SBML Model Report

Model name: “Carbo2013 - Cytokine driven CD4+ T Cell differentiation and phenotype plasticity”

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 Chelliah[1] and Adria Carbo[2] at May nineth 2013 at 2:36 p. m. and last time modified at October tenth 2014 at 11:12 a. 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	2
species types	0	species	94
events	0	constraints	0
reactions	53	function definitions	16
global parameters	5	unit definitions	1
rules	2	initial assignments	12

Model Notes

Carbo2013 - Cytokine driven CD4+ T Cell differentiation and phenotype plasticity

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CD4+ T cells can differentiate into different phenotypes depending on the cytokine milieu. Here a computational and mathematical model with sixty ordinary differential equations representing a CD4+ T cell differentiating into either Th1, Th2, Th17 or iTreg cells, has been constructed. The model includes cytokines, nuclear receptors and transcription factors that define fate and function of CD4+ T cells. Computational simulations illustrate how a proinflammatory Th17 cell can undergo reprogramming into an anti-inflammatory iTreg phenotype following PPARc activation.

This model is described in the article:Systems Modeling of Molecular Mechanisms Controlling Cytokine-driven CD4+ T Cell Differentiation and Phenotype Plasticity.Carbo A, Hontecillas R, Kronsteiner B, Viladomiu M, Pedragosa M, Lu P, Philipson CW, Hoops S, Marathe M, Eubank S, Bisset K, Wendelsdorf K, Jarrah A, Mei Y, Bassaganya-Riera JPLoS Computational Biology [2013, 9(4):e1003027]

Abstract:

Differentiation of CD4+ T cells into effector or regulatory phenotypes is tightly controlled by the cytokine milieu, complex intracellular signaling networks and numerous transcriptional regulators. We combined experimental approaches and computational modeling to investigate the mechanisms controlling differentiation and plasticity of CD4+ T cells in the gut of mice. Our computational model encompasses the major intracellular pathways involved in CD4+ T cell differentiation into T helper 1 (Th1), Th2, Th17 and induced regulatory T cells (iTreg). Our modeling efforts predicted a critical role for peroxisome proliferator-activated receptor gamma (PPAR) in modulating plasticity between Th17 and iTreg cells. PPAR regulates differentiation, activation and cytokine production, thereby controlling the induction of effector and regulatory responses, and is a promising therapeutic target for dysregulated immune responses and inflammation. Our modeling efforts predict that following PPAR activation, Th17 cells undergo phenotype switch and become iTreg cells. This prediction was validated by results of adoptive transfer studies showing an increase of colonic iTreg and a decrease of Th17 cells in the gut mucosa of mice with colitis following pharmacological activation of PPAR. Deletion of PPAR in CD4+ T cells impaired mucosal iTreg and enhanced colitogenic Th17 responses in mice with CD4+ T cell-induced colitis. Thus, for the first time we provide novel molecular evidence in vivo demonstrating that PPAR in addition to regulating CD4+ T cell differentiation also plays a major role controlling Th17 and iTreg plasticity in the gut mucosa.

Author's comment: CD4+ T cell computational model (Version 1.4)Steady state corrected. There was a problem in the internalization of IL-17 in its mathematical function.

This model is hosted on BioModels Database and identifiedby: MODEL1304230001 .

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

2 Unit Definitions

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

2.1 Unit `time`

Name time

Definition 3600 s

2.2 Unit `substance`

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

Definition mol

2.3 Unit `volume`

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

Definition l

2.4 Unit `area`

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

Definition m^2

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 two compartments.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
`default`	default	0000290	3	1	litre	☑	
`c1`	T Helper Cell	0000290	3	1	litre	☑	

3.1 Compartment `default`

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

Name default

SBO:0000290 physical compartment

3.2 Compartment `c1`

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

Name T Helper Cell

SBO:0000290 physical compartment

4 Species

This model contains 94 species. The boundary condition of 35 of these species is set to `true` so that these species' amount cannot be changed by any reaction. Section 10 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
s22	eIFNg	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s11	eIL12	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s51	eIL21	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s55	eIL23	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s30	eIL4	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s87	eTGFb	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s89	eIL2	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s90	eIL6	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_1	eIL17	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_2	eIL10	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_12	eIL18	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_13	anti-IL4	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_14	anti-IFNg	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_15	pIL4	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_16	IL18_pool	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_17	IL12_pool	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_18	IFNg_pool	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_19	IL21_pool	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_20	IL23_pool	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_21	IL17_pool	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_22	IL10_pool	default	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
species_23	IL6_pool	default	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☑	☑
species_24	IL2_pool	default	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☑	☑
species_25	TGFb_pool	default	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☑	☑
species_26	IL4_pool	default	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☑	☑
species_27	pIL10	default	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☑	☑
s48	IL6-IL6R	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s47	IL6R	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s46	IL6	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s45	TGFb-TGFbR	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s44	TGFbR	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s43	TGFb	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s38	IL2-IL2R	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s37	IL2R	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s36	IL2	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s33	IL4-IL4R	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s32	IL4R	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s31	IL4	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s25	IFNg-IFNgR	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s24	IFNgR	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s14	IL12-IL12R	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s13	IL12R	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s12	IL12	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s3	IL18-IL18R	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s2	IL18R	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s1	IL18	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s52	IL21	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐
s54	IL21-IL21R	c1	$\mathrm{mol}\cdot\mathrm{l}^{-1}$	☐	☐

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
s53	IL21R	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s58	IL23R	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s59	IL23-IL23R	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s62	IL10R	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s63	IL10-IL10R	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s65	IRAK1	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s10	IRAK1-P	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s20	p50/p65 dimer	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s67	STAT4	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s21	STAT4-P	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s68	IFNg	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s69	JAK1	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s28	JAK1-P	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s70	STAT1	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s26	STAT1-P	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s57	p40/p19 dimer	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s73	IL17	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s74	IL10	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s75	RORgt	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s50	RORgt-ligand	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s49	STAT3-P	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s76	STAT3	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s39	STAT5-P	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s77	STAT5	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s78	FOXP3	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s79	SOCS1	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s29	SOCS1-JAKs	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
s27	Tbet-P	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s80	Tbet	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s81	GATA3	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s35	GATA3-P	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s34	STAT6-P	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s82	STAT6	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s85	PPARg	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s83	L-PPARg	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
s86	Ligand	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
s40	acetylated FOXP3	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_8	p19	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_9	p40	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_10	p50	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_11	p65	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_4	IL17R	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_3	IL17-IL17R	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
species_5	pIFNg	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_6	pIL21	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑
species_7	pIL17	c1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☑	☑

5 Parameters

This model contains five global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
parameter_1	Hill Coeficient		2.000		☑
parameter_2	BActin		0.009		☑
parameter_3	FOXP3R		0.000		☐
parameter_4	IL17R		0.000		☐
ModelValue_5	Initial for BActin		0.009		☑

6 Initialassignments

This is an overview of twelve initialassignments.

6.1 Initialassignment s22

Derived unit $\mathrm{mol} \cdot \mathrm{l}^{-1}$

Math [species_18]

6.2 Initialassignment s11

Derived unit $\mathrm{mol} \cdot \mathrm{l}^{-1}$

Math [species_17]

6.3 Initialassignment s51

Derived unit $\mathrm{mol} \cdot \mathrm{l}^{-1}$

Math [species_19]

6.4 Initialassignment s55

Derived unit $\mathrm{mol} \cdot \mathrm{l}^{-1}$

Math [species_20]

6.5 Initialassignment s30

Derived unit $\mathrm{mol} \cdot \mathrm{l}^{-1}$

Math [species_26]

6.6 Initialassignment s87

Derived unit $\mathrm{mol} \cdot \mathrm{l}^{-1}$

Math [species_25]

6.7 Initialassignment s89

Derived unit $\mathrm{mol} \cdot \mathrm{l}^{-1}$

Math [species_24]

6.8 Initialassignment s90

Derived unit $\mathrm{mol} \cdot \mathrm{l}^{-1}$

Math [species_23]

6.9 Initialassignment species_1

Derived unit $\mathrm{mol} \cdot \mathrm{l}^{-1}$

Math [species_21]

6.10 Initialassignment species_2

Derived unit $\mathrm{mol} \cdot \mathrm{l}^{-1}$

Math [species_22]

6.11 Initialassignment species_12

Derived unit $\mathrm{mol} \cdot \mathrm{l}^{-1}$

Math [species_16]

6.12 Initialassignment ModelValue_5

Derived unit contains undeclared units

Math parameter_2

7 Function definitions

This is an overview of 16 function definitions.

7.1 Function definition function_1

Name 2 Reactants, 1 Inhibitor

Arguments Vf, r1, r2, K, n, I, Vr, p

Mathematical Expression

$$\mathrm{Vf} \cdot \mathrm{r1} \cdot \mathrm{r2} \cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}} - \mathrm{Vr} \cdot \mathrm{p} \tag{1}$$

7.2 Function definition function_2

Name 1 Reactant, 1 Activator

Arguments Vf, r1, A, n, K, Vr, p

Mathematical Expression

$$\mathrm{Vf} \cdot \mathrm{r1} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n}}}{\mathrm{A}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}}\right) - \mathrm{Vr} \cdot \mathrm{p} \tag{2}$$

7.3 Function definition function_3

Name 2 Reactants, 2 Inhibitors

Arguments Vf, r1, r2, K1, n1, I1, K2, n2, I2, Vr, p

Mathematical Expression

$$\mathrm{Vf} \cdot \mathrm{r1} \cdot \mathrm{r2} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} - \mathrm{Vr} \cdot \mathrm{p} \tag{3}$$

7.4 Function definition function_4

Name 2 Reactants, 2 Inhibitors, 1 Activator

Arguments Vf, K1, n1, I1, K2, n2, I2, A, n3, K3, Vr, p, r1, r2

Mathematical Expression

$$\mathrm{Vf} \cdot \mathrm{r1} \cdot \mathrm{r2} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n3}}}{\mathrm{A}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}}\right) - \mathrm{Vr} \cdot \mathrm{p} \tag{4}$$

7.5 Function definition function_6

Name 1 Reactant, 1 Inhibitor, 3 Activators

Arguments Vf, r1, K, n, I, A1, n1, K1, A2, n2, K2, A3, n3, K3, Vr, p

Mathematical Expression

$$\mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n1}}}{\mathrm{A1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} + \frac{\mathrm{A2}^{\mathrm{n2}}}{\mathrm{A2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} + \frac{\mathrm{A3}^{\mathrm{n3}}}{\mathrm{A3}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} \right) - \mathrm{Vr} \cdot \mathrm{p} \quad (5)$$

7.6 Function definition function_7

Name 1 Reactant, 3 Inhibitors, 3 Activators

Arguments Vf, r1, K1, n1, I1, K2, n2, I2, K3, n3, I3, A1, n4, K4, A2, n5, K5, A3, n6, K6, Vr, p

Mathematical Expression

$$\begin{aligned} &\mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \frac{\mathrm{K3}^{\mathrm{n3}}}{\mathrm{I3}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} \\ &\cdot \left(\frac{\mathrm{A1}^{\mathrm{n4}}}{\mathrm{A1}^{\mathrm{n4}} + \mathrm{K4}^{\mathrm{n4}}} + \frac{\mathrm{A2}^{\mathrm{n5}}}{\mathrm{A2}^{\mathrm{n5}} + \mathrm{K5}^{\mathrm{n5}}} + \frac{\mathrm{A3}^{\mathrm{n6}}}{\mathrm{A3}^{\mathrm{n6}} + \mathrm{K6}^{\mathrm{n6}}} \right) - \mathrm{Vr} \cdot \mathrm{p} \end{aligned} \quad (6)$$

7.7 Function definition function_8

Name 1 Reactant, 2 Inhibitors, 1 Activator

Arguments Vf, r1, K1, n1, I1, K2, n2, I2, A, n3, K3, Vr, p

Mathematical Expression

$$\mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n3}}}{\mathrm{A}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} \right) - \mathrm{Vr} \cdot \mathrm{p} \quad (7)$$

7.8 Function definition function_9

Name 1 Reactant, 2 Activators

Arguments Vf, r1, A1, n1, K1, A2, n2, K2, Vr, p

Mathematical Expression

$$\mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{A1}^{\mathrm{n1}}}{\mathrm{A1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{A2}^{\mathrm{n2}}}{\mathrm{A2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} - \mathrm{Vr} \cdot \mathrm{p} \quad (8)$$

7.9 Function definition function_10

Name 1 Reactant, 3 Inhibitors, 2 Activators

Arguments Vf, r1, K1, n1, I1, K2, n2, I2, K3, n3, I3, A1, n4, K4, A2, n5, K5, Vr, p

Mathematical Expression

$$\mathrm{Vf}\cdot \mathrm{r1}\cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}}+\mathrm{K1}^{\mathrm{n1}}}\cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}}+\mathrm{K2}^{\mathrm{n2}}}\cdot \frac{\mathrm{K3}^{\mathrm{n3}}}{\mathrm{I3}^{\mathrm{n3}}+\mathrm{K3}^{\mathrm{n3}}} \cdot\left(\frac{\mathrm{A1}^{\mathrm{n4}}}{\mathrm{A1}^{\mathrm{n4}}+\mathrm{K4}^{\mathrm{n4}}}+\frac{\mathrm{A2}^{\mathrm{n5}}}{\mathrm{A2}^{\mathrm{n5}}+\mathrm{K5}^{\mathrm{n5}}}\right)-\mathrm{Vr}\cdot \mathrm{p} \tag{9}$$

7.10 Function definition function_12

Name 1 Reactant, 1 Inhibitor, 4 Activators

Arguments Vf, r1, K, n, I, A1, n1, K1, A2, n2, K2, A3, n3, K3, A4, n4, K4, Vr, p

Mathematical Expression

$$\mathrm{Vf}\cdot \mathrm{r1}\cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}}+\mathrm{K}^{\mathrm{n}}} \cdot\left(\frac{\mathrm{A1}^{\mathrm{n1}}}{\mathrm{A1}^{\mathrm{n1}}+\mathrm{K1}^{\mathrm{n1}}}+\frac{\mathrm{A2}^{\mathrm{n2}}}{\mathrm{A2}^{\mathrm{n2}}+\mathrm{K2}^{\mathrm{n2}}}+\frac{\mathrm{A3}^{\mathrm{n3}}}{\mathrm{A3}^{\mathrm{n3}}+\mathrm{K3}^{\mathrm{n3}}}+\frac{\mathrm{A4}^{\mathrm{n4}}}{\mathrm{A4}^{\mathrm{n4}}+\mathrm{K4}^{\mathrm{n4}}}\right)-\mathrm{Vr}\cdot \mathrm{p} \tag{10}$$

7.11 Function definition function_14

Name 2 Reactants, 1 Inhibitor, 1 Activator

Arguments Vf, r1, r2, K, n, I, A, n1, K1, Vr, p

Mathematical Expression

$$\mathrm{Vf}\cdot \mathrm{r1}\cdot \mathrm{r2}\cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}}+\mathrm{K}^{\mathrm{n}}}\cdot\left(1+\frac{\mathrm{A}^{\mathrm{n1}}}{\mathrm{A}^{\mathrm{n1}}+\mathrm{K1}^{\mathrm{n1}}}\right)-\mathrm{Vr}\cdot \mathrm{p} \tag{11}$$

