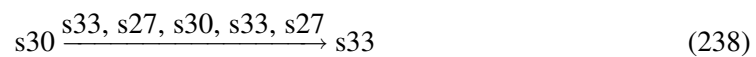
$$\text{function_4}(k, \text{substrate}, A, n, kA, B, kB, C, kC) = k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} \right) \quad (237)$$

10.56 Reaction [reaction_9](#)

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

Name re092

Reaction equation



Reactant

Table 156: Properties of each reactant.

Id	Name	SBO
s30	Th17	

Modifiers

Table 157: Properties of each modifier.

Id	Name	SBO
s33	iTreg	
s27	tDC	
s30	Th17	
s33	iTreg	
s27	tDC	

Product

Table 158: Properties of each product.

Id	Name	SBO
s33	iTreg	

Kinetic Law

Derived unit contains undeclared units

$$v_{56} = \text{vol}(c3) \cdot \text{function_11}(\text{parameter_88}, [s30], [s33], \text{parameter_63}, \text{parameter_92}, [s27], \text{parameter_92}) \quad (239)$$

$$\text{function_11}(k, \text{substrate}, A, n, kA, B, kB) = k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} \right) \quad (240)$$

$$\text{function_11}(k, \text{substrate}, A, n, kA, B, kB) = k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} \right) \quad (241)$$

10.57 Reaction [reaction_15](#)

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

Name re122

Reaction equation



Reactants

Table 159: Properties of each reactant.

Id	Name	SBO
s22	M0	
s6	HP	

Modifiers

Table 160: Properties of each modifier.

Id	Name	SBO
s22	M0	
s6	HP	

Product

Table 161: Properties of each product.

Id	Name	SBO
s19	M1	

Kinetic Law

Derived unit contains undeclared units

$$v_{57} = \text{vol}(c2) \cdot \text{parameter_59} \cdot [s22] \cdot [s6] \quad (243)$$

10.58 Reaction `reaction_18`

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

Name re123

Reaction equation



Reactants

Table 162: Properties of each reactant.

Id	Name	SBO
s22	M0	
s6	HP	

Modifiers

Table 163: Properties of each modifier.

Id	Name	SBO
s22	M0	
s6	HP	

Product

Table 164: Properties of each product.

Id	Name	SBO
s21	M2	

Kinetic Law

Derived unit contains undeclared units

$$v_{58} = \text{vol}(c2) \cdot \text{parameter}_{.60} \cdot [s22] \cdot [s6] \quad (245)$$

10.59 Reaction `reaction_21`

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

Name re116

Reaction equation



Reactant

Table 165: Properties of each reactant.

Id	Name	SBO
s26	eDC	

Modifier

Table 166: Properties of each modifier.

Id	Name	SBO
s26	eDC	

Kinetic Law

Derived unit contains undeclared units

$$v_{59} = \text{vol}(c3) \cdot \text{parameter}_{.46} \cdot [s26] \quad (247)$$

10.60 Reaction `reaction_22`

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

Name re124

Reaction equation



Reactant

Table 167: Properties of each reactant.

Id	Name	SBO
s27	tDC	

Modifier

Table 168: Properties of each modifier.

Id	Name	SBO
s27	tDC	

Kinetic Law

Derived unit contains undeclared units

$$v_{60} = \text{vol}(c3) \cdot \text{parameter_46} \cdot [s27] \quad (249)$$

10.61 Reaction `reaction_23`

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

Name `re127`

Reaction equation



Reactant

Table 169: Properties of each reactant.

Id	Name	SBO
<code>species_1</code>	iDC	

Modifiers

Table 170: Properties of each modifier.

Id	Name	SBO
<code>species_1</code>	iDC	
<code>s4</code>	iDC	

Product

Table 171: Properties of each product.

Id	Name	SBO
<code>s4</code>	iDC	

Kinetic Law

Derived unit contains undeclared units

$$v_{61} = \text{function_12}(V, [\text{species_1}], k, [s4]) \quad (251)$$

$$\text{function_12}(V, s, k, P) = V \cdot (s - k \cdot P) \quad (252)$$

Table 172: Properties of each parameter.

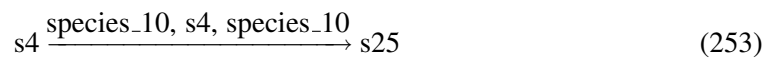
Id	Name	SBO	Value	Unit	Constant
V	V		94.376		<input checked="" type="checkbox"/>
k	k		1.359		<input checked="" type="checkbox"/>

10.62 Reaction [reaction_25](#)

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

Name re128

Reaction equation



Reactant

Table 173: Properties of each reactant.

Id	Name	SBO
s4	iDC	

Modifiers

Table 174: Properties of each modifier.

Id	Name	SBO
species_10	LB	
s4	iDC	
species_10	LB	

Product

Table 175: Properties of each product.

Id	Name	SBO
s25	tDC	

Kinetic Law

Derived unit contains undeclared units

$$v_{62} = \text{function_3}([s4], [\text{species_10}], \text{parameter_77}) \quad (254)$$

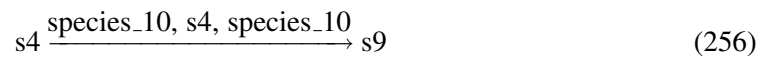
$$\text{function_3}(\text{substrate}, a1, k1) = \text{substrate} \cdot a1 \cdot k1 \quad (255)$$

10.63 Reaction [reaction_26](#)

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

Name re129

Reaction equation



Reactant

Table 176: Properties of each reactant.