7.12 Function definition function_11

Name 1 Reactant, 3 Inhibitors, 4 Activators

Arguments Vf, r1, K1, n1, I1, K2, n2, I2, K3, n3, I3, A1, n4, K4, A2, n5, K5, A3, n6, K6, A4, n7, K7, Vr, p

Mathematical Expression

$$\mathrm{Vf}\cdot \mathrm{r1}\cdot\frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}}+\mathrm{K1}^{\mathrm{n1}}}\cdot\frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}}+\mathrm{K2}^{\mathrm{n2}}}\cdot\frac{\mathrm{K3}^{\mathrm{n3}}}{\mathrm{I3}^{\mathrm{n3}}+\mathrm{K3}^{\mathrm{n3}}} \cdot\left(\frac{\mathrm{A1}^{\mathrm{n4}}}{\mathrm{A1}^{\mathrm{n4}}+\mathrm{K4}^{\mathrm{n4}}}+\frac{\mathrm{A2}^{\mathrm{n5}}}{\mathrm{A2}^{\mathrm{n5}}+\mathrm{K5}^{\mathrm{n5}}}+\frac{\mathrm{A3}^{\mathrm{n6}}}{\mathrm{A3}^{\mathrm{n6}}+\mathrm{K6}^{\mathrm{n6}}}+\frac{\mathrm{A4}^{\mathrm{n7}}}{\mathrm{A4}^{\mathrm{n7}}+\mathrm{K7}^{\mathrm{n7}}}\right)-\mathrm{Vr}\cdot\mathrm{p} \tag{12}$$

7.13 Function definition `function_5`

Name 1 Reactant, 2 Inhibitors, 2 Activators

Arguments Vf, r1, K1, n1, I1, K2, n2, I2, A1, n3, K3, A2, n4, K4, Vr, p

Mathematical Expression

$$\mathrm{Vf}\cdot\mathrm{r1}\cdot\frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}}+\mathrm{K1}^{\mathrm{n1}}}\cdot\frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}}+\mathrm{K2}^{\mathrm{n2}}}\cdot\left(\frac{\mathrm{A1}^{\mathrm{n3}}}{\mathrm{A1}^{\mathrm{n3}}+\mathrm{K3}^{\mathrm{n3}}}+\frac{\mathrm{A2}^{\mathrm{n4}}}{\mathrm{A2}^{\mathrm{n4}}+\mathrm{K4}^{\mathrm{n4}}}\right)-\mathrm{Vr}\cdot\mathrm{p} \tag{13}$$

7.14 Function definition `function_13`

Name 1 Reactant, 2 Inhibitors, 3 Activators

Arguments Vf, r1, K1, n1, I1, K2, n2, I2, A1, n3, K3, A2, n4, K4, A3, n5, K5, Vr, p

Mathematical Expression

$$\mathrm{Vf}\cdot\mathrm{r1}\cdot\frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}}+\mathrm{K1}^{\mathrm{n1}}}\cdot\frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}}+\mathrm{K2}^{\mathrm{n2}}} \cdot\left(\frac{\mathrm{A1}^{\mathrm{n3}}}{\mathrm{A1}^{\mathrm{n3}}+\mathrm{K3}^{\mathrm{n3}}}+\frac{\mathrm{A2}^{\mathrm{n4}}}{\mathrm{A2}^{\mathrm{n4}}+\mathrm{K4}^{\mathrm{n4}}}+\frac{\mathrm{A3}^{\mathrm{n5}}}{\mathrm{A3}^{\mathrm{n5}}+\mathrm{K5}^{\mathrm{n5}}}\right)-\mathrm{Vr}\cdot\mathrm{p} \tag{14}$$

7.15 Function definition `function_15`

Name 1 Reactant, 1 inhibitor, 1 activator

Arguments Vf, r1, K, n, I, A1, n1, K1, Vr, p

Mathematical Expression

$$\mathrm{Vf}\cdot\mathrm{r1}\cdot\frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}}+\mathrm{K}^{\mathrm{n}}}\cdot\frac{\mathrm{A1}^{\mathrm{n1}}}{\mathrm{A1}^{\mathrm{n1}}+\mathrm{K1}^{\mathrm{n1}}}-\mathrm{Vr}\cdot\mathrm{p} \tag{15}$$

7.16 Function definition function_16

Name Pool coupling

Arguments V, pool, n, ext, k

Mathematical Expression

$$\mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \tag{16}$$

8 Rules

This is an overview of two rules.

8.1 Rule parameter_3

Rule parameter_3 is an assignment rule for parameter parameter_3:

$$\mathrm{parameter\_3} = \frac{[\mathrm{s40}]}{\mathrm{ModelValue\_5}} \tag{17}$$

8.2 Rule parameter_4

Rule parameter_4 is an assignment rule for parameter parameter_4:

$$\mathrm{parameter\_4} = \frac{[\mathrm{s73}]}{\mathrm{ModelValue\_5}} \tag{18}$$

9 Reactions

This model contains 53 reactions. All reactions are listed in the following table and are subsequently described in detail. If a reaction is affected by a modifier, the identifier of this species is written above the reaction arrow.

Table 5: Overview of all reactions

№	Id	Name	Reaction Equation	SBO
1	re2	re2	$\text{species\_12} + \text{s2} \xrightleftharpoons{\text{s34, species\_12, s2, s34, s3}} \text{s3}$	
2	re3	re3	$\text{s65} \xrightleftharpoons{\text{s3, s65, s3, s10}} \text{s10}$	
3	re6	re6	$\text{s12} \xrightarrow{\text{s12}} \text{s11}$	
4	re8	re8	$\text{s11} + \text{s13} \xrightleftharpoons{\text{s34, s83, s11, s13, s34, s83, s14}} \text{s14}$	
5	re9	re9	$\text{species\_10} + \text{species\_11} \xrightleftharpoons{\text{s83, s40, s10, s83, s40, s10, s20, species\_10, species\_11}} \text{s20}$	
6	re10	re10	$\text{s67} \xrightleftharpoons{\text{s54, s35, s14, s59, s67, s54, s35, s14, s59, s21}} \text{s21}$	
7	re11	re11	$\text{s22} + \text{s24} \xrightleftharpoons{\text{s29, s22, s24, s29, s25}} \text{s25}$	
8	re12	re12	$\text{s68} \xrightarrow{\text{s68}} \text{s22}$	
9	re13	re13	$\text{s70} \xrightleftharpoons{\text{s83, s54, s25, s28, s70, s83, s54, s25, s28, s26}} \text{s26}$	
10	re14	re14	$\text{species\_5} \xrightleftharpoons{\text{species\_14, s49, s83, s21, s20, s27, species\_5, species\_14, s49, s83, s21, s20,}}$	
11	re15	re15	$\text{s80} \xrightleftharpoons{\text{s45, s49, s21, s26, s27, s80, s45, s49, s21, s26, s27}} \text{s27}$	
12	re16	re16	$\text{s69} \xrightleftharpoons{\text{s83, s29, s25, s69, s83, s29, s25, s28}} \text{s28}$	
13	re17	re17	$\text{s79} \xrightleftharpoons{\text{s26, s27, s79, s26, s27, s29}} \text{s29}$	
14	re18	re18	$\text{s31} \xrightarrow{\text{s31}} \text{s30}$	
15	re19	re19	$\text{s30} + \text{s32} \xrightleftharpoons{\text{s29, s30, s32, s29, s33}} \text{s33}$	

№	Id	Name	Reaction Equation	SBO
16	re20	re20	$\text{species\_15} \xrightleftharpoons{\text{s26, species\_13, s31, s35, s39, species\_15, s26, species\_13, s31, s35, s39}} \text{s3}$	
17	re23	re23	$\text{s81} \xrightleftharpoons{\text{s27, s49, s45, s34, s83, s81, s27, s49, s45, s34, s83, s35}} \text{s35}$	
18	re24	re24	$\text{s82} \xrightleftharpoons{\text{s25, s33, s82, s25, s33, s34}} \text{s34}$	
19	re25	re25	$\text{s89} + \text{s37} \xrightleftharpoons{\text{s89, s37, s38}} \text{s38}$	
20	re26	re26	$\text{s77} \xrightleftharpoons{\text{s38, s77, s38, s39}} \text{s39}$	
21	re27	re27	$\text{s78} \xrightleftharpoons{\text{s34, s49, s48, s45, s26, s39, s83, s78, s34, s49, s48, s45, s26, s39, s83, s40}} \text{s40}$	
22	re28	re28	$\text{s87} + \text{s44} \xrightleftharpoons{\text{s87, s44, s45}} \text{s45}$	
23	re29	re29	$\text{s90} + \text{s47} \xrightleftharpoons{\text{s90, s47, s48}} \text{s48}$	
24	re30	re30	$\text{s76} \xrightleftharpoons{\text{s83, s54, s59, s63, s48, s76, s83, s54, s59, s63, s48, s49}} \text{s49}$	
25	re31	re31	$\text{s75} \xrightleftharpoons{\text{s40, s83, s49, s45, s75, s40, s83, s49, s45, s50}} \text{s50}$	
26	re32	re32	$\text{s51} + \text{s53} \xrightleftharpoons{\text{s39, species\_3, s51, s53, s39, species\_3, s54}} \text{s54}$	
27	re33	re33	$\text{s52} \xrightarrow{\text{s52}} \text{s51}$	
28	re34	re34	$\text{s55} \xrightleftharpoons{\text{s55, s57}} \text{s57}$	
29	re35	re35	$\text{s57} + \text{s58} \xrightleftharpoons{\text{s27, s57, s58, s27, s59}} \text{s59}$	
30	re36	re36	$\text{species\_9} + \text{species\_8} \xrightleftharpoons{\text{s83, s48, species\_9, species\_8, s83, s48, s57}} \text{s57}$	
31	re37	re37	$\text{species\_6} \xrightleftharpoons{\text{s49, species\_6, s49, s52}} \text{s52}$	
32	re39	re38	$\text{species\_2} + \text{s62} \xrightleftharpoons{\text{species\_2, s62, s63}} \text{s63}$	
33	re42	re42	$\text{s85} + \text{s86} \xrightleftharpoons{\text{s25, s33, s85, s86, s25, s33, s83}} \text{s83}$	
34	re44	re44	$\text{s43} \xrightarrow{\text{s43}} \text{s87}$	

№	Id	Name	Reaction Equation	SBO
35	re45	re45	s36 $\xrightarrow{\text{s36}}$ s89	
36	re46	re46	s46 $\xrightarrow{\text{s46}}$ s90	
37	reaction_1	re48	s74 $\xrightarrow{\text{s74}}$ species_2	
38	reaction_2	re49	s73 $\xrightarrow{\text{s73}}$ species_1	
39	reaction_3	re50	species_1 + species_4 $\xleftrightarrow{\text{species_1, species_4, species_3}}$ species_3	
40	reaction_4	re47	s1 $\xrightarrow{\text{s1}}$ species_12	
41	reaction_5	re51	species_7 $\xleftrightarrow{\text{s83, s59, s50, s21, species_7, s83, s59, s50, s21, s73}}$ s73	
42	reaction_6	IL18 pool	species_16 $\xleftrightarrow{\text{species_16, species_12}}$ species_12	
43	reaction_7	IL12 pool	species_17 $\xleftrightarrow{\text{species_17, s11}}$ s11	
44	reaction_8	IFNg pool	species_18 $\xleftrightarrow{\text{species_18, s22}}$ s22	
45	reaction_9	IL21 pool	species_19 $\xleftrightarrow{\text{species_19, s51}}$ s51	
46	reaction_10	IL23 pool	species_20 $\xleftrightarrow{\text{species_20, s55}}$ s55	
47	reaction_11	IL17 pool	species_21 $\xleftrightarrow{\text{species_21, s73}}$ s73	
48	reaction_12	IL10 pool	species_22 $\xleftrightarrow{\text{species_22, species_2}}$ species_2	
49	reaction_13	IL6 pool	species_23 $\xleftrightarrow{\text{species_23, s90}}$ s90	
50	reaction_14	IL2 pool	species_24 $\xleftrightarrow{\text{species_24, s89}}$ s89	
51	reaction_15	TGFb pool	species_25 $\xleftrightarrow{\text{species_25, s87}}$ s87	
52	reaction_16	IL4 pool	species_26 $\xleftrightarrow{\text{species_26, s30}}$ s30	
53	reaction_17	re52	species_27 $\xleftrightarrow{\text{s59, s83, s54, s35, s39, species_27, s59, s83, s54, s35, s39, s74}}$ s74	

9.1 Reaction re2

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

Name re2

Reaction equation

$$\text{species\_12} + \text{s2} \xrightleftharpoons{\text{s34, species\_12, s2, s34, s3}} \text{s3} \tag{19}$$

Reactants

Table 6: Properties of each reactant.

Id	Name	SBO
species_12	eIL18	
s2	IL18R	

Modifiers

Table 7: Properties of each modifier.

Id	Name	SBO
s34	STAT6-P	
species_12	eIL18	
s2	IL18R	
s34	STAT6-P	
s3	IL18-IL18R	

Product

Table 8: Properties of each product.

Id	Name	SBO
s3	IL18-IL18R	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \text{function\_1}\left(\text{Vf}, [\text{species\_12}], [\text{s2}], \text{K}, \text{parameter\_1}, [\text{s34}], \text{Vr}, [\text{s3}]\right) \tag{20}$$

$$\text{function\_1}\left(\text{Vf},\text{r1},\text{r2},\text{K},\text{n},\text{I},\text{Vr},\text{p}\right) = \text{Vf}\cdot\text{r1}\cdot\text{r2}\cdot\frac{\text{K}^{\text{n}}}{\text{I}^{\text{n}}+\text{K}^{\text{n}}} - \text{Vr}\cdot\text{p} \tag{21}$$

Table 9: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
`Vf`	Vf		0.100		☑
`K`	K		0.138		☑
`Vr`	Vr		0.100		☑

9.2 Reaction `re3`

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

Name re3

Reaction equation

$$\text{s65} \xrightleftharpoons{\text{s3, s65, s3, s10}} \text{s10} \tag{22}$$

Reactant

Table 10: Properties of each reactant.

Id	Name	SBO
`s65`	IRAK1	

Modifiers

Table 11: Properties of each modifier.

Id	Name	SBO
`s3`	IL18-IL18R	
`s65`	IRAK1	
`s3`	IL18-IL18R	
`s10`	IRAK1-P	

Product

Table 12: Properties of each product.