Id	Name	SBO
s4	iDC	

Modifiers

Table 177: Properties of each modifier.

Id	Name	SBO
species_10	LB	
s4	iDC	
species_10	LB	

Product

Table 178: Properties of each product.

Id	Name	SBO
s9	eDC	

Kinetic Law**Derived unit** contains undeclared units

$$v_{63} = \text{function_3}([s4], [\text{species_10}], \text{parameter_78}) \quad (257)$$

$$\text{function_3}(\text{substrate}, a1, k1) = \text{substrate} \cdot a1 \cdot k1 \quad (258)$$

10.64 Reaction *reaction_28*

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

Name re130**Reaction equation****Reactant**

Table 179: Properties of each reactant.

Id	Name	SBO
species_10	LB	

Modifier

Table 180: Properties of each modifier.

Id	Name	SBO
species_10	LB	

Kinetic Law**Derived unit** contains undeclared units

$$v_{64} = \text{vol}(c1) \cdot \text{parameter_94} \cdot [\text{species_10}] \quad (260)$$

10.65 Reaction `reaction_29`

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

Name `re131`

Reaction equation



Product

Table 181: Properties of each product.

Id	Name	SBO
s15	iTreg	

Kinetic Law

Derived unit contains undeclared units

$$v_{65} = \text{vol}(\text{c2}) \cdot \text{function_13}(\text{parameter_82})$$

(262)

$$\text{function_13}(v) = v$$

(263)

$$\text{function_13}(v) = v$$

(264)

10.66 Reaction `reaction_30`

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

Name `re132`

Reaction equation



Product

Table 182: Properties of each product.

Id	Name	SBO
s13	Th1	

Kinetic Law

Derived unit contains undeclared units

$$v_{66} = \text{vol}(c2) \cdot \text{function_13}(\text{parameter_83})$$

(266)

$$\text{function_13}(v) = v$$

(267)

$$\text{function_13}(v) = v$$

(268)

10.67 Reaction `reaction_33`

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

Name re133

Reaction equation



Product

Table 183: Properties of each product.

Id	Name	SBO
s16	Th17	

Kinetic Law

Derived unit contains undeclared units

$$v_{67} = \text{vol}(c2) \cdot \text{function_13}(\text{parameter_84})$$

(270)

$$\text{function_13}(v) = v$$

(271)

$$\text{function_13}(v) = v$$

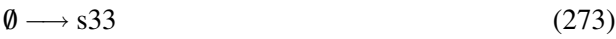
(272)

10.68 Reaction `reaction_34`

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

Name re134

Reaction equation



Product

Table 184: Properties of each product.

Id	Name	SBO
s33	iTreg	

Kinetic Law

Derived unit contains undeclared units

$$v_{68} = \text{vol}(\text{c3}) \cdot \text{function_13}(\text{parameter_79})$$

(274)

$$\text{function_13}(v) = v$$

(275)

$$\text{function_13}(v) = v$$

(276)

10.69 Reaction `reaction_35`

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

Name re135

Reaction equation



Product

Table 185: Properties of each product.

Id	Name	SBO
s31	Th1	

Kinetic Law

Derived unit contains undeclared units

$$v_{69} = \text{vol}(\text{c3}) \cdot \text{function_13}(\text{parameter_80})$$

(278)

$$\text{function_13}(v) = v \quad (279)$$

$$\text{function_13}(v) = v \quad (280)$$

10.70 Reaction [reaction_36](#)

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

Name re136

Reaction equation



Product

Table 186: Properties of each product.

Id	Name	SBO
s30	Th17	

Kinetic Law

Derived unit contains undeclared units

$$v_{70} = \text{vol}(\text{c3}) \cdot \text{function_13}(\text{parameter_81}) \quad (282)$$

$$\text{function_13}(v) = v \quad (283)$$

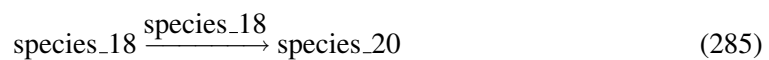
$$\text{function_13}(v) = v \quad (284)$$

10.71 Reaction [reaction_41](#)

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

Name re137

Reaction equation



Reactant

Table 187: Properties of each reactant.

Id	Name	SBO
species_18	eDCLB	

Modifier

Table 188: Properties of each modifier.

Id	Name	SBO
species_18	eDCLB	

Product

Table 189: Properties of each product.

Id	Name	SBO
species_20	eDCLB	

Kinetic Law

Derived unit contains undeclared units

$$v_{71} = \text{parameter_9} \cdot [\text{species_18}] \quad (286)$$

10.72 Reaction [reaction_42](#)

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

Name re138

Reaction equation



Reactant

Table 190: Properties of each reactant.

Id	Name	SBO
species_20	eDCLB	

Modifier

Table 191: Properties of each modifier.

Id	Name	SBO
species_20	eDCLB	

Kinetic Law

Derived unit contains undeclared units

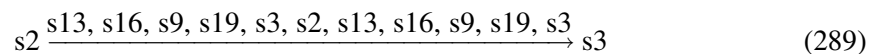
$$v_{72} = \text{vol}(c3) \cdot \text{parameter_46} \cdot [\text{species_20}] \quad (288)$$

10.73 Reaction [reaction_43](#)

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

Name re139

Reaction equation



Reactant

Table 192: Properties of each reactant.

Id	Name	SBO
s2	E	

Modifiers

Table 193: Properties of each modifier.

Id	Name	SBO
s13	Th1	
s16	Th17	
s9	eDC	
s19	M1	
s3	Ep	
s2	E	

Id	Name	SBO
s13	Th1	
s16	Th17	
s9	eDC	
s19	M1	
s3	Ep	

Product

Table 194: Properties of each product.

Id	Name	SBO
s3	Ep	

Kinetic Law

Derived unit contains undeclared units

$$v_{73} = \text{vol}(c4) \cdot \text{function_2}(\text{parameter_105}, [s2], [s13], \text{parameter_63}, \text{parameter_91}, [s16], \text{parameter_91}, [s9], \text{parameter_91}, [s19], \text{parameter_91}, [s3], \text{parameter_106}) \quad (290)$$

$$\begin{aligned} & \text{function_2}(k, \text{substrate}, A, n, kA, B, kB, C, kC, D, kD, E, kE) \\ &= k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} + \frac{D^n}{D^n + kD^n} + \frac{E^n}{E^n + kE^n} \right) \end{aligned} \quad (291)$$

$$\begin{aligned} & \text{function_2}(k, \text{substrate}, A, n, kA, B, kB, C, kC, D, kD, E, kE) \\ &= k \cdot \text{substrate} \cdot \left(\frac{A^n}{A^n + kA^n} + \frac{B^n}{B^n + kB^n} + \frac{C^n}{C^n + kC^n} + \frac{D^n}{D^n + kD^n} + \frac{E^n}{E^n + kE^n} \right) \end{aligned} \quad (292)$$

10.74 Reaction [reaction_44](#)

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

Name re140

Reaction equation



Reactant

Table 195: Properties of each reactant.

Id	Name	SBO
species_20	eDCLB	

Modifier

Table 196: Properties of each modifier.

Id	Name	SBO
species_20	eDCLB	

Kinetic Law

Derived unit contains undeclared units

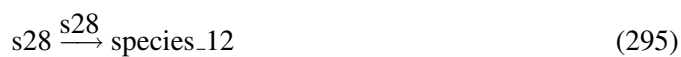
$$v_{74} = \text{vol}(c3) \cdot \text{parameter_46} \cdot [\text{species_20}] \quad (294)$$

10.75 Reaction [reaction_45](#)

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

Name nTh1 creation

Reaction equation



Reactant

Table 197: Properties of each reactant.

Id	Name	SBO
s28	nT	

Modifier

Table 198: Properties of each modifier.

Id	Name	SBO
s28	nT	

Product

Table 199: Properties of each product.

Id	Name	SBO
species_12	nTh1	

Kinetic Law

Derived unit contains undeclared units

$$v_{75} = k1 \cdot [s28] \quad (296)$$

Table 200: Properties of each parameter.

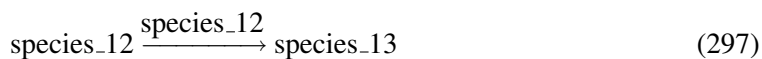
Id	Name	SBO	Value	Unit	Constant
k1	k1		0.003		<input checked="" type="checkbox"/>

10.76 Reaction [reaction_46](#)

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

Name nTh1 trans

Reaction equation



Reactant

Table 201: Properties of each reactant.

Id	Name	SBO
species_12	nTh1	

Modifier

Table 202: Properties of each modifier.

Id	Name	SBO
species_12	nTh1	

Id	Name	SBO
----	------	-----

Product

Table 203: Properties of each product.

Id	Name	SBO
species_13	nTh1_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_{76} = \text{vol}(c1) \cdot k1 \cdot [\text{species_12}] \quad (298)$$

Table 204: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.106		<input checked="" type="checkbox"/>

10.77 Reaction [reaction_47](#)

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

Name nTh1_LP deg

Reaction equation



Reactant

Table 205: Properties of each reactant.

Id	Name	SBO
species_13	nTh1_LP	

Modifier

Table 206: Properties of each modifier.

Id	Name	SBO
species_13	nTh1_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_{77} = \text{vol}(c1) \cdot k1 \cdot [\text{species_13}] \quad (300)$$

Table 207: Properties of each parameter.

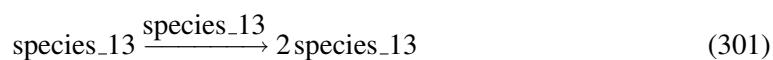
Id	Name	SBO	Value	Unit	Constant
k1	k1		0.158		<input checked="" type="checkbox"/>

10.78 Reaction [reaction_48](#)

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

Name nTh1_LP expansion

Reaction equation



Reactant

Table 208: Properties of each reactant.

Id	Name	SBO
species_13	nTh1_LP	

Modifier

Table 209: Properties of each modifier.

Id	Name	SBO
species_13	nTh1_LP	

Product

Table 210: Properties of each product.