Id	Name	SBO
s10	IRAK1-P	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \mathrm{vol}(\mathrm{c1}) \cdot \mathrm{function\_2}(\mathrm{Vf}, [\mathrm{s65}], [\mathrm{s3}], \mathrm{parameter\_1}, \mathrm{K}, \mathrm{Vr}, [\mathrm{s10}]) \tag{23}$$

$$\mathrm{function\_2}(\mathrm{Vf}, \mathrm{r1}, \mathrm{A}, \mathrm{n}, \mathrm{K}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n}}}{\mathrm{A}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}}\right) - \mathrm{Vr} \cdot \mathrm{p} \tag{24}$$

$$\mathrm{function\_2}(\mathrm{Vf}, \mathrm{r1}, \mathrm{A}, \mathrm{n}, \mathrm{K}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n}}}{\mathrm{A}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}}\right) - \mathrm{Vr} \cdot \mathrm{p} \tag{25}$$

Table 13: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K	K		2.017		☑
Vr	Vr		0.100		☑

9.3 Reaction re6

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

Name re6

Reaction equation

$$\mathrm{s12} \xrightarrow{\mathrm{s12}} \mathrm{s11} \tag{26}$$

Reactant

Table 14: Properties of each reactant.

Id	Name	SBO
s12	IL12	

Modifier

Table 15: Properties of each modifier.

Id	Name	SBO
s12	IL12	

Product

Table 16: Properties of each product.

Id	Name	SBO
s11	eIL12	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \mathrm{k1} \cdot [\mathrm{s12}] \tag{27}$$

Table 17: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑

9.4 Reaction re8

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

Name re8

Reaction equation

$$\mathrm{s11} + \mathrm{s13} \xrightleftharpoons{\mathrm{s34,\ s83,\ s11,\ s13,\ s34,\ s83,\ s14}} \mathrm{s14} \tag{28}$$

Reactants

Table 18: Properties of each reactant.

Id	Name	SBO
s11	eIL12	

Id	Name	SBO
s13	IL12R	

Modifiers

Table 19: Properties of each modifier.

Id	Name	SBO
s34	STAT6-P	
s83	L-PPARg	
s11	eIL12	
s13	IL12R	
s34	STAT6-P	
s83	L-PPARg	
s14	IL12-IL12R	

Product

Table 20: Properties of each product.

Id	Name	SBO
s14	IL12-IL12R	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \text{function\_3}\left(\text{Vf}, [\text{s11}], [\text{s13}], \text{K1}, \text{parameter\_1}, [\text{s34}], \text{K2}, \text{parameter\_1}, [\text{s83}], \text{Vr}, [\text{s14}]\right) \quad (29)$$

$$\text{function\_3}\left(\text{Vf}, \text{r1}, \text{r2}, \text{K1}, \text{n1}, \text{I1}, \text{K2}, \text{n2}, \text{I2}, \text{Vr}, \text{p}\right) = \text{Vf} \cdot \text{r1} \cdot \text{r2} \cdot \frac{\text{K1}^{\text{n1}}}{\text{I1}^{\text{n1}} + \text{K1}^{\text{n1}}} \cdot \frac{\text{K2}^{\text{n2}}}{\text{I2}^{\text{n2}} + \text{K2}^{\text{n2}}} - \text{Vr} \cdot \text{p} \quad (30)$$

Table 21: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K1	K1		2.946		☑
K2	K2		0.744		☑
Vr	Vr		0.100		☑

9.5 Reaction re9

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

Name re9

Reaction equation

$$\text{species\_10} + \text{species\_11} \xrightleftharpoons{\text{s83, s40, s10, s83, s40, s10, s20, species\_10, species\_11}} \text{s20} \quad (31)$$

Reactants

Table 22: Properties of each reactant.

Id	Name	SBO
species_10	p50	
species_11	p65	

Modifiers

Table 23: Properties of each modifier.

Id	Name	SBO
s83	L-PPARg	
s40	acetylated FOXP3	
s10	IRAK1-P	
s83	L-PPARg	
s40	acetylated FOXP3	
s10	IRAK1-P	
s20	p50/p65 dimer	
species_10	p50	
species_11	p65	

Product

Table 24: Properties of each product.

Id	Name	SBO
s20	p50/p65 dimer	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \mathrm{vol}(\mathrm{c1}) \cdot \mathrm{function\_4}(\mathrm{Vf}, \mathrm{K1}, \mathrm{parameter\_1}, [\mathrm{s83}], \mathrm{K2}, \mathrm{parameter\_1}, [\mathrm{s40}], [\mathrm{s10}], \mathrm{parameter\_1}, \mathrm{K3}, \mathrm{Vr}, [\mathrm{s20}], [\mathrm{species\_10}], [\mathrm{species\_11}]) \tag{32}$$

$$\begin{aligned} &\mathrm{function\_4}(\mathrm{Vf}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{A}, \mathrm{n3}, \mathrm{K3}, \mathrm{Vr}, \mathrm{p}, \mathrm{r1}, \mathrm{r2}) \\ &= \mathrm{Vf} \cdot \mathrm{r1} \cdot \mathrm{r2} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n3}}}{\mathrm{A}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}}\right) - \mathrm{Vr} \cdot \mathrm{p} \end{aligned} \tag{33}$$

$$\begin{aligned} &\mathrm{function\_4}(\mathrm{Vf}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{A}, \mathrm{n3}, \mathrm{K3}, \mathrm{Vr}, \mathrm{p}, \mathrm{r1}, \mathrm{r2}) \\ &= \mathrm{Vf} \cdot \mathrm{r1} \cdot \mathrm{r2} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n3}}}{\mathrm{A}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}}\right) - \mathrm{Vr} \cdot \mathrm{p} \end{aligned} \tag{34}$$

Table 25: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
`Vf`	Vf		0.100		☑
`K1`	K1		0.100		☑
`K2`	K2		98.948		☑
`K3`	K3		0.054		☑
`Vr`	Vr		0.100		☑

9.6 Reaction `re10`

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

Name re10

Reaction equation

$$\mathrm{s67} \xrightleftharpoons{\mathrm{s54,\ s35,\ s14,\ s59,\ s67,\ s54,\ s35,\ s14,\ s59,\ s21}} \mathrm{s21} \tag{35}$$

Reactant

Table 26: Properties of each reactant.

Id	Name	SBO
`s67`	STAT4	

Modifiers

Table 27: Properties of each modifier.

Id	Name	SBO
s54	IL21-IL21R	
s35	GATA3-P	
s14	IL12-IL12R	
s59	IL23-IL23R	
s67	STAT4	
s54	IL21-IL21R	
s35	GATA3-P	
s14	IL12-IL12R	
s59	IL23-IL23R	
s21	STAT4-P	

Product

Table 28: Properties of each product.

Id	Name	SBO
s21	STAT4-P	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \mathrm{vol}\,(\mathrm{c1}) \cdot \mathrm{function\_5}\,(\mathrm{Vf}, [\mathrm{s67}], \mathrm{K1}, \mathrm{parameter\_1}, [\mathrm{s54}], \mathrm{K2}, \mathrm{parameter\_1}, [\mathrm{s35}], [\mathrm{s14}], \mathrm{parameter\_1}, \mathrm{K3}, [\mathrm{s59}], \mathrm{parameter\_1}, \mathrm{K4}, \mathrm{Vr}, [\mathrm{s21}]) \tag{36}$$

$$\begin{aligned}&\mathrm{function\_5}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{A1}, \mathrm{n3}, \mathrm{K3}, \mathrm{A2}, \mathrm{n4}, \mathrm{K4}, \mathrm{Vr}, \mathrm{p}) \\ &= \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n3}}}{\mathrm{A1}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} + \frac{\mathrm{A2}^{\mathrm{n4}}}{\mathrm{A2}^{\mathrm{n4}} + \mathrm{K4}^{\mathrm{n4}}} \right) - \mathrm{Vr} \cdot \mathrm{p}\end{aligned} \tag{37}$$

$$\begin{aligned}&\mathrm{function\_5}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{A1}, \mathrm{n3}, \mathrm{K3}, \mathrm{A2}, \mathrm{n4}, \mathrm{K4}, \mathrm{Vr}, \mathrm{p}) \\ &= \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n3}}}{\mathrm{A1}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} + \frac{\mathrm{A2}^{\mathrm{n4}}}{\mathrm{A2}^{\mathrm{n4}} + \mathrm{K4}^{\mathrm{n4}}} \right) - \mathrm{Vr} \cdot \mathrm{p}\end{aligned} \tag{38}$$

Table 29: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K1	K1		0.125		☑
K2	K2		0.897		☑
K3	K3		0.031		☑
K4	K4		66.617		☑
Vr	Vr		0.100		☑

9.7 Reaction re11

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

Name re11

Reaction equation

$$\mathrm{s22} + \mathrm{s24} \xrightleftharpoons{\mathrm{s29,\ s22,\ s24,\ s29,\ s25}} \mathrm{s25} \tag{39}$$

Reactants

Table 30: Properties of each reactant.

Id	Name	SBO
s22	eIFNg	
s24	IFNgR	

Modifiers

Table 31: Properties of each modifier.

Id	Name	SBO
s29	SOCS1-JAKs	
s22	eIFNg	
s24	IFNgR	
s29	SOCS1-JAKs	
s25	IFNg-IFNgR	

Product

Table 32: Properties of each product.

Id	Name	SBO
s25	IFNg-IFNgR	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \text{function\_1}\,(\text{Vf}, [\text{s22}], [\text{s24}], \text{K}, \text{parameter\_1}, [\text{s29}], \text{Vr}, [\text{s25}]) \tag{40}$$

$$\text{function\_1}\,(\text{Vf}, \text{r1}, \text{r2}, \text{K}, \text{n}, \text{I}, \text{Vr}, \text{p}) = \text{Vf} \cdot \text{r1} \cdot \text{r2} \cdot \frac{\text{K}^{\text{n}}}{\text{I}^{\text{n}} + \text{K}^{\text{n}}} - \text{Vr} \cdot \text{p} \tag{41}$$

Table 33: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K	K		0.264		☑
Vr	Vr		0.100		☑

9.8 Reaction re12

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

Name re12

Reaction equation

$$\text{s68} \xrightarrow{\text{s68}} \text{s22} \tag{42}$$

Reactant

Table 34: Properties of each reactant.

Id	Name	SBO
s68	IFNg	

Modifier

Table 35: Properties of each modifier.

Id	Name	SBO
s68	IFNg	

Product

Table 36: Properties of each product.

Id	Name	SBO
s22	eIFNg	

Kinetic Law

Derived unit contains undeclared units

$$v_8 = \mathrm{k1} \cdot [\mathrm{s68}] \tag{43}$$

Table 37: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑

9.9 Reaction re13

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

Name re13

Reaction equation

$$\mathrm{s70} \xrightleftharpoons{\mathrm{s83,\ s54,\ s25,\ s28,\ s70,\ s83,\ s54,\ s25,\ s28,\ s26}} \mathrm{s26} \tag{44}$$

Reactant

Table 38: Properties of each reactant.

Id	Name	SBO
s70	STAT1	

Modifiers

Table 39: Properties of each modifier.

Id	Name	SBO
s83	L-PPARg	
s54	IL21-IL21R	
s25	IFNg-IFNgR	
s28	JAK1-P	
s70	STAT1	
s83	L-PPARg	
s54	IL21-IL21R	
s25	IFNg-IFNgR	
s28	JAK1-P	
s26	STAT1-P	

Product

Table 40: Properties of each product.

Id	Name	SBO
s26	STAT1-P	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \mathrm{vol}(\mathrm{c1}) \cdot \mathrm{function\_6}(\mathrm{Vf}, [\mathrm{s70}], \mathrm{K}, \mathrm{parameter\_1}, [\mathrm{s83}], [\mathrm{s54}], \mathrm{parameter\_1}, \mathrm{K1}, [\mathrm{s25}], \mathrm{parameter\_1}, \mathrm{K2}, [\mathrm{s28}], \mathrm{parameter\_1}, \mathrm{K3}, \mathrm{Vr}, [\mathrm{s26}]) \tag{45}$$

$$\begin{aligned}&\mathrm{function\_6}(\mathrm{Vf}, \mathrm{r1}, \mathrm{K}, \mathrm{n}, \mathrm{I}, \mathrm{A1}, \mathrm{n1}, \mathrm{K1}, \mathrm{A2}, \mathrm{n2}, \mathrm{K2}, \mathrm{A3}, \mathrm{n3}, \mathrm{K3}, \mathrm{Vr}, \mathrm{p}) \\ &= \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n1}}}{\mathrm{A1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} + \frac{\mathrm{A2}^{\mathrm{n2}}}{\mathrm{A2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} + \frac{\mathrm{A3}^{\mathrm{n3}}}{\mathrm{A3}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} \right) - \mathrm{Vr} \cdot \mathrm{p}\end{aligned} \tag{46}$$

$$\begin{aligned}&\mathrm{function\_6}(\mathrm{Vf}, \mathrm{r1}, \mathrm{K}, \mathrm{n}, \mathrm{I}, \mathrm{A1}, \mathrm{n1}, \mathrm{K1}, \mathrm{A2}, \mathrm{n2}, \mathrm{K2}, \mathrm{A3}, \mathrm{n3}, \mathrm{K3}, \mathrm{Vr}, \mathrm{p}) \\ &= \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n1}}}{\mathrm{A1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} + \frac{\mathrm{A2}^{\mathrm{n2}}}{\mathrm{A2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} + \frac{\mathrm{A3}^{\mathrm{n3}}}{\mathrm{A3}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} \right) - \mathrm{Vr} \cdot \mathrm{p}\end{aligned} \tag{47}$$

Table 41: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K	K		0.100		☑
K1	K1		5.044		☑
K2	K2		0.071		☑
K3	K3		14.978		☑
Vr	Vr		0.100		☑

9.10 Reaction re14

This is a reversible reaction of one reactant forming one product influenced by 14 modifiers.

Name re14

Reaction equation

$$\text{species\_5} \xrightleftharpoons{\text{species\_14, s49, s83, s21, s20, s27, species\_5, species\_14, s49, s83, s21, s20, s27, s68}} \text{s68} \tag{48}$$

Reactant

Table 42: Properties of each reactant.

Id	Name	SBO
species_5	pIFNg	

Modifiers

Table 43: Properties of each modifier.

Id	Name	SBO
species_14	anti-IFNg	
s49	STAT3-P	
s83	L-PPARg	
s21	STAT4-P	
s20	p50/p65 dimer	
s27	Tbet-P	
species_5	pIFNg	
species_14	anti-IFNg	
s49	STAT3-P	

Id	Name	SBO
s83	L-PPARg	
s21	STAT4-P	
s20	p50/p65 dimer	
s27	Tbet-P	
s68	IFNg	

Product

Table 44: Properties of each product.