Id	Name	SBO
species_13	nTh1_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_{78} = \text{vol}(c1) \cdot k1 \cdot [\text{species_13}] \quad (302)$$

Table 211: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		<input checked="" type="checkbox"/>

10.79 Reaction [reaction_49](#)

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

Name nTh1 deg

Reaction equation



Reactant

Table 212: Properties of each reactant.

Id	Name	SBO
species_12	nTh1	

Modifier

Table 213: Properties of each modifier.

Id	Name	SBO
species_12	nTh1	

Id	Name	SBO
----	------	-----

Kinetic Law

Derived unit contains undeclared units

$$v_{79} = \text{vol}(c1) \cdot k1 \cdot [\text{species_12}] \quad (304)$$

Table 214: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.108		<input checked="" type="checkbox"/>

10.80 Reaction [reaction_50](#)

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

Name nTh17 creation

Reaction equation



Reactant

Table 215: Properties of each reactant.

Id	Name	SBO
s28	nT	

Modifier

Table 216: Properties of each modifier.

Id	Name	SBO
s28	nT	

Product

Table 217: Properties of each product.

Id	Name	SBO
species_14	nTh17	

Kinetic Law

Derived unit contains undeclared units

$$v_{80} = k1 \cdot [s28] \quad (306)$$

Table 218: Properties of each parameter.

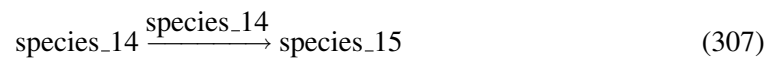
Id	Name	SBO	Value	Unit	Constant
k1	k1		0.002		<input checked="" type="checkbox"/>

10.81 Reaction [reaction_51](#)

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

Name nTh17 trans

Reaction equation



Reactant

Table 219: Properties of each reactant.

Id	Name	SBO
species_14	nTh17	

Modifier

Table 220: Properties of each modifier.

Id	Name	SBO
species_14	nTh17	

Product

Table 221: Properties of each product.

Id	Name	SBO
species_15	nTh17_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_{81} = \text{vol}(c1) \cdot k1 \cdot [\text{species_14}] \quad (308)$$

Table 222: Properties of each parameter.

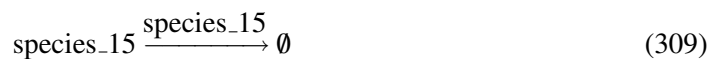
Id	Name	SBO	Value	Unit	Constant
k1	k1		0.117		<input checked="" type="checkbox"/>

10.82 Reaction [reaction_52](#)

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

Name nTh17_LP deg

Reaction equation



Reactant

Table 223: Properties of each reactant.

Id	Name	SBO
species_15	nTh17_LP	

Modifier

Table 224: Properties of each modifier.

Id	Name	SBO
species_15	nTh17_LP	

Id	Name	SBO
----	------	-----

Kinetic Law

Derived unit contains undeclared units

$$v_{82} = \text{vol}(c1) \cdot k1 \cdot [\text{species}_15] \quad (310)$$

Table 225: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		<input checked="" type="checkbox"/>

10.83 Reaction [reaction_53](#)

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

Name nTh17 deg

Reaction equation



Reactant

Table 226: Properties of each reactant.

Id	Name	SBO
species_14	nTh17	

Modifier

Table 227: Properties of each modifier.

Id	Name	SBO
species_14	nTh17	

Kinetic Law

Derived unit contains undeclared units

$$v_{83} = \text{vol}(c1) \cdot k1 \cdot [\text{species_14}] \quad (312)$$

Table 228: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		<input checked="" type="checkbox"/>

10.84 Reaction [reaction_54](#)

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

Name nTreg creation

Reaction equation



Reactant

Table 229: Properties of each reactant.

Id	Name	SBO
s28	nT	

Modifier

Table 230: Properties of each modifier.

Id	Name	SBO
s28	nT	

Product

Table 231: Properties of each product.

Id	Name	SBO
species_16	nTreg	

Kinetic Law

Derived unit contains undeclared units

$$v_{84} = k1 \cdot [s28] \quad (314)$$

Table 232: Properties of each parameter.

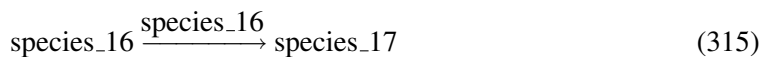
Id	Name	SBO	Value	Unit	Constant
k1	k1		0.003		<input checked="" type="checkbox"/>

10.85 Reaction `reaction_55`

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

Name nTreg trans

Reaction equation



Reactant

Table 233: Properties of each reactant.

Id	Name	SBO
species_16	nTreg	

Modifier

Table 234: Properties of each modifier.

Id	Name	SBO
species_16	nTreg	

Product

Table 235: Properties of each product.

Id	Name	SBO
species_17	nTreg_LP	

Id	Name	SBO
----	------	-----

Kinetic Law

Derived unit contains undeclared units

$$v_{85} = \text{vol}(c1) \cdot k1 \cdot [\text{species}_16] \quad (316)$$

Table 236: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		<input checked="" type="checkbox"/>

10.86 Reaction [reaction_56](#)

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

Name nTreg_LP deg

Reaction equation



Reactant

Table 237: Properties of each reactant.

Id	Name	SBO
species_17	nTreg_LP	

Modifier

Table 238: Properties of each modifier.