Id	Name	SBO
s68	IFNg	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \mathrm{vol}\,(\mathrm{c1}) \cdot \mathrm{function\_7}\,(\mathrm{Vf}, [\mathrm{species\_5}], \mathrm{K1}, \mathrm{parameter\_1}, [\mathrm{species\_14}], \mathrm{K2}, \mathrm{parameter\_1}, [\mathrm{s49}], \mathrm{K3}, \mathrm{parameter\_1}, [\mathrm{s83}], [\mathrm{s21}], \mathrm{parameter\_1}, \mathrm{K4}, [\mathrm{s20}], \mathrm{parameter\_1}, \mathrm{K5}, [\mathrm{s27}], \mathrm{parameter\_1}, \mathrm{K6}, \mathrm{Vr}, [\mathrm{s68}]) \tag{49}$$

$$\begin{aligned}&\mathrm{function\_7}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{K3}, \mathrm{n3}, \mathrm{I3}, \mathrm{A1}, \mathrm{n4}, \mathrm{K4}, \mathrm{A2}, \mathrm{n5}, \mathrm{K5}, \mathrm{A3}, \mathrm{n6}, \mathrm{K6}, \mathrm{Vr}, \mathrm{p}) \\ &= \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \frac{\mathrm{K3}^{\mathrm{n3}}}{\mathrm{I3}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} \\ &\quad \cdot \left(\frac{\mathrm{A1}^{\mathrm{n4}}}{\mathrm{A1}^{\mathrm{n4}} + \mathrm{K4}^{\mathrm{n4}}} + \frac{\mathrm{A2}^{\mathrm{n5}}}{\mathrm{A2}^{\mathrm{n5}} + \mathrm{K5}^{\mathrm{n5}}} + \frac{\mathrm{A3}^{\mathrm{n6}}}{\mathrm{A3}^{\mathrm{n6}} + \mathrm{K6}^{\mathrm{n6}}} \right) - \mathrm{Vr} \cdot \mathrm{p}\end{aligned} \tag{50}$$

$$\begin{aligned}&\mathrm{function\_7}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{K3}, \mathrm{n3}, \mathrm{I3}, \mathrm{A1}, \mathrm{n4}, \mathrm{K4}, \mathrm{A2}, \mathrm{n5}, \mathrm{K5}, \mathrm{A3}, \mathrm{n6}, \mathrm{K6}, \mathrm{Vr}, \mathrm{p}) \\ &= \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \frac{\mathrm{K3}^{\mathrm{n3}}}{\mathrm{I3}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} \\ &\quad \cdot \left(\frac{\mathrm{A1}^{\mathrm{n4}}}{\mathrm{A1}^{\mathrm{n4}} + \mathrm{K4}^{\mathrm{n4}}} + \frac{\mathrm{A2}^{\mathrm{n5}}}{\mathrm{A2}^{\mathrm{n5}} + \mathrm{K5}^{\mathrm{n5}}} + \frac{\mathrm{A3}^{\mathrm{n6}}}{\mathrm{A3}^{\mathrm{n6}} + \mathrm{K6}^{\mathrm{n6}}} \right) - \mathrm{Vr} \cdot \mathrm{p}\end{aligned} \tag{51}$$

Table 45: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K1	K1		0.502		☑
K2	K2		0.812		☑
K3	K3		0.100		☑
K4	K4		0.001		☑
K5	K5		100.000		☑
K6	K6		0.231		☑
Vr	Vr		0.100		☑

9.11 Reaction re15

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

Name re15

Reaction equation

$$\text{s80} \xrightleftharpoons{\text{s45, s49, s21, s26, s27, s80, s45, s49, s21, s26, s27}} \text{s27} \tag{52}$$

Reactant

Table 46: Properties of each reactant.

Id	Name	SBO
s80	Tbet	

Modifiers

Table 47: Properties of each modifier.

Id	Name	SBO
s45	TGFb-TGFbR	
s49	STAT3-P	
s21	STAT4-P	
s26	STAT1-P	
s27	Tbet-P	
s80	Tbet	
s45	TGFb-TGFbR	
s49	STAT3-P	

Id	Name	SBO
s21	STAT4-P	
s26	STAT1-P	
s27	Tbet-P	

Product

Table 48: Properties of each product.

Id	Name	SBO
s27	Tbet-P	

Kinetic Law

Derived unit contains undeclared units

$$v_{11} = \mathrm{vol}\,(\mathrm{c1}) \cdot \mathrm{function\_13}\,(\mathrm{Vf}, [\mathrm{s80}], \mathrm{K1}, \mathrm{parameter\_1}, [\mathrm{s45}], \mathrm{K2}, \mathrm{parameter\_1}, [\mathrm{s49}], [\mathrm{s21}], \mathrm{parameter\_1}, \mathrm{K3}, [\mathrm{s26}], \mathrm{parameter\_1}, \mathrm{K4}, [\mathrm{s27}], \mathrm{parameter\_1}, \mathrm{K5}, \mathrm{Vr}, [\mathrm{s27}]) \tag{53}$$

$$\mathrm{function\_13}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{A1}, \mathrm{n3}, \mathrm{K3}, \mathrm{A2}, \mathrm{n4}, \mathrm{K4}, \mathrm{A3}, \mathrm{n5}, \mathrm{K5}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n3}}}{\mathrm{A1}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} + \frac{\mathrm{A2}^{\mathrm{n4}}}{\mathrm{A2}^{\mathrm{n4}} + \mathrm{K4}^{\mathrm{n4}}} + \frac{\mathrm{A3}^{\mathrm{n5}}}{\mathrm{A3}^{\mathrm{n5}} + \mathrm{K5}^{\mathrm{n5}}} \right) - \mathrm{Vr} \cdot \mathrm{p} \tag{54}$$

$$\mathrm{function\_13}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{A1}, \mathrm{n3}, \mathrm{K3}, \mathrm{A2}, \mathrm{n4}, \mathrm{K4}, \mathrm{A3}, \mathrm{n5}, \mathrm{K5}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n3}}}{\mathrm{A1}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} + \frac{\mathrm{A2}^{\mathrm{n4}}}{\mathrm{A2}^{\mathrm{n4}} + \mathrm{K4}^{\mathrm{n4}}} + \frac{\mathrm{A3}^{\mathrm{n5}}}{\mathrm{A3}^{\mathrm{n5}} + \mathrm{K5}^{\mathrm{n5}}} \right) - \mathrm{Vr} \cdot \mathrm{p} \tag{55}$$

Table 49: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K1	K1		0.917		☑
K2	K2		1.335		☑
K3	K3		3.588		☑
K4	K4		0.728		☑
K5	K5		6.978		☑
Vr	Vr		0.100		☑

9.12 Reaction re16

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

Name re16

Reaction equation

$$\text{s69} \xrightleftharpoons{\text{s83, s29, s25, s69, s83, s29, s25, s28}} \text{s28} \tag{56}$$

Reactant

Table 50: Properties of each reactant.

Id	Name	SBO
s69	JAK1	

Modifiers

Table 51: Properties of each modifier.

Id	Name	SBO
s83	L-PPARg	
s29	SOCS1-JAKs	
s25	IFNg-IFNgR	
s69	JAK1	
s83	L-PPARg	
s29	SOCS1-JAKs	
s25	IFNg-IFNgR	
s28	JAK1-P	

Product

Table 52: Properties of each product.

Id	Name	SBO
s28	JAK1-P	

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = \mathrm{vol}\,(\mathrm{c1}) \cdot \mathrm{function\_8}\,(\mathrm{Vf}, [\mathrm{s69}], \mathrm{K1}, \mathrm{parameter\_1}, [\mathrm{s83}], \mathrm{K2}, \mathrm{parameter\_1}, [\mathrm{s29}], [\mathrm{s25}], \mathrm{parameter\_1}, \mathrm{K3}, \mathrm{Vr}, [\mathrm{s28}]) \tag{57}$$

$$\begin{aligned}&\mathrm{function\_8}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{A}, \mathrm{n3}, \mathrm{K3}, \mathrm{Vr}, \mathrm{p}) \\ &= \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n3}}}{\mathrm{A}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}}\right) - \mathrm{Vr} \cdot \mathrm{p}\end{aligned} \tag{58}$$

$$\begin{aligned}&\mathrm{function\_8}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{A}, \mathrm{n3}, \mathrm{K3}, \mathrm{Vr}, \mathrm{p}) \\ &= \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n3}}}{\mathrm{A}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}}\right) - \mathrm{Vr} \cdot \mathrm{p}\end{aligned} \tag{59}$$

Table 53: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
`Vf`	Vf		0.100		☑
`K1`	K1		0.100		☑
`K2`	K2		0.004		☑
`K3`	K3		99.987		☑
`Vr`	Vr		0.100		☑

9.13 Reaction `re17`

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

Name re17

Reaction equation

$$\mathrm{s79} \xrightleftharpoons{\mathrm{s26,\ s27,\ s79,\ s26,\ s27,\ s29}} \mathrm{s29} \tag{60}$$

Reactant

Table 54: Properties of each reactant.

Id	Name	SBO
`s79`	SOCS1	

Modifiers

Table 55: Properties of each modifier.

Id	Name	SBO
s26	STAT1-P	
s27	Tbet-P	
s79	SOCS1	
s26	STAT1-P	
s27	Tbet-P	
s29	SOCS1-JAKs	

Product

Table 56: Properties of each product.

Id	Name	SBO
s29	SOCS1-JAKs	

Kinetic Law

Derived unit contains undeclared units

$$v_{13} = \mathrm{vol}\,(\mathrm{c1}) \cdot \mathrm{function\_9}\,(\mathrm{Vf}, [\mathrm{s79}], [\mathrm{s26}], \mathrm{parameter\_1}, \mathrm{K1}, [\mathrm{s27}], \mathrm{parameter\_1}, \mathrm{K2}, \mathrm{Vr}, [\mathrm{s29}]) \tag{61}$$

$$\mathrm{function\_9}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{A1}, \mathrm{n1}, \mathrm{K1}, \mathrm{A2}, \mathrm{n2}, \mathrm{K2}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{A1}^{\mathrm{n1}}}{\mathrm{A1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{A2}^{\mathrm{n2}}}{\mathrm{A2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} - \mathrm{Vr} \cdot \mathrm{p} \tag{62}$$

$$\mathrm{function\_9}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{A1}, \mathrm{n1}, \mathrm{K1}, \mathrm{A2}, \mathrm{n2}, \mathrm{K2}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{A1}^{\mathrm{n1}}}{\mathrm{A1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{A2}^{\mathrm{n2}}}{\mathrm{A2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} - \mathrm{Vr} \cdot \mathrm{p} \tag{63}$$

Table 57: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K1	K1		7.838		☑
K2	K2		0.667		☑
Vr	Vr		0.100		☑

9.14 Reaction re18

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

Name re18

Reaction equation

$$\mathrm{s31} \xrightarrow{\mathrm{s31}} \mathrm{s30} \tag{64}$$

Reactant

Table 58: Properties of each reactant.

Id	Name	SBO
s31	IL4	

Modifier

Table 59: Properties of each modifier.

Id	Name	SBO
s31	IL4	

Product

Table 60: Properties of each product.

Id	Name	SBO
s30	eIL4	

Kinetic Law

Derived unit contains undeclared units

$$v_{14} = \mathrm{k1} \cdot [\mathrm{s31}] \tag{65}$$

Table 61: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑

9.15 Reaction re19

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

Name re19

Reaction equation

$$\mathrm{s30} + \mathrm{s32} \xrightleftharpoons{\mathrm{s29,\ s30,\ s32,\ s29,\ s33}} \mathrm{s33} \tag{66}$$

Reactants

Table 62: Properties of each reactant.

Id	Name	SBO
s30	eIL4	
s32	IL4R	

Modifiers

Table 63: Properties of each modifier.

Id	Name	SBO
s29	SOCS1-JAKs	
s30	eIL4	
s32	IL4R	
s29	SOCS1-JAKs	
s33	IL4-IL4R	

Product

Table 64: Properties of each product.

Id	Name	SBO
s33	IL4-IL4R	

Kinetic Law

Derived unit contains undeclared units

$$v_{15} = \mathrm{function\_1}\left(\mathrm{Vf}, [\mathrm{s30}], [\mathrm{s32}], \mathrm{K}, \mathrm{parameter\_1}, [\mathrm{s29}], \mathrm{Vr}, [\mathrm{s33}]\right) \tag{67}$$

$$\text{function\_1}\left(\text{Vf},\text{r1},\text{r2},\text{K},\text{n},\text{I},\text{Vr},\text{p}\right) = \text{Vf}\cdot\text{r1}\cdot\text{r2}\cdot\frac{\text{K}^{\text{n}}}{\text{I}^{\text{n}}+\text{K}^{\text{n}}} - \text{Vr}\cdot\text{p} \tag{68}$$

Table 65: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
`Vf`	Vf		0.100		☑
`K`	K		13.066		☑
`Vr`	Vr		0.100		☑

9.16 Reaction `re20`

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

Name re20

Reaction equation

$$\text{species\_15} \xrightleftharpoons{\text{s26, species\_13, s31, s35, s39, species\_15, s26, species\_13, s31, s35, s39}} \text{s31} \tag{69}$$

Reactant

Table 66: Properties of each reactant.

Id	Name	SBO
`species_15`	pIL4	

Modifiers

Table 67: Properties of each modifier.

Id	Name	SBO
`s26`	STAT1-P	
`species_13`	anti-IL4	
`s31`	IL4	
`s35`	GATA3-P	
`s39`	STAT5-P	
`species_15`	pIL4	
`s26`	STAT1-P	
`species_13`	anti-IL4	
`s31`	IL4	

Id	Name	SBO
s35	GATA3-P	
s39	STAT5-P	

Product

Table 68: Properties of each product.

Id	Name	SBO
s31	IL4	

Kinetic Law

Derived unit contains undeclared units

$$v_{16} = \text{function\_13}\,(\text{Vf}, [\text{species\_15}], \text{K1}, \text{parameter\_1}, [\text{s26}], \text{K2}, \text{parameter\_1}, [\text{species\_13}], [\text{s31}], \text{parameter\_1}, \text{K3}, [\text{s35}], \text{parameter\_1}, \text{K4}, [\text{s39}], \text{parameter\_1}, \text{K5}, \text{Vr}, [\text{s31}]) \tag{70}$$

$$\text{function\_13}\,(\text{Vf}, \text{r1}, \text{K1}, \text{n1}, \text{I1}, \text{K2}, \text{n2}, \text{I2}, \text{A1}, \text{n3}, \text{K3}, \text{A2}, \text{n4}, \text{K4}, \text{A3}, \text{n5}, \text{K5}, \text{Vr}, \text{p}) = \text{Vf}\cdot\text{r1}\cdot\frac{\text{K1}^{\text{n1}}}{\text{I1}^{\text{n1}}+\text{K1}^{\text{n1}}}\cdot\frac{\text{K2}^{\text{n2}}}{\text{I2}^{\text{n2}}+\text{K2}^{\text{n2}}}\cdot\left(\frac{\text{A1}^{\text{n3}}}{\text{A1}^{\text{n3}}+\text{K3}^{\text{n3}}}+\frac{\text{A2}^{\text{n4}}}{\text{A2}^{\text{n4}}+\text{K4}^{\text{n4}}}+\frac{\text{A3}^{\text{n5}}}{\text{A3}^{\text{n5}}+\text{K5}^{\text{n5}}}\right)-\text{Vr}\cdot\text{p} \tag{71}$$

Table 69: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K1	K1		0.210		☑
K2	K2		56.345		☑
K3	K3		98.037		☑
K4	K4		0.856		☑
K5	K5		4.327		☑
Vr	Vr		0.100		☑

9.17 Reaction re23

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

Name re23

Reaction equation

$$\text{s81} \xrightleftharpoons{\text{s27, s49, s45, s34, s83, s81, s27, s49, s45, s34, s83, s35}} \text{s35} \tag{72}$$

Reactant

Table 70: Properties of each reactant.