Id	Name	SBO
species_17	nTreg_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_{86} = \text{vol}(c1) \cdot k1 \cdot [\text{species.17}] \quad (318)$$

Table 239: Properties of each parameter.

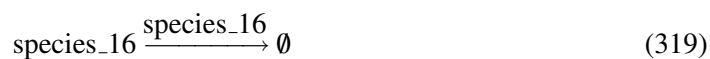
Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		<input checked="" type="checkbox"/>

10.87 Reaction [reaction_57](#)

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

Name nTreg deg

Reaction equation



Reactant

Table 240: Properties of each reactant.

Id	Name	SBO
species_16	nTreg	

Modifier

Table 241: Properties of each modifier.

Id	Name	SBO
species_16	nTreg	

Kinetic Law

Derived unit contains undeclared units

$$v_{87} = \text{vol}(c1) \cdot k1 \cdot [\text{species.16}] \quad (320)$$

Table 242: Properties of each parameter.

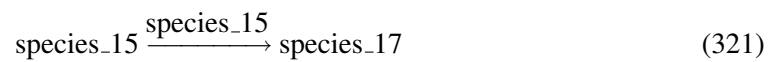
Id	Name	SBO	Value	Unit	Constant
k1	k1		0.119		<input checked="" type="checkbox"/>

10.88 Reaction [reaction_58](#)

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

Name Th17 to Treg

Reaction equation



Reactant

Table 243: Properties of each reactant.

Id	Name	SBO
species_15	nTh17_LP	

Modifier

Table 244: Properties of each modifier.

Id	Name	SBO
species_15	nTh17_LP	

Product

Table 245: Properties of each product.

Id	Name	SBO
species_17	nTreg_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_{88} = \text{vol}(c1) \cdot k1 \cdot [\text{species_15}] \quad (322)$$

Table 246: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.167		<input checked="" type="checkbox"/>

11 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.

11.1 Species `s1`

Name HP

Initial concentration $5.34 \cdot 10^{-8} \text{ item} \cdot \text{ml}^{-1}$

Initial assignment `s1`

Involved in events `event_1`, `event_2`

This species takes part in 17 reactions (as a reactant in `re3`, `re13`, `reaction_5`, `reaction_6`, `reaction_16`, `reaction_17`, `reaction_20` and as a product in `reaction_5` and as a modifier in `re2`, `re3`, `re13`, `reaction_5`, `reaction_6`, `reaction_16`, `reaction_17`, `reaction_20`).

$$\frac{d}{dt}s1 = 2 \text{v}_{35} - \text{v}_2 - \text{v}_6 - \text{v}_{35} - \text{v}_{36} - \text{v}_{42} - \text{v}_{43} - \text{v}_{45} \quad (323)$$

Furthermore, two events influence this species' rate of change.

11.2 Species `species_7`

Name HP Dose

Initial concentration $0.0534 \text{ item} \cdot \text{ml}^{-1}$

$$\frac{d}{dt}\text{species}_7 = 0 \quad (324)$$

11.3 Species `species_10`

Name LB

Initial concentration 1 item · ml⁻¹

Initial assignment `species_10`

Involved in events `event_1`, `event_2`

This species takes part in six reactions (as a reactant in `reaction_28` and as a modifier in `reaction_25`, `reaction_25`, `reaction_26`, `reaction_26`, `reaction_28`).

$$\frac{d}{dt}\text{species_10} = -v_{64} \quad (325)$$

Furthermore, two events influence this species' rate of change.

11.4 Species `species_11`

Name LB Dose

Initial concentration 1 item · ml⁻¹

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

$$\frac{d}{dt}\text{species_11} = 0 \quad (326)$$

11.5 Species `species_12`

Name nTh1

Initial concentration 1 item · ml⁻¹

This species takes part in five reactions (as a reactant in `reaction_46`, `reaction_49` and as a product in `reaction_45` and as a modifier in `reaction_46`, `reaction_49`).

$$\frac{d}{dt}\text{species_12} = v_{75} - v_{76} - v_{79} \quad (327)$$

11.6 Species `species_13`

Name nTh1_LP

Initial concentration 150000 item · ml⁻¹

This species takes part in six reactions (as a reactant in `reaction_47`, `reaction_48` and as a product in `reaction_46`, `reaction_48` and as a modifier in `reaction_47`, `reaction_48`).

$$\frac{d}{dt}\text{species_13} = v_{76} + 2 v_{78} - v_{77} - v_{78} \quad (328)$$

11.7 Species `species_14`

Name `nTh17`

Initial concentration $1 \text{ item} \cdot \text{ml}^{-1}$

This species takes part in five reactions (as a reactant in [reaction_51](#), [reaction_53](#) and as a product in [reaction_50](#) and as a modifier in [reaction_51](#), [reaction_53](#)).

$$\frac{d}{dt}\text{species_14} = v_{80} - v_{81} - v_{83} \quad (329)$$

11.8 Species `species_15`

Name `nTh17_LP`

Initial concentration $150000 \text{ item} \cdot \text{ml}^{-1}$

This species takes part in five reactions (as a reactant in [reaction_52](#), [reaction_58](#) and as a product in [reaction_51](#) and as a modifier in [reaction_52](#), [reaction_58](#)).