Id	Name	SBO
s81	GATA3	

Modifiers

Table 71: Properties of each modifier.

Id	Name	SBO
s27	Tbet-P	
s49	STAT3-P	
s45	TGFb-TGFbR	
s34	STAT6-P	
s83	L-PPARg	
s81	GATA3	
s27	Tbet-P	
s49	STAT3-P	
s45	TGFb-TGFbR	
s34	STAT6-P	
s83	L-PPARg	
s35	GATA3-P	

Product

Table 72: Properties of each product.

Id	Name	SBO
s35	GATA3-P	

Kinetic Law

Derived unit contains undeclared units

$$v_{17} = \mathrm{vol}(\mathrm{c1}) \cdot \mathrm{function\_10}(\mathrm{Vf}, [\mathrm{s81}], \mathrm{K1}, \mathrm{parameter\_1}, [\mathrm{s27}], \mathrm{K2}, \mathrm{parameter\_1}, [\mathrm{s49}], \mathrm{K3}, \mathrm{parameter\_1}, [\mathrm{s45}], [\mathrm{s34}], \mathrm{parameter\_1}, \mathrm{K4}, [\mathrm{s83}], \mathrm{parameter\_1}, \mathrm{K5}, \mathrm{Vr}, [\mathrm{s35}]) \quad (73)$$

$$\mathrm{function\_10}(\mathrm{Vf}, \mathrm{r1}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{K3}, \mathrm{n3}, \mathrm{I3}, \mathrm{A1}, \mathrm{n4}, \mathrm{K4}, \mathrm{A2}, \mathrm{n5}, \mathrm{K5}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \frac{\mathrm{K3}^{\mathrm{n3}}}{\mathrm{I3}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n4}}}{\mathrm{A1}^{\mathrm{n4}} + \mathrm{K4}^{\mathrm{n4}}} + \frac{\mathrm{A2}^{\mathrm{n5}}}{\mathrm{A2}^{\mathrm{n5}} + \mathrm{K5}^{\mathrm{n5}}} \right) - \mathrm{Vr} \cdot \mathrm{p} \quad (74)$$

$$\mathrm{function\_10}(\mathrm{Vf}, \mathrm{r1}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{K3}, \mathrm{n3}, \mathrm{I3}, \mathrm{A1}, \mathrm{n4}, \mathrm{K4}, \mathrm{A2}, \mathrm{n5}, \mathrm{K5}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \frac{\mathrm{K3}^{\mathrm{n3}}}{\mathrm{I3}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n4}}}{\mathrm{A1}^{\mathrm{n4}} + \mathrm{K4}^{\mathrm{n4}}} + \frac{\mathrm{A2}^{\mathrm{n5}}}{\mathrm{A2}^{\mathrm{n5}} + \mathrm{K5}^{\mathrm{n5}}} \right) - \mathrm{Vr} \cdot \mathrm{p} \quad (75)$$

Table 73: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K1	K1		0.199		☑
K2	K2		9.615		☑
K3	K3		0.214		☑
K4	K4		0.321		☑
K5	K5		0.100		☑
Vr	Vr		0.100		☑

9.18 Reaction re24

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

Name re24

Reaction equation

$$\mathrm{s82} \xrightleftharpoons{\mathrm{s25,\ s33,\ s82,\ s25,\ s33,\ s34}} \mathrm{s34} \quad (76)$$

Reactant

Table 74: Properties of each reactant.

Id	Name	SBO
s82	STAT6	

Modifiers

Table 75: Properties of each modifier.

Id	Name	SBO
s25	IFNg-IFNgR	
s33	IL4-IL4R	
s82	STAT6	
s25	IFNg-IFNgR	
s33	IL4-IL4R	
s34	STAT6-P	

Product

Table 76: Properties of each product.

Id	Name	SBO
s34	STAT6-P	

Kinetic Law

Derived unit contains undeclared units

$$v_{18} = \mathrm{vol}\,(\mathrm{c1}) \cdot \mathrm{function\_15}\,(\mathrm{Vf}, [\mathrm{s82}], \mathrm{K}, \mathrm{parameter\_1}, [\mathrm{s25}], [\mathrm{s33}], \mathrm{n1}, \mathrm{K1}, \mathrm{Vr}, [\mathrm{s34}]) \quad (77)$$

$$\mathrm{function\_15}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K}, \mathrm{n}, \mathrm{I}, \mathrm{A1}, \mathrm{n1}, \mathrm{K1}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}} \cdot \frac{\mathrm{A1}^{\mathrm{n1}}}{\mathrm{A1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} - \mathrm{Vr} \cdot \mathrm{p} \quad (78)$$

$$\mathrm{function\_15}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K}, \mathrm{n}, \mathrm{I}, \mathrm{A1}, \mathrm{n1}, \mathrm{K1}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}} \cdot \frac{\mathrm{A1}^{\mathrm{n1}}}{\mathrm{A1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} - \mathrm{Vr} \cdot \mathrm{p} \quad (79)$$

Table 77: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K	K		0.100		☑
n1	n1		0.004		☑
K1	K1		0.100		☑
Vr	Vr		0.100		☑

9.19 Reaction re25

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

Name re25

Reaction equation

$$\mathrm{s89} + \mathrm{s37} \xrightleftharpoons{\mathrm{s89,\ s37,\ s38}} \mathrm{s38} \tag{80}$$

Reactants

Table 78: Properties of each reactant.

Id	Name	SBO
s89	eIL2	
s37	IL2R	

Modifiers

Table 79: Properties of each modifier.

Id	Name	SBO
s89	eIL2	
s37	IL2R	
s38	IL2-IL2R	

Product

Table 80: Properties of each product.

Id	Name	SBO
s38	IL2-IL2R	

Kinetic Law

Derived unit contains undeclared units

$$v_{19} = \mathrm{k1} \cdot [\mathrm{s89}] \cdot [\mathrm{s37}] - \mathrm{k2} \cdot [\mathrm{s38}] \tag{81}$$

Table 81: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑
k2	k2		0.1		☑

9.20 Reaction re26

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

Name re26

Reaction equation

$$\text{s77} \overset{\text{s38, s77, s38, s39}}{\rightleftharpoons} \text{s39} \tag{82}$$

Reactant

Table 82: Properties of each reactant.

Id	Name	SBO
s77	STAT5	

Modifiers

Table 83: Properties of each modifier.

Id	Name	SBO
s38	IL2-IL2R	
s77	STAT5	
s38	IL2-IL2R	
s39	STAT5-P	

Product

Table 84: Properties of each product.

Id	Name	SBO
s39	STAT5-P	

Kinetic Law

Derived unit contains undeclared units

$$v_{20} = \mathrm{vol}\,(\mathrm{c1}) \cdot \mathrm{function\_2}\,(\mathrm{Vf}, [\mathrm{s77}], [\mathrm{s38}], \mathrm{parameter\_1}, \mathrm{K}, \mathrm{Vr}, [\mathrm{s39}]) \tag{83}$$

$$\mathrm{function\_2}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{A}, \mathrm{n}, \mathrm{K}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n}}}{\mathrm{A}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}}\right) - \mathrm{Vr} \cdot \mathrm{p} \tag{84}$$

$$\mathrm{function\_2}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{A}, \mathrm{n}, \mathrm{K}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n}}}{\mathrm{A}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}}\right) - \mathrm{Vr} \cdot \mathrm{p} \tag{85}$$

Table 85: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
`Vf`	Vf		0.100		☑
`K`	K		0.375		☑
`Vr`	Vr		0.100		☑

9.21 Reaction `re27`

This is a reversible reaction of one reactant forming one product influenced by 16 modifiers.

Name re27

Reaction equation

$$\mathrm{s78} \xrightleftharpoons{\mathrm{s34, s49, s48, s45, s26, s39, s83, s78, s34, s49, s48, s45, s26, s39, s83, s40}} \mathrm{s40} \tag{86}$$

Reactant

Table 86: Properties of each reactant.

Id	Name	SBO
`s78`	FOXP3	

Modifiers

Table 87: Properties of each modifier.

Id	Name	SBO
s34	STAT6-P	
s49	STAT3-P	
s48	IL6-IL6R	
s45	TGFb-TGFbR	
s26	STAT1-P	
s39	STAT5-P	
s83	L-PPARg	
s78	FOXP3	
s34	STAT6-P	
s49	STAT3-P	
s48	IL6-IL6R	
s45	TGFb-TGFbR	
s26	STAT1-P	
s39	STAT5-P	
s83	L-PPARg	
s40	acetylated FOXP3	

Product

Table 88: Properties of each product.

Id	Name	SBO
s40	acetylated FOXP3	

Kinetic Law

Derived unit contains undeclared units

$$v_{21} = \mathrm{vol}\,(\mathrm{c1}) \cdot \mathrm{function\_11}\,(\mathrm{Vf}, [\mathrm{s78}], \mathrm{K1}, \mathrm{parameter\_1}, [\mathrm{s34}], \mathrm{K2}, \mathrm{parameter\_1}, [\mathrm{s49}], \mathrm{K3}, \mathrm{parameter\_1}, [\mathrm{s48}], [\mathrm{s45}], \mathrm{parameter\_1}, \mathrm{K4}, [\mathrm{s26}], \mathrm{parameter\_1}, \mathrm{K5}, [\mathrm{s39}], \mathrm{parameter\_1}, \mathrm{K6}, [\mathrm{s83}], \mathrm{parameter\_1}, \mathrm{K7}, \mathrm{Vr}, [\mathrm{s40}]) \tag{87}$$

$$\begin{aligned}\mathrm{function\_11}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{K3}, \mathrm{n3}, \mathrm{I3}, \mathrm{A1}, \mathrm{n4}, \mathrm{K4}, \mathrm{A2}, \mathrm{n5}, \mathrm{K5}, \mathrm{A3}, \\ \mathrm{n6}, \mathrm{K6}, \mathrm{A4}, \mathrm{n7}, \mathrm{K7}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \frac{\mathrm{K3}^{\mathrm{n3}}}{\mathrm{I3}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} \\ \cdot \left(\frac{\mathrm{A1}^{\mathrm{n4}}}{\mathrm{A1}^{\mathrm{n4}} + \mathrm{K4}^{\mathrm{n4}}} + \frac{\mathrm{A2}^{\mathrm{n5}}}{\mathrm{A2}^{\mathrm{n5}} + \mathrm{K5}^{\mathrm{n5}}} + \frac{\mathrm{A3}^{\mathrm{n6}}}{\mathrm{A3}^{\mathrm{n6}} + \mathrm{K6}^{\mathrm{n6}}} + \frac{\mathrm{A4}^{\mathrm{n7}}}{\mathrm{A4}^{\mathrm{n7}} + \mathrm{K7}^{\mathrm{n7}}} \right) - \mathrm{Vr} \cdot \mathrm{p}\end{aligned} \tag{88}$$

$$\begin{aligned}\text{function\_11}(\mathrm{Vf},\mathrm{r1},\mathrm{K1},\mathrm{n1},\mathrm{I1},\mathrm{K2},\mathrm{n2},\mathrm{I2},\mathrm{K3},\mathrm{n3},\mathrm{I3},\mathrm{A1},\mathrm{n4},\mathrm{K4},\mathrm{A2},\mathrm{n5},\mathrm{K5},\mathrm{A3},\\ \mathrm{n6},\mathrm{K6},\mathrm{A4},\mathrm{n7},\mathrm{K7},\mathrm{Vr},\mathrm{p}) = \mathrm{Vf}\cdot\mathrm{r1}\cdot\frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}}+\mathrm{K1}^{\mathrm{n1}}}\cdot\frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}}+\mathrm{K2}^{\mathrm{n2}}}\cdot\frac{\mathrm{K3}^{\mathrm{n3}}}{\mathrm{I3}^{\mathrm{n3}}+\mathrm{K3}^{\mathrm{n3}}}\\ \cdot\left(\frac{\mathrm{A1}^{\mathrm{n4}}}{\mathrm{A1}^{\mathrm{n4}}+\mathrm{K4}^{\mathrm{n4}}}+\frac{\mathrm{A2}^{\mathrm{n5}}}{\mathrm{A2}^{\mathrm{n5}}+\mathrm{K5}^{\mathrm{n5}}}+\frac{\mathrm{A3}^{\mathrm{n6}}}{\mathrm{A3}^{\mathrm{n6}}+\mathrm{K6}^{\mathrm{n6}}}+\frac{\mathrm{A4}^{\mathrm{n7}}}{\mathrm{A4}^{\mathrm{n7}}+\mathrm{K7}^{\mathrm{n7}}}\right)-\mathrm{Vr}\cdot\mathrm{p}\end{aligned} \tag{89}$$

Table 89: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K1	K1		100.000		☑
K2	K2		0.355		☑
K3	K3		1.313		☑
K4	K4		$6.79025\cdot10^{-4}$		☑
K5	K5		2.079		☑
K6	K6		100.000		☑
K7	K7		$1.93254\cdot10^{-7}$		☑
Vr	Vr		0.100		☑

9.22 Reaction re28

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

Name re28

Reaction equation

$$\mathrm{s87}+\mathrm{s44}\xrightleftharpoons{\text{s87, s44, s45}}\mathrm{s45} \tag{90}$$

Reactants

Table 90: Properties of each reactant.

Id	Name	SBO
s87	eTGFb	
s44	TGFbR	

Modifiers

Table 91: Properties of each modifier.

Id	Name	SBO
s87	eTGFb	
s44	TGFbR	
s45	TGFb-TGFbR	

Product

Table 92: Properties of each product.

Id	Name	SBO
s45	TGFb-TGFbR	

Kinetic Law

Derived unit contains undeclared units

$$v_{22} = \mathrm{k1} \cdot [\mathrm{s87}] \cdot [\mathrm{s44}] - \mathrm{k2} \cdot [\mathrm{s45}] \tag{91}$$

Table 93: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑
k2	k2		0.1		☑

9.23 Reaction re29

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

Name re29

Reaction equation

$$\mathrm{s90} + \mathrm{s47} \overset{\mathrm{s90,\ s47,\ s48}}{\rightleftharpoons} \mathrm{s48} \tag{92}$$

Reactants

Table 94: Properties of each reactant.

Id	Name	SBO
s90	eIL6	
s47	IL6R	

Modifiers

Table 95: Properties of each modifier.

Id	Name	SBO
s90	eIL6	
s47	IL6R	
s48	IL6-IL6R	

Product

Table 96: Properties of each product.