$$\frac{d}{dt}\text{species_15} = v_{81} - v_{82} - v_{88} \quad (330)$$

11.9 Species `species_16`

Name `nTreg`

Initial concentration $1 \text{ item} \cdot \text{ml}^{-1}$

This species takes part in five reactions (as a reactant in [reaction_55](#), [reaction_57](#) and as a product in [reaction_54](#) and as a modifier in [reaction_55](#), [reaction_57](#)).

$$\frac{d}{dt}\text{species_16} = v_{84} - v_{85} - v_{87} \quad (331)$$

11.10 Species `species_17`

Name `nTreg_LP`

Initial concentration $150000 \text{ item} \cdot \text{ml}^{-1}$

This species takes part in four reactions (as a reactant in [reaction_56](#) and as a product in [reaction_55](#), [reaction_58](#) and as a modifier in [reaction_56](#)).

$$\frac{d}{dt}\text{species_17} = v_{85} + v_{88} - v_{86} \quad (332)$$

11.11 Species s9

Name eDC

Initial concentration 1 item · ml⁻¹

This species takes part in 21 reactions (as a reactant in [re21](#) and as a product in [re6](#), [re13](#), [reaction_26](#) and as a modifier in [re16](#), [re16](#), [re18](#), [re18](#), [re21](#), [re42](#), [re42](#), [reaction_10](#), [reaction_10](#), [reaction_11](#), [reaction_11](#), [reaction_24](#), [reaction_24](#), [reaction_27](#), [reaction_27](#), [reaction_43](#), [reaction_43](#)).

$$\frac{d}{dt}s9 = v_4 + v_6 + v_{63} - v_{12} \quad (333)$$

11.12 Species s13

Name Th1

Initial concentration 0 item · ml⁻¹

This species takes part in 21 reactions (as a reactant in [re44](#), [re47](#), [reaction_39](#) and as a product in [re33](#), [reaction_10](#), [reaction_30](#) and as a modifier in [re4](#), [re4](#), [re15](#), [re15](#), [re16](#), [re16](#), [re18](#), [re18](#), [re42](#), [re42](#), [re44](#), [re47](#), [reaction_39](#), [reaction_43](#), [reaction_43](#)).

$$\frac{d}{dt}s13 = v_{21} + v_{37} + v_{66} - v_{26} - v_{29} - v_{52} \quad (334)$$

11.13 Species s15

Name iTreg

Initial concentration 0 item · ml⁻¹

This species takes part in 18 reactions (as a reactant in [re42](#), [re45](#), [re49](#), [reaction_40](#) and as a product in [re11](#), [re35](#), [reaction_8](#), [reaction_29](#) and as a modifier in [re17](#), [re17](#), [re42](#), [re45](#), [re49](#), [reaction_40](#), [reaction_7](#), [reaction_7](#), [reaction_8](#), [reaction_8](#)).

$$\frac{d}{dt}s15 = v_5 + v_{22} + v_{55} + v_{65} - v_{24} - v_{27} - v_{30} - v_{53} \quad (335)$$

11.14 Species s16

Name Th17

Initial concentration 0 item · ml⁻¹

This species takes part in 24 reactions (as a reactant in [re43](#), [re46](#), [reaction_12](#), [reaction_8](#) and as a product in [re32](#), [re42](#), [reaction_11](#), [reaction_33](#) and as a modifier in [re4](#), [re4](#), [re15](#), [re15](#), [re16](#), [re16](#), [re18](#), [re18](#), [re42](#), [re42](#), [re43](#), [re46](#), [reaction_12](#), [reaction_8](#), [reaction_43](#), [reaction_43](#)).

$$\frac{d}{dt}s16 = v_{20} + v_{24} + v_{38} + v_{67} - v_{25} - v_{28} - v_{39} - v_{55} \quad (336)$$

11.15 Species s19

Name M1

Initial concentration 0 item · ml⁻¹

This species takes part in 29 reactions (as a reactant in [reaction_37](#), [reaction_7](#) and as a product in [re16](#), [re18](#), [reaction_15](#) and as a modifier in [re4](#), [re4](#), [re15](#), [re15](#), [re16](#), [re16](#), [re18](#), [re18](#), [re42](#), [re42](#), [reaction_10](#), [reaction_10](#), [reaction_11](#), [reaction_11](#), [reaction_19](#), [reaction_19](#), [reaction_24](#), [reaction_24](#), [reaction_27](#), [reaction_27](#), [reaction_37](#), [reaction_7](#), [reaction_43](#), [reaction_43](#)).

$$\frac{d}{dt}s19 = v_8 + v_{10} + v_{57} - v_{50} - v_{54} \quad (337)$$

11.16 Species s21

Name M2

Initial concentration 0 item · ml⁻¹

This species takes part in 15 reactions (as a reactant in [re18](#), [reaction_38](#) and as a product in [re17](#), [reaction_7](#), [reaction_18](#) and as a modifier in [re11](#), [re11](#), [re17](#), [re17](#), [re18](#), [reaction_38](#), [reaction_7](#), [reaction_7](#), [reaction_8](#), [reaction_8](#)).

$$\frac{d}{dt}s21 = v_9 + v_{54} + v_{58} - v_{10} - v_{51} \quad (338)$$

11.17 Species s22

Name M0

Initial concentration 1000000 item · ml⁻¹

This species takes part in eleven reactions (as a reactant in [re16](#), [re17](#), [reaction_32](#), [reaction_15](#), [reaction_18](#) and as a product in [reaction_27](#) and as a modifier in [re16](#), [re17](#), [reaction_32](#), [reaction_15](#), [reaction_18](#)).

$$\frac{d}{dt}s22 = v_{47} - v_8 - v_9 - v_{49} - v_{57} - v_{58} \quad (339)$$

11.18 Species s25

Name tDC

Initial concentration 0 item · ml⁻¹

This species takes part in 13 reactions (as a reactant in [re22](#) and as a product in [re20](#), [reaction_17](#), [reaction_25](#) and as a modifier in [re11](#), [re11](#), [re17](#), [re17](#), [re22](#), [reaction_7](#), [reaction_7](#), [reaction_8](#), [reaction_8](#)).

$$\frac{d}{dt}s25 = v_{11} + v_{43} + v_{62} - v_{13} \quad (340)$$

11.19 Species s17

Name emT

Initial concentration 1198199.01671451 item · ml⁻¹

This species takes part in nine reactions (as a reactant in [re11](#), [reaction_10](#), [reaction_11](#) and as a product in [re43](#), [re44](#), [re45](#) and as a modifier in [re11](#), [reaction_10](#), [reaction_11](#)).

$$\frac{d}{dt}s17 = v_{25} + v_{26} + v_{27} - v_5 - v_{37} - v_{38} \quad (341)$$

11.20 Species s6

Name HP

Initial concentration 0 item · ml⁻¹

This species takes part in 17 reactions (as a reactant in [re6](#), [re20](#), [reaction_3](#), [reaction_4](#), [reaction_19](#), [reaction_15](#), [reaction_18](#) and as a product in [re3](#), [reaction_3](#), [reaction_16](#) and as a modifier in [re6](#), [re20](#), [reaction_3](#), [reaction_4](#), [reaction_19](#), [reaction_15](#), [reaction_18](#)).

$$\frac{d}{dt}s6 = v_2 + 2 v_{33} + v_{42} - v_4 - v_{11} - v_{33} - v_{34} - v_{44} - v_{57} - v_{58} \quad (342)$$

11.21 Species species_1

Name iDC

Initial concentration 1000000 item · ml⁻¹

This species takes part in nine reactions (as a reactant in [re6](#), [re20](#), [reaction_31](#), [reaction_23](#) and as a product in [reaction_24](#) and as a modifier in [re6](#), [re20](#), [reaction_31](#), [reaction_23](#)).

$$\frac{d}{dt}species_1 = v_{46} - v_4 - v_{11} - v_{48} - v_{61} \quad (343)$$

11.22 Species species_2

Name TotalDC

Initial concentration 5501140.56260765 item · ml⁻¹

Involved in rule [species_2](#)

One rule determines the species' quantity.

11.23 Species [species_3](#)

Name TotalM

Initial concentration 1000000 item · ml⁻¹

Involved in rule [species_3](#)

One rule determines the species' quantity.

11.24 Species [species_4](#)

Name TotalT

Initial concentration 1198199.01671451 item · ml⁻¹

Involved in rule [species_4](#)

One rule determines the species' quantity.

11.25 Species [species_18](#)

Name eDCLB

Initial concentration 1 item · ml⁻¹

This species takes part in six reactions (as a reactant in [reaction_41](#) and as a modifier in [reaction_10](#), [reaction_10](#), [reaction_11](#), [reaction_11](#), [reaction_41](#)).

$$\frac{d}{dt}\text{species_18} = -v_{71} \quad (344)$$

11.26 Species [species_19](#)

Name pEC

Initial concentration 1 item · ml⁻¹

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

$$\frac{d}{dt}\text{species_19} = 0 \quad (345)$$

11.27 Species [s2](#)

Name E

Initial concentration 10000 item · ml⁻¹

This species takes part in eight reactions (as a reactant in [re2](#), [re15](#), [reaction_43](#) and as a product in [reaction_1](#), [reaction_2](#) and as a modifier in [re2](#), [re15](#), [reaction_43](#)).

$$\frac{d}{dt}s2 = v_{31} + v_{32} - v_1 - v_7 - v_{73} \quad (346)$$

11.28 Species s3

Name Ep

Initial concentration 0 item · ml⁻¹

This species takes part in 24 reactions (as a reactant in [re4](#), [reaction_1](#) and as a product in [re2](#), [reaction_43](#) and as a modifier in [re4](#), [re16](#), [re16](#), [re18](#), [re18](#), [re42](#), [re42](#), [reaction_1](#), [reaction_16](#), [reaction_16](#), [reaction_19](#), [reaction_19](#), [reaction_20](#), [reaction_20](#), [reaction_24](#), [reaction_24](#), [reaction_27](#), [reaction_27](#), [reaction_43](#), [reaction_43](#)).

$$\frac{d}{dt}s3 = v_1 + v_{73} - v_3 - v_{31} \quad (347)$$

11.29 Species species_5

Name Edead

Initial concentration 0 item · ml⁻¹

This species takes part in six reactions (as a reactant in [reaction_2](#) and as a product in [re4](#), [re15](#) and as a modifier in [re3](#), [re3](#), [reaction_2](#)).