Id	Name	SBO
s48	IL6-IL6R	

Kinetic Law

Derived unit contains undeclared units

$$v_{23} = \mathrm{k1} \cdot [\mathrm{s90}] \cdot [\mathrm{s47}] - \mathrm{k2} \cdot [\mathrm{s48}] \tag{93}$$

Table 97: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑
k2	k2		0.1		☑

9.24 Reaction re30

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

Name re30

Reaction equation

$$\text{s76} \xrightleftharpoons{\text{s83, s54, s59, s63, s48, s76, s83, s54, s59, s63, s48, s49}} \text{s49} \tag{94}$$

Reactant

Table 98: Properties of each reactant.

Id	Name	SBO
s76	STAT3	

Modifiers

Table 99: Properties of each modifier.

Id	Name	SBO
s83	L-PPARg	
s54	IL21-IL21R	
s59	IL23-IL23R	
s63	IL10-IL10R	
s48	IL6-IL6R	
s76	STAT3	
s83	L-PPARg	
s54	IL21-IL21R	
s59	IL23-IL23R	
s63	IL10-IL10R	
s48	IL6-IL6R	
s49	STAT3-P	

Product

Table 100: Properties of each product.

Id	Name	SBO
s49	STAT3-P	

Kinetic Law

Derived unit contains undeclared units

$$v_{24} = \mathrm{vol}\,(\mathrm{c1}) \cdot \mathrm{function\_12}\,(\mathrm{Vf}, [\mathrm{s76}], \mathrm{K}, \mathrm{parameter\_1}, [\mathrm{s83}], [\mathrm{s54}], \mathrm{parameter\_1}, \mathrm{K1}, [\mathrm{s59}], \mathrm{parameter\_1}, \mathrm{K2}, [\mathrm{s63}], \mathrm{parameter\_1}, \mathrm{K3}, [\mathrm{s48}], \mathrm{parameter\_1}, \mathrm{K4}, \mathrm{Vr}, [\mathrm{s49}]) \quad (95)$$

$$\mathrm{function\_12}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K}, \mathrm{n}, \mathrm{I}, \mathrm{A1}, \mathrm{n1}, \mathrm{K1}, \mathrm{A2}, \mathrm{n2}, \mathrm{K2}, \mathrm{A3}, \mathrm{n3}, \mathrm{K3}, \mathrm{A4}, \mathrm{n4}, \mathrm{K4}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n1}}}{\mathrm{A1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} + \frac{\mathrm{A2}^{\mathrm{n2}}}{\mathrm{A2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} + \frac{\mathrm{A3}^{\mathrm{n3}}}{\mathrm{A3}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} + \frac{\mathrm{A4}^{\mathrm{n4}}}{\mathrm{A4}^{\mathrm{n4}} + \mathrm{K4}^{\mathrm{n4}}} \right) - \mathrm{Vr} \cdot \mathrm{p} \quad (96)$$

$$\mathrm{function\_12}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K}, \mathrm{n}, \mathrm{I}, \mathrm{A1}, \mathrm{n1}, \mathrm{K1}, \mathrm{A2}, \mathrm{n2}, \mathrm{K2}, \mathrm{A3}, \mathrm{n3}, \mathrm{K3}, \mathrm{A4}, \mathrm{n4}, \mathrm{K4}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n1}}}{\mathrm{A1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} + \frac{\mathrm{A2}^{\mathrm{n2}}}{\mathrm{A2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} + \frac{\mathrm{A3}^{\mathrm{n3}}}{\mathrm{A3}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} + \frac{\mathrm{A4}^{\mathrm{n4}}}{\mathrm{A4}^{\mathrm{n4}} + \mathrm{K4}^{\mathrm{n4}}} \right) - \mathrm{Vr} \cdot \mathrm{p} \quad (97)$$

Table 101: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K	K		0.100		☑
K1	K1		0.637		☑
K2	K2		39.018		☑
K3	K3		2.270		☑
K4	K4		0.138		☑
Vr	Vr		0.100		☑

9.25 Reaction re31

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

Name re31

Reaction equation

$$\mathrm{s75} \xrightleftharpoons{\mathrm{s40,\ s83,\ s49,\ s45,\ s75,\ s40,\ s83,\ s49,\ s45,\ s50}} \mathrm{s50} \quad (98)$$

Reactant

Table 102: Properties of each reactant.

Id	Name	SBO
s75	RORgt	

Modifiers

Table 103: Properties of each modifier.

Id	Name	SBO
s40	acetylated FOXP3	
s83	L-PPARg	
s49	STAT3-P	
s45	TGFb-TGFbR	
s75	RORgt	
s40	acetylated FOXP3	
s83	L-PPARg	
s49	STAT3-P	
s45	TGFb-TGFbR	
s50	RORgt-ligand	

Product

Table 104: Properties of each product.

Id	Name	SBO
s50	RORgt-ligand	

Kinetic Law

Derived unit contains undeclared units

$$v_{25} = \mathrm{vol}\,(\mathrm{c1}) \cdot \mathrm{function\_5}\,(\mathrm{Vf}, [\mathrm{s75}], \mathrm{K1}, \mathrm{parameter\_1}, [\mathrm{s40}], \mathrm{K2}, \mathrm{parameter\_1}, [\mathrm{s83}], [\mathrm{s49}], \mathrm{parameter\_1}, \mathrm{K3}, [\mathrm{s45}], \mathrm{parameter\_1}, \mathrm{K4}, \mathrm{Vr}, [\mathrm{s50}]) \tag{99}$$

$$\begin{aligned}&\mathrm{function\_5}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{A1}, \mathrm{n3}, \mathrm{K3}, \mathrm{A2}, \mathrm{n4}, \mathrm{K4}, \mathrm{Vr}, \mathrm{p}) \\ &= \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n3}}}{\mathrm{A1}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} + \frac{\mathrm{A2}^{\mathrm{n4}}}{\mathrm{A2}^{\mathrm{n4}} + \mathrm{K4}^{\mathrm{n4}}} \right) - \mathrm{Vr} \cdot \mathrm{p}\end{aligned} \tag{100}$$

$$\begin{aligned}&\mathrm{function\_5}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{K1}, \mathrm{n1}, \mathrm{I1}, \mathrm{K2}, \mathrm{n2}, \mathrm{I2}, \mathrm{A1}, \mathrm{n3}, \mathrm{K3}, \mathrm{A2}, \mathrm{n4}, \mathrm{K4}, \mathrm{Vr}, \mathrm{p}) \\ &= \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K1}^{\mathrm{n1}}}{\mathrm{I1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} \cdot \frac{\mathrm{K2}^{\mathrm{n2}}}{\mathrm{I2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n3}}}{\mathrm{A1}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} + \frac{\mathrm{A2}^{\mathrm{n4}}}{\mathrm{A2}^{\mathrm{n4}} + \mathrm{K4}^{\mathrm{n4}}} \right) - \mathrm{Vr} \cdot \mathrm{p}\end{aligned} \tag{101}$$

Table 105: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.225		☑
K1	K1		9722.090		☑
K2	K2		0.704		☑
K3	K3		1.241		☑
K4	K4		997.263		☑
Vr	Vr		0.100		☑

9.26 Reaction re32

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

Name re32

Reaction equation

$$\mathrm{s51} + \mathrm{s53} \xrightleftharpoons{\mathrm{s39,\ species\_3,\ s51,\ s53,\ s39,\ species\_3,\ s54}} \mathrm{s54} \tag{102}$$

Reactants

Table 106: Properties of each reactant.

Id	Name	SBO
s51	eIL21	
s53	IL21R	

Modifiers

Table 107: Properties of each modifier.

Id	Name	SBO
s39	STAT5-P	
species_3	IL17-IL17R	
s51	eIL21	
s53	IL21R	
s39	STAT5-P	
species_3	IL17-IL17R	
s54	IL21-IL21R	

Product

Table 108: Properties of each product.

Id	Name	SBO
s54	IL21-IL21R	

Kinetic Law

Derived unit contains undeclared units

$$v_{26} = \text{function\_14}\,(\text{Vf}, [\text{s51}], [\text{s53}], \text{K}, \text{parameter\_1}, [\text{s39}], [\text{species\_3}], \text{parameter\_1}, \text{K1}, \text{Vr}, [\text{s54}]) \tag{103}$$

$$\text{function\_14}\,(\text{Vf},\text{r1},\text{r2},\text{K},\text{n},\text{I},\text{A},\text{n1},\text{K1},\text{Vr},\text{p}) = \text{Vf}\cdot\text{r1}\cdot\text{r2}\cdot\frac{\text{K}^{\text{n}}}{\text{I}^{\text{n}}+\text{K}^{\text{n}}}\cdot\left(1+\frac{\text{A}^{\text{n1}}}{\text{A}^{\text{n1}}+\text{K1}^{\text{n1}}}\right)-\text{Vr}\cdot\text{p} \tag{104}$$

Table 109: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K	K		0.241		☑
K1	K1		8.142		☑
Vr	Vr		0.100		☑

9.27 Reaction re33

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

Name re33

Reaction equation

$$\text{s52} \xrightarrow{\text{s52}} \text{s51} \tag{105}$$

Reactant

Table 110: Properties of each reactant.

Id	Name	SBO
s52	IL21	

Modifier

Table 111: Properties of each modifier.

Id	Name	SBO
s52	IL21	

Product

Table 112: Properties of each product.

Id	Name	SBO
s51	eIL21	

Kinetic Law

Derived unit contains undeclared units

$$v_{27} = \mathrm{k1} \cdot [\mathrm{s52}] \tag{106}$$

Table 113: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑

9.28 Reaction re34

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

Name re34

Reaction equation

$$\mathrm{s55} \overset{\mathrm{s55,\ s57}}{\rightleftharpoons} \mathrm{s57} \tag{107}$$

Reactant

Table 114: Properties of each reactant.

Id	Name	SBO
s55	eIL23	

Modifiers

Table 115: Properties of each modifier.

Id	Name	SBO
s55	eIL23	
s57	p40/p19 dimer	

Product

Table 116: Properties of each product.

Id	Name	SBO
s57	p40/p19 dimer	

Kinetic Law

Derived unit contains undeclared units

$$v_{28} = \mathrm{k1} \cdot [\mathrm{s55}] - \mathrm{k2} \cdot [\mathrm{s57}] \tag{108}$$

Table 117: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑
k2	k2		0.1		☑

9.29 Reaction re35

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

Name re35

Reaction equation

$$\mathrm{s57} + \mathrm{s58} \xrightleftharpoons{\mathrm{s27,\ s57,\ s58,\ s27,\ s59}} \mathrm{s59} \tag{109}$$

Reactants

Table 118: Properties of each reactant.

Id	Name	SBO
s57	p40/p19 dimer	
s58	IL23R	

Modifiers

Table 119: Properties of each modifier.

Id	Name	SBO
s27	Tbet-P	
s57	p40/p19 dimer	
s58	IL23R	
s27	Tbet-P	
s59	IL23-IL23R	

Product

Table 120: Properties of each product.

Id	Name	SBO
s59	IL23-IL23R	

Kinetic Law

Derived unit contains undeclared units

$$v_{29} = \mathrm{vol}\,(\mathrm{c1}) \cdot \mathrm{function\_1}\,(\mathrm{Vf}, [\mathrm{s57}], [\mathrm{s58}], \mathrm{K}, \mathrm{parameter\_1}, [\mathrm{s27}], \mathrm{Vr}, [\mathrm{s59}]) \tag{110}$$

$$\mathrm{function\_1}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{r2}, \mathrm{K}, \mathrm{n}, \mathrm{I}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \mathrm{r2} \cdot \frac{\mathrm{K^n}}{\mathrm{I^n} + \mathrm{K^n}} - \mathrm{Vr} \cdot \mathrm{p} \tag{111}$$

$$\mathrm{function\_1}\,(\mathrm{Vf}, \mathrm{r1}, \mathrm{r2}, \mathrm{K}, \mathrm{n}, \mathrm{I}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \mathrm{r2} \cdot \frac{\mathrm{K^n}}{\mathrm{I^n} + \mathrm{K^n}} - \mathrm{Vr} \cdot \mathrm{p} \tag{112}$$

Table 121: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K	K		4.661		☑
Vr	Vr		0.100		☑

9.30 Reaction re36

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

Name re36

Reaction equation

$$\text{species\_9} + \text{species\_8} \xrightleftharpoons{\text{s83, s48, species\_9, species\_8, s83, s48, s57}} \text{s57} \qquad (113)$$

Reactants

Table 122: Properties of each reactant.

Id	Name	SBO
species_9	p40	
species_8	p19	

Modifiers

Table 123: Properties of each modifier.

Id	Name	SBO
s83	L-PPARg	
s48	IL6-IL6R	
species_9	p40	
species_8	p19	
s83	L-PPARg	
s48	IL6-IL6R	
s57	p40/p19 dimer	

Product

Table 124: Properties of each product.

Id	Name	SBO
s57	p40/p19 dimer	

Kinetic Law

Derived unit contains undeclared units

$$v_{30} = \mathrm{vol}(\mathrm{c1}) \cdot \mathrm{function\_14}(\mathrm{Vf}, [\mathrm{species\_9}], [\mathrm{species\_8}], \mathrm{K}, \mathrm{parameter\_1}, [\mathrm{s83}], [\mathrm{s48}], \mathrm{parameter\_1}, \mathrm{K1}, \mathrm{Vr}, [\mathrm{s57}]) \tag{114}$$

$$\mathrm{function\_14}(\mathrm{Vf}, \mathrm{r1}, \mathrm{r2}, \mathrm{K}, \mathrm{n}, \mathrm{I}, \mathrm{A}, \mathrm{n1}, \mathrm{K1}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \mathrm{r2} \cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n1}}}{\mathrm{A}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}}\right) - \mathrm{Vr} \cdot \mathrm{p} \tag{115}$$

$$\mathrm{function\_14}(\mathrm{Vf}, \mathrm{r1}, \mathrm{r2}, \mathrm{K}, \mathrm{n}, \mathrm{I}, \mathrm{A}, \mathrm{n1}, \mathrm{K1}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \mathrm{r2} \cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n1}}}{\mathrm{A}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}}\right) - \mathrm{Vr} \cdot \mathrm{p} \tag{116}$$

Table 125: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K	K		0.100		☑
K1	K1		25.535		☑
Vr	Vr		0.100		☑

9.31 Reaction re37

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

Name re37

Reaction equation

$$\mathrm{species\_6} \xrightleftharpoons{\mathrm{s49},\ \mathrm{species\_6},\ \mathrm{s49},\ \mathrm{s52}} \mathrm{s52} \tag{117}$$

Reactant

Table 126: Properties of each reactant.

Id	Name	SBO
species_6	pIL21	

Modifiers

Table 127: Properties of each modifier.

Id	Name	SBO
s49	STAT3-P	
species_6	pIL21	
s49	STAT3-P	
s52	IL21	

Product

Table 128: Properties of each product.

Id	Name	SBO
s52	IL21	

Kinetic Law

Derived unit contains undeclared units

$$v_{31} = \mathrm{vol}(\mathrm{c1}) \cdot \mathrm{function\_2}(\mathrm{Vf}, [\mathrm{species\_6}], [\mathrm{s49}], \mathrm{parameter\_1}, \mathrm{K}, \mathrm{Vr}, [\mathrm{s52}]) \quad (118)$$

$$\mathrm{function\_2}(\mathrm{Vf}, \mathrm{r1}, \mathrm{A}, \mathrm{n}, \mathrm{K}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n}}}{\mathrm{A}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}}\right) - \mathrm{Vr} \cdot \mathrm{p} \quad (119)$$

$$\mathrm{function\_2}(\mathrm{Vf}, \mathrm{r1}, \mathrm{A}, \mathrm{n}, \mathrm{K}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n}}}{\mathrm{A}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}}\right) - \mathrm{Vr} \cdot \mathrm{p} \quad (120)$$

Table 129: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K	K		0.119		☑
Vr	Vr		0.100		☑

9.32 Reaction re39

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

Name re38

Reaction equation

$$\text{species\_2} + \text{s62} \xrightleftharpoons{\text{species\_2, s62, s63}} \text{s63} \tag{121}$$

Reactants

Table 130: Properties of each reactant.

Id	Name	SBO
species_2	eIL10	
s62	IL10R	

Modifiers

Table 131: Properties of each modifier.

Id	Name	SBO
species_2	eIL10	
s62	IL10R	
s63	IL10-IL10R	

Product

Table 132: Properties of each product.

Id	Name	SBO
s63	IL10-IL10R	

Kinetic Law

Derived unit contains undeclared units

$$v_{32} = \text{k1} \cdot [\text{species\_2}] \cdot [\text{s62}] - \text{k2} \cdot [\text{s63}] \tag{122}$$

Table 133: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑
k2	k2		0.1		☑

9.33 Reaction re42

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

Name re42

Reaction equation

$$\mathrm{s85} + \mathrm{s86} \xrightleftharpoons{\mathrm{s25},\ \mathrm{s33},\ \mathrm{s85},\ \mathrm{s86},\ \mathrm{s25},\ \mathrm{s33},\ \mathrm{s83}} \mathrm{s83} \tag{123}$$

Reactants

Table 134: Properties of each reactant.

Id	Name	SBO
s85	PPARg	
s86	Ligand	

Modifiers

Table 135: Properties of each modifier.

Id	Name	SBO
s25	IFNg-IFNgR	
s33	IL4-IL4R	
s85	PPARg	
s86	Ligand	
s25	IFNg-IFNgR	
s33	IL4-IL4R	
s83	L-PPARg	

Product

Table 136: Properties of each product.

Id	Name	SBO
s83	L-PPARg	

Kinetic Law

Derived unit contains undeclared units

$$v_{33} = \mathrm{vol}(\mathrm{c1}) \cdot \mathrm{function\_14}(\mathrm{Vf}, [\mathrm{s85}], [\mathrm{s86}], \mathrm{K}, \mathrm{parameter\_1}, [\mathrm{s25}], [\mathrm{s33}], \mathrm{parameter\_1}, \mathrm{K1}, \mathrm{Vr}, [\mathrm{s83}]) \tag{124}$$

$$\mathrm{function\_14}(\mathrm{Vf}, \mathrm{r1}, \mathrm{r2}, \mathrm{K}, \mathrm{n}, \mathrm{I}, \mathrm{A}, \mathrm{n1}, \mathrm{K1}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \mathrm{r2} \cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n1}}}{\mathrm{A}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}}\right) - \mathrm{Vr} \cdot \mathrm{p} \tag{125}$$

$$\mathrm{function\_14}(\mathrm{Vf}, \mathrm{r1}, \mathrm{r2}, \mathrm{K}, \mathrm{n}, \mathrm{I}, \mathrm{A}, \mathrm{n1}, \mathrm{K1}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \mathrm{r2} \cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}} \cdot \left(1 + \frac{\mathrm{A}^{\mathrm{n1}}}{\mathrm{A}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}}\right) - \mathrm{Vr} \cdot \mathrm{p} \tag{126}$$

Table 137: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.1		☑
K	K		0.1		☑
K1	K1		0.1		☑
Vr	Vr		0.1		☑

9.34 Reaction re44

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

Name re44

Reaction equation

$$\mathrm{s43} \xrightarrow{\mathrm{s43}} \mathrm{s87} \tag{127}$$

Reactant

Table 138: Properties of each reactant.

Id	Name	SBO
s43	TGFb	

Modifier

Table 139: Properties of each modifier.

Id	Name	SBO
s43	TGFb	

Product

Table 140: Properties of each product.

Id	Name	SBO
s87	eTGFb	

Kinetic Law

Derived unit contains undeclared units

$$v_{34} = \mathrm{k1} \cdot [\mathrm{s43}] \tag{128}$$

Table 141: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑

9.35 Reaction re45

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

Name re45

Reaction equation

$$\mathrm{s36} \xrightarrow{\mathrm{s36}} \mathrm{s89} \tag{129}$$

Reactant

Table 142: Properties of each reactant.

Id	Name	SBO
s36	IL2	

Modifier

Table 143: Properties of each modifier.

Id	Name	SBO
s36	IL2	

Product

Table 144: Properties of each product.

Id	Name	SBO
s89	eIL2	

Kinetic Law

Derived unit contains undeclared units

$$v_{35} = \mathrm{k1} \cdot [\mathrm{s36}] \tag{130}$$

Table 145: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑

9.36 Reaction re46

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

Name re46

Reaction equation

$$\mathrm{s46} \xrightarrow{\mathrm{s46}} \mathrm{s90} \tag{131}$$

Reactant

Table 146: Properties of each reactant.

Id	Name	SBO
s46	IL6	

Modifier

Table 147: Properties of each modifier.

Id	Name	SBO
s46	IL6	

Product

Table 148: Properties of each product.

Id	Name	SBO
s90	eIL6	

Kinetic Law

Derived unit contains undeclared units

$$v_{36} = \mathrm{k1} \cdot [\mathrm{s46}] \tag{132}$$

Table 149: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑

9.37 Reaction reaction_1

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

Name re48

Reaction equation

$$\mathrm{s74} \xrightarrow{\mathrm{s74}} \mathrm{species\_2} \tag{133}$$

Reactant

Table 150: Properties of each reactant.

Id	Name	SBO
s74	IL10	

Modifier

Table 151: Properties of each modifier.

Id	Name	SBO
s74	IL10	

Product

Table 152: Properties of each product.

Id	Name	SBO
species_2	eIL10	

Kinetic Law

Derived unit contains undeclared units

$$v_{37} = \mathrm{k1} \cdot [\mathrm{s74}] \tag{134}$$

Table 153: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑

9.38 Reaction reaction_2

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

Name re49

Reaction equation

$$\mathrm{s73} \xrightarrow{\mathrm{s73}} \mathrm{species\_1} \tag{135}$$

Reactant

Table 154: Properties of each reactant.

Id	Name	SBO
s73	IL17	

Modifier

Table 155: Properties of each modifier.

Id	Name	SBO
s73	IL17	

Product

Table 156: Properties of each product.

Id	Name	SBO
species_1	eIL17	

Kinetic Law

Derived unit contains undeclared units

$$v_{38} = \mathrm{k1} \cdot [\mathrm{s73}] \tag{136}$$

Table 157: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑

9.39 Reaction reaction_3

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

Name re50

Reaction equation

$$\text{species\_1} + \text{species\_4} \xrightleftharpoons{\text{species\_1, species\_4, species\_3}} \text{species\_3} \tag{137}$$

Reactants

Table 158: Properties of each reactant.

Id	Name	SBO
species_1	eIL17	
species_4	IL17R	

Modifiers

Table 159: Properties of each modifier.

Id	Name	SBO
species_1	eIL17	
species_4	IL17R	
species_3	IL17-IL17R	

Product

Table 160: Properties of each product.

Id	Name	SBO
species_3	IL17-IL17R	

Kinetic Law

Derived unit contains undeclared units

$$v_{39} = \text{k1} \cdot [\text{species\_1}] \cdot [\text{species\_4}] - \text{k2} \cdot [\text{species\_3}] \tag{138}$$

Table 161: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.185		☑
k2	k2		0.190		☑

9.40 Reaction reaction_4

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

Name re47

Reaction equation

$$\mathrm{s1} \xrightarrow{\mathrm{s1}} \mathrm{species\_12} \tag{139}$$

Reactant

Table 162: Properties of each reactant.

Id	Name	SBO
s1	IL18	

Modifier

Table 163: Properties of each modifier.

Id	Name	SBO
s1	IL18	

Product

Table 164: Properties of each product.

Id	Name	SBO
species_12	eIL18	

Kinetic Law

Derived unit contains undeclared units

$$v_{40} = \mathrm{k1} \cdot [\mathrm{s1}] \tag{140}$$

Table 165: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.1		☑

9.41 Reaction reaction_5

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

Name re51

Reaction equation

$$\text{species\_7} \xrightleftharpoons{\text{s83, s59, s50, s21, species\_7, s83, s59, s50, s21, s73}} \text{s73} \tag{141}$$

Reactant

Table 166: Properties of each reactant.

Id	Name	SBO
species_7	pIL17	

Modifiers

Table 167: Properties of each modifier.

Id	Name	SBO
s83	L-PPARg	
s59	IL23-IL23R	
s50	RORgt-ligand	
s21	STAT4-P	
species_7	pIL17	
s83	L-PPARg	
s59	IL23-IL23R	
s50	RORgt-ligand	
s21	STAT4-P	
s73	IL17	

Product

Table 168: Properties of each product.

Id	Name	SBO
s73	IL17	

Kinetic Law

Derived unit contains undeclared units

$$v_{41} = \mathrm{vol}(\mathrm{c1}) \cdot \mathrm{function\_6}(\mathrm{Vf}, [\mathrm{species\_7}], \mathrm{K}, \mathrm{parameter\_1}, [\mathrm{s83}], [\mathrm{s59}], \mathrm{parameter\_1}, \mathrm{K1}, [\mathrm{s50}], \mathrm{parameter\_1}, \mathrm{K2}, [\mathrm{s21}], \mathrm{parameter\_1}, \mathrm{K3}, \mathrm{Vr}, [\mathrm{s73}]) \quad (142)$$

$$\mathrm{function\_6}(\mathrm{Vf}, \mathrm{r1}, \mathrm{K}, \mathrm{n}, \mathrm{I}, \mathrm{A1}, \mathrm{n1}, \mathrm{K1}, \mathrm{A2}, \mathrm{n2}, \mathrm{K2}, \mathrm{A3}, \mathrm{n3}, \mathrm{K3}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n1}}}{\mathrm{A1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} + \frac{\mathrm{A2}^{\mathrm{n2}}}{\mathrm{A2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} + \frac{\mathrm{A3}^{\mathrm{n3}}}{\mathrm{A3}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} \right) - \mathrm{Vr} \cdot \mathrm{p} \quad (143)$$

$$\mathrm{function\_6}(\mathrm{Vf}, \mathrm{r1}, \mathrm{K}, \mathrm{n}, \mathrm{I}, \mathrm{A1}, \mathrm{n1}, \mathrm{K1}, \mathrm{A2}, \mathrm{n2}, \mathrm{K2}, \mathrm{A3}, \mathrm{n3}, \mathrm{K3}, \mathrm{Vr}, \mathrm{p}) = \mathrm{Vf} \cdot \mathrm{r1} \cdot \frac{\mathrm{K}^{\mathrm{n}}}{\mathrm{I}^{\mathrm{n}} + \mathrm{K}^{\mathrm{n}}} \cdot \left(\frac{\mathrm{A1}^{\mathrm{n1}}}{\mathrm{A1}^{\mathrm{n1}} + \mathrm{K1}^{\mathrm{n1}}} + \frac{\mathrm{A2}^{\mathrm{n2}}}{\mathrm{A2}^{\mathrm{n2}} + \mathrm{K2}^{\mathrm{n2}}} + \frac{\mathrm{A3}^{\mathrm{n3}}}{\mathrm{A3}^{\mathrm{n3}} + \mathrm{K3}^{\mathrm{n3}}} \right) - \mathrm{Vr} \cdot \mathrm{p} \quad (144)$$

Table 169: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.225		☑
K	K		0.100		☑
K1	K1		1.629		☑
K2	K2		0.527		☑
K3	K3		5.479		☑
Vr	Vr		0.100		☑

9.42 Reaction reaction_6

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

Name IL18 pool

Reaction equation

$$\mathrm{species\_16} \underset{\text{species\_16, species\_12}}{\rightleftharpoons} \mathrm{species\_12} \quad (145)$$

Reactant

Table 170: Properties of each reactant.

Id	Name	SBO
species_16	IL18_pool	

Modifiers

Table 171: Properties of each modifier.

Id	Name	SBO
species_16	IL18_pool	
species_12	eIL18	

Product

Table 172: Properties of each product.

Id	Name	SBO
species_12	eIL18	

Kinetic Law

Derived unit contains undeclared units

$$v_{42} = \mathrm{vol}\,(\mathrm{default}) \cdot \mathrm{function\_16}\,(\mathrm{V}, [\mathrm{species\_16}], \mathrm{parameter\_1}, [\mathrm{species\_12}], \mathrm{k}) \quad (146)$$

$$\mathrm{function\_16}\,(\mathrm{V}, \mathrm{pool}, \mathrm{n}, \mathrm{ext}, \mathrm{k}) = \mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \quad (147)$$

$$\mathrm{function\_16}\,(\mathrm{V}, \mathrm{pool}, \mathrm{n}, \mathrm{ext}, \mathrm{k}) = \mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \quad (148)$$

Table 173: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V		0.1		☑
k	k		0.5		☑

9.43 Reaction reaction_7

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

Name IL12 pool

Reaction equation

$$\text{species\_17} \xrightleftharpoons{\text{species\_17, s11}} \text{s11} \tag{149}$$

Reactant

Table 174: Properties of each reactant.

Id	Name	SBO
species_17	IL12_pool	

Modifiers

Table 175: Properties of each modifier.

Id	Name	SBO
species_17	IL12_pool	
s11	eIL12	

Product

Table 176: Properties of each product.

Id	Name	SBO
s11	eIL12	

Kinetic Law

Derived unit contains undeclared units

$$v_{43} = \text{vol}\,(\text{default}) \cdot \text{function\_16}\,(\text{V}, [\text{species\_17}], \text{parameter\_1}, [\text{s11}], \text{k}) \tag{150}$$

$$\text{function\_16}\,(\text{V}, \text{pool}, \text{n}, \text{ext}, \text{k}) = \text{V} \cdot \left(\frac{\text{pool}^{\text{n}}}{\text{pool}^{\text{n}} + \text{ext}^{\text{n}} + 0.0010} - \text{k} \cdot \text{ext} \right) \tag{151}$$

$$\text{function\_16}\left(\text{V},\text{pool},\text{n},\text{ext},\text{k}\right) = \text{V} \cdot \left(\frac{\text{pool}^{\text{n}}}{\text{pool}^{\text{n}} + \text{ext}^{\text{n}} + 0.0010} - \text{k} \cdot \text{ext}\right) \tag{152}$$

Table 177: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V		0.1		☑
k	k		0.5		☑

9.44 Reaction reaction_8

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

Name IFNg pool

Reaction equation

$$\text{species\_18} \xrightleftharpoons{\text{species\_18, s22}} \text{s22} \tag{153}$$

Reactant

Table 178: Properties of each reactant.