$$\frac{d}{dt}\text{species}_5 = v_3 + v_7 - v_{32} \quad (348)$$

11.30 Species s4

Name iDC

Initial concentration 4501139.56260765 item · ml⁻¹

This species takes part in ten reactions (as a reactant in [re13](#), [reaction_17](#), [reaction_25](#), [reaction_26](#) and as a product in [reaction_23](#) and as a modifier in [re13](#), [reaction_17](#), [reaction_23](#), [reaction_25](#), [reaction_26](#)).

$$\frac{d}{dt}s4 = v_{61} - v_6 - v_{43} - v_{62} - v_{63} \quad (349)$$

11.31 Species s26

Name eDC

Initial concentration 0 item · ml⁻¹

This species takes part in 15 reactions (as a reactant in [reaction_21](#) and as a product in [re21](#) and as a modifier in [re23](#), [re23](#), [re24](#), [re24](#), [re28](#), [re28](#), [re29](#), [re29](#), [re41](#), [re41](#), [reaction_13](#), [reaction_13](#), [reaction_21](#)).

$$\frac{d}{dt}s26 = v_{12} - v_{59} \quad (350)$$

11.32 Species s27

Name tDC

Initial concentration 0 item · ml⁻¹

This species takes part in nine reactions (as a reactant in [reaction_22](#) and as a product in [re22](#) and as a modifier in [re27](#), [re27](#), [re31](#), [re31](#), [reaction_9](#), [reaction_9](#), [reaction_22](#)).

$$\frac{d}{dt}s_{27} = v_{13} - v_{60} \quad (351)$$

11.33 Species s28

Name nT

Initial concentration 10⁷ item · ml⁻¹

This species takes part in 15 reactions (as a reactant in [re23](#), [re24](#), [re27](#), [reaction_14](#), [reaction_45](#), [reaction_50](#), [reaction_54](#) and as a product in [reaction_13](#) and as a modifier in [re23](#), [re24](#), [re27](#), [reaction_14](#), [reaction_45](#), [reaction_50](#), [reaction_54](#)).

$$\frac{d}{dt}s_{28} = v_{40} - v_{14} - v_{15} - v_{16} - v_{41} - v_{75} - v_{80} - v_{84} \quad (352)$$

11.34 Species s29

Name cmT

Initial concentration 4.17752018460542 · 10⁷ item · ml⁻¹

This species takes part in nine reactions (as a reactant in [re28](#), [re29](#), [re31](#) and as a product in [re46](#), [re47](#), [re49](#) and as a modifier in [re28](#), [re29](#), [re31](#)).

$$\frac{d}{dt}s_{29} = v_{28} + v_{29} + v_{30} - v_{17} - v_{18} - v_{19} \quad (353)$$

11.35 Species s30

Name Th17

Initial concentration 0 item · ml⁻¹

This species takes part in ten reactions (as a reactant in [re32](#), [reaction_9](#) and as a product in [re23](#), [re28](#), [re41](#), [reaction_36](#) and as a modifier in [re32](#), [re41](#), [re41](#), [reaction_9](#)).

$$\frac{d}{dt}s_{30} = v_{14} + v_{17} + v_{23} + v_{70} - v_{20} - v_{56} \quad (354)$$

11.36 Species s31

Name Th1

Initial concentration 0 item · ml⁻¹

This species takes part in seven reactions (as a reactant in [re33](#) and as a product in [re24](#), [re29](#), [reaction_35](#) and as a modifier in [re33](#), [re41](#), [re41](#)).

$$\frac{d}{dt}s31 = v_{15} + v_{18} + v_{69} - v_{21} \quad (355)$$

11.37 Species s33

Name iTreg

Initial concentration 0 item · ml⁻¹

This species takes part in ten reactions (as a reactant in [re35](#), [re41](#) and as a product in [re27](#), [re31](#), [reaction_9](#), [reaction_34](#) and as a modifier in [re35](#), [re41](#), [reaction_9](#), [reaction_9](#)).

$$\frac{d}{dt}s33 = v_{16} + v_{19} + v_{56} + v_{68} - v_{22} - v_{23} \quad (356)$$

11.38 Species species_6

Name TotalDC

Initial concentration 0 item · ml⁻¹

Involved in rule [species_6](#)

One rule determines the species' quantity.

11.39 Species species_8

Name TotalT

Initial concentration 5.17752018460542 · 10⁷ item · ml⁻¹

Involved in rule [species_8](#)

One rule determines the species' quantity.

11.40 Species `species_9`

Name TotalT-s

Notes Multiplied by 0.01 to account for the fact that the data is in percent.

Initial concentration 51775.2018460542 item · ml⁻¹

Involved in rule `species_9`

One rule determines the species' quantity.

11.41 Species `species_20`

Name eDCLB

Initial concentration 1 item · ml⁻¹

This species takes part in eleven reactions (as a reactant in `reaction_42`, `reaction_44` and as a product in `reaction_41` and as a modifier in `re23`, `re23`, `re28`, `re28`, `re29`, `re29`, `reaction_42`, `reaction_44`).

$$\frac{d}{dt} \text{species_20} = v_{71} - v_{72} - v_{74} \quad (357)$$

A Glossary of Systems Biology Ontology Terms

SBO:0000290 physical compartment: Specific location of space, that can be bounded or not.

A physical compartment can have 1, 2 or 3 dimensions

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