Id	Name	SBO
species_18	IFNg_pool	

Modifiers

Table 179: Properties of each modifier.

Id	Name	SBO
species_18	IFNg_pool	
s22	eIFNg	

Product

Table 180: Properties of each product.

Id	Name	SBO
s22	eIFNg	

Kinetic Law

Derived unit contains undeclared units

$$v_{44} = \mathrm{vol}\,(\mathrm{default}) \cdot \mathrm{function\_16}\,(\mathrm{V}, [\mathrm{species\_18}], \mathrm{parameter\_1}, [\mathrm{s22}], \mathrm{k}) \tag{154}$$

$$\mathrm{function\_16}\,(\mathrm{V}, \mathrm{pool}, \mathrm{n}, \mathrm{ext}, \mathrm{k}) = \mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \tag{155}$$

$$\mathrm{function\_16}\,(\mathrm{V}, \mathrm{pool}, \mathrm{n}, \mathrm{ext}, \mathrm{k}) = \mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \tag{156}$$

Table 181: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V		0.1		☑
k	k		0.1		☑

9.45 Reaction reaction_9

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

Name IL21 pool

Reaction equation

$$\mathrm{species\_19} \overset{\mathrm{species\_19,\ s51}}{\rightleftharpoons} \mathrm{s51} \tag{157}$$

Reactant

Table 182: Properties of each reactant.

Id	Name	SBO
species_19	IL21_pool	

Modifiers

Table 183: Properties of each modifier.

Id	Name	SBO
species_19	IL21_pool	
s51	eIL21	

Product

Table 184: Properties of each product.

Id	Name	SBO
s51	eIL21	

Kinetic Law

Derived unit contains undeclared units

$$v_{45} = \text{vol}\,(\text{default}) \cdot \text{function\_16}\,(\text{V}, [\text{species\_19}], \text{parameter\_1}, [\text{s51}], \text{k}) \tag{158}$$

$$\text{function\_16}\,(\text{V}, \text{pool}, \text{n}, \text{ext}, \text{k}) = \text{V} \cdot \left(\frac{\text{pool}^{\text{n}}}{\text{pool}^{\text{n}} + \text{ext}^{\text{n}} + 0.0010} - \text{k} \cdot \text{ext} \right) \tag{159}$$

$$\text{function\_16}\,(\text{V}, \text{pool}, \text{n}, \text{ext}, \text{k}) = \text{V} \cdot \left(\frac{\text{pool}^{\text{n}}}{\text{pool}^{\text{n}} + \text{ext}^{\text{n}} + 0.0010} - \text{k} \cdot \text{ext} \right) \tag{160}$$

Table 185: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V		0.1		☑
k	k		0.1		☑

9.46 Reaction reaction_10

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

Name IL23 pool

Reaction equation

$$\text{species\_20} \underset{\text{species\_20, s55}}{\rightleftharpoons} \text{s55} \tag{161}$$

Reactant

Table 186: Properties of each reactant.

Id	Name	SBO
species_20	IL23_pool	

Modifiers

Table 187: Properties of each modifier.

Id	Name	SBO
species_20	IL23_pool	
s55	eIL23	

Product

Table 188: Properties of each product.

Id	Name	SBO
s55	eIL23	

Kinetic Law

Derived unit contains undeclared units

$$v_{46} = \mathrm{vol}\,(\mathrm{default}) \cdot \mathrm{function\_16}\,(\mathrm{V}, [\mathrm{species\_20}], \mathrm{parameter\_1}, [\mathrm{s55}], \mathrm{k}) \tag{162}$$

$$\mathrm{function\_16}\,(\mathrm{V}, \mathrm{pool}, \mathrm{n}, \mathrm{ext}, \mathrm{k}) = \mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \tag{163}$$

$$\mathrm{function\_16}\,(\mathrm{V}, \mathrm{pool}, \mathrm{n}, \mathrm{ext}, \mathrm{k}) = \mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \tag{164}$$

Table 189: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V		0.1		☑
k	k		0.1		☑

9.47 Reaction reaction_11

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

Name IL17 pool

Reaction equation

$$\text{species\_21} \xrightleftharpoons{\text{species\_21, s73}} \text{s73} \tag{165}$$

Reactant

Table 190: Properties of each reactant.

Id	Name	SBO
species_21	IL17_pool	

Modifiers

Table 191: Properties of each modifier.

Id	Name	SBO
species_21	IL17_pool	
s73	IL17	

Product

Table 192: Properties of each product.

Id	Name	SBO
s73	IL17	

Kinetic Law

Derived unit contains undeclared units

$$v_{47} = \text{function\_16}\left(\text{V}, [\text{species\_21}], \text{parameter\_1}, [\text{s73}], \text{k}\right) \tag{166}$$

$$\text{function\_16}\left(\text{V}, \text{pool}, \text{n}, \text{ext}, \text{k}\right) = \text{V} \cdot \left(\frac{\text{pool}^{\text{n}}}{\text{pool}^{\text{n}} + \text{ext}^{\text{n}} + 0.0010} - \text{k} \cdot \text{ext} \right) \tag{167}$$

Table 193: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V		0.1		☑
k	k		0.1		☑

9.48 Reaction reaction_12

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

Name IL10 pool

Reaction equation

$$\text{species\_22} \xrightleftharpoons{\text{species\_22, species\_2}} \text{species\_2} \tag{168}$$

Reactant

Table 194: Properties of each reactant.

Id	Name	SBO
species_22	IL10_pool	

Modifiers

Table 195: Properties of each modifier.

Id	Name	SBO
species_22	IL10_pool	
species_2	eIL10	

Product

Table 196: Properties of each product.

Id	Name	SBO
species_2	eIL10	

Kinetic Law

Derived unit contains undeclared units

$$v_{48} = \mathrm{vol}\,(\mathrm{default}) \cdot \mathrm{function\_16}\,(\mathrm{V}, [\mathrm{species\_22}], \mathrm{parameter\_1}, [\mathrm{species\_2}], \mathrm{k}) \tag{169}$$

$$\mathrm{function\_16}\,(\mathrm{V}, \mathrm{pool}, \mathrm{n}, \mathrm{ext}, \mathrm{k}) = \mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \tag{170}$$

$$\mathrm{function\_16}\,(\mathrm{V}, \mathrm{pool}, \mathrm{n}, \mathrm{ext}, \mathrm{k}) = \mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \tag{171}$$

Table 197: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V		0.1		☑
k	k		0.1		☑

9.49 Reaction reaction_13

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

Name IL6 pool

Reaction equation

$$\mathrm{species\_23} \underset{\mathrm{species\_23,\ s90}}{\rightleftharpoons} \mathrm{s90} \tag{172}$$

Reactant

Table 198: Properties of each reactant.

Id	Name	SBO
species_23	IL6_pool	

Modifiers

Table 199: Properties of each modifier.

Id	Name	SBO
species_23	IL6_pool	
s90	eIL6	

Product

Table 200: Properties of each product.

Id	Name	SBO
s90	eIL6	

Kinetic Law

Derived unit contains undeclared units

$$v_{49} = \mathrm{vol}\,(\mathrm{default}) \cdot \mathrm{function\_16}\,(\mathrm{V}, [\mathrm{species\_23}], \mathrm{parameter\_1}, [\mathrm{s90}], \mathrm{k}) \tag{173}$$

$$\mathrm{function\_16}\,(\mathrm{V}, \mathrm{pool}, \mathrm{n}, \mathrm{ext}, \mathrm{k}) = \mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \tag{174}$$

$$\mathrm{function\_16}\,(\mathrm{V}, \mathrm{pool}, \mathrm{n}, \mathrm{ext}, \mathrm{k}) = \mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \tag{175}$$

Table 201: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V		0.1		☑
k	k		0.1		☑

9.50 Reaction reaction_14

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

Name IL2 pool

Reaction equation

$$\mathrm{species\_24} \underset{\mathrm{species\_24,\ s89}}{\rightleftharpoons} \mathrm{s89} \tag{176}$$

Reactant

Table 202: Properties of each reactant.

Id	Name	SBO
species_24	IL2_pool	

Modifiers

Table 203: Properties of each modifier.

Id	Name	SBO
species_24	IL2_pool	
s89	eIL2	

Product

Table 204: Properties of each product.

Id	Name	SBO
s89	eIL2	

Kinetic Law

Derived unit contains undeclared units

$$v_{50} = \mathrm{vol}\,(\mathrm{default}) \cdot \mathrm{function\_16}\,(\mathrm{V}, [\mathrm{species\_24}], \mathrm{parameter\_1}, [\mathrm{s89}], \mathrm{k}) \tag{177}$$

$$\mathrm{function\_16}\,(\mathrm{V}, \mathrm{pool}, \mathrm{n}, \mathrm{ext}, \mathrm{k}) = \mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \tag{178}$$

$$\mathrm{function\_16}\,(\mathrm{V}, \mathrm{pool}, \mathrm{n}, \mathrm{ext}, \mathrm{k}) = \mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \tag{179}$$

Table 205: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V		0.1		☑
k	k		0.1		☑

9.51 Reaction reaction_15

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

Name TGFb pool

Reaction equation

$$\text{species\_25} \xrightleftharpoons{\text{species\_25, s87}} \text{s87} \tag{180}$$

Reactant

Table 206: Properties of each reactant.

Id	Name	SBO
species_25	TGFb_pool	

Modifiers

Table 207: Properties of each modifier.

Id	Name	SBO
species_25	TGFb_pool	
s87	eTGFb	

Product

Table 208: Properties of each product.

Id	Name	SBO
s87	eTGFb	

Kinetic Law

Derived unit contains undeclared units

$$v_{51} = \text{vol}\,(\text{default}) \cdot \text{function\_16}\,(\text{V}, [\text{species\_25}], \text{parameter\_1}, [\text{s87}], \text{k}) \tag{181}$$

$$\text{function\_16}\,(\text{V}, \text{pool}, \text{n}, \text{ext}, \text{k}) = \text{V} \cdot \left(\frac{\text{pool}^{\text{n}}}{\text{pool}^{\text{n}} + \text{ext}^{\text{n}} + 0.0010} - \text{k} \cdot \text{ext} \right) \tag{182}$$

$$\text{function\_16}\left(\text{V},\text{pool},\text{n},\text{ext},\text{k}\right) = \text{V}\cdot\left(\frac{\text{pool}^{\text{n}}}{\text{pool}^{\text{n}}+\text{ext}^{\text{n}}+0.0010}-\text{k}\cdot\text{ext}\right) \tag{183}$$

Table 209: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V		0.1		☑
k	k		0.1		☑

9.52 Reaction reaction_16

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

Name IL4 pool

Reaction equation

$$\text{species\_26} \overset{\text{species\_26, s30}}{\rightleftharpoons} \text{s30} \tag{184}$$

Reactant

Table 210: Properties of each reactant.

Id	Name	SBO
species_26	IL4_pool	

Modifiers

Table 211: Properties of each modifier.

Id	Name	SBO
species_26	IL4_pool	
s30	eIL4	

Product

Table 212: Properties of each product.

Id	Name	SBO
s30	eIL4	

Kinetic Law

Derived unit contains undeclared units

$$v_{52} = \mathrm{vol}\,(\mathrm{default}) \cdot \mathrm{function\_16}\,(\mathrm{V}, [\mathrm{species\_26}], \mathrm{parameter\_1}, [\mathrm{s30}], \mathrm{k}) \tag{185}$$

$$\mathrm{function\_16}\,(\mathrm{V}, \mathrm{pool}, \mathrm{n}, \mathrm{ext}, \mathrm{k}) = \mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \tag{186}$$

$$\mathrm{function\_16}\,(\mathrm{V}, \mathrm{pool}, \mathrm{n}, \mathrm{ext}, \mathrm{k}) = \mathrm{V} \cdot \left(\frac{\mathrm{pool}^{\mathrm{n}}}{\mathrm{pool}^{\mathrm{n}} + \mathrm{ext}^{\mathrm{n}} + 0.0010} - \mathrm{k} \cdot \mathrm{ext} \right) \tag{187}$$

Table 213: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V	V		0.1		☑
k	k		0.1		☑

9.53 Reaction reaction_17

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

Name re52

Reaction equation

$$\mathrm{species\_27} \xrightleftharpoons{\mathrm{s59},\ \mathrm{s83},\ \mathrm{s54},\ \mathrm{s35},\ \mathrm{s39},\ \mathrm{species\_27},\ \mathrm{s59},\ \mathrm{s83},\ \mathrm{s54},\ \mathrm{s35},\ \mathrm{s39},\ \mathrm{s74}} \mathrm{s74} \tag{188}$$

Reactant

Table 214: Properties of each reactant.

Id	Name	SBO
species_27	pIL10	

Modifiers

Table 215: Properties of each modifier.

Id	Name	SBO
s59	IL23-IL23R	
s83	L-PPARg	
s54	IL21-IL21R	
s35	GATA3-P	
s39	STAT5-P	
species_27	pIL10	
s59	IL23-IL23R	
s83	L-PPARg	
s54	IL21-IL21R	
s35	GATA3-P	
s39	STAT5-P	
s74	IL10	

Product

Table 216: Properties of each product.

Id	Name	SBO
s74	IL10	

Kinetic Law

Derived unit contains undeclared units

$$v_{53} = \text{function\_12}\,(\text{Vf}, [\text{species\_27}], \text{K}, \text{parameter\_1}, [\text{s59}], [\text{s83}], \text{parameter\_1}, \text{K1}, [\text{s54}], \text{parameter\_1}, \text{K2}, [\text{s35}], \text{parameter\_1}, \text{K3}, [\text{s39}], \text{parameter\_1}, \text{K4}, \text{Vr}, [\text{s74}]) \tag{189}$$

$$\begin{aligned}&\text{function\_12}\,(\text{Vf}, \text{r1}, \text{K}, \text{n}, \text{I}, \text{A1}, \text{n1}, \text{K1}, \text{A2}, \text{n2}, \text{K2}, \text{A3}, \text{n3}, \text{K3}, \text{A4}, \text{n4}, \text{K4}, \text{Vr}, \text{p}) \\ &= \text{Vf} \cdot \text{r1} \cdot \frac{\text{K}^{\text{n}}}{\text{I}^{\text{n}} + \text{K}^{\text{n}}} \cdot \left(\frac{\text{A1}^{\text{n1}}}{\text{A1}^{\text{n1}} + \text{K1}^{\text{n1}}} + \frac{\text{A2}^{\text{n2}}}{\text{A2}^{\text{n2}} + \text{K2}^{\text{n2}}} + \frac{\text{A3}^{\text{n3}}}{\text{A3}^{\text{n3}} + \text{K3}^{\text{n3}}} + \frac{\text{A4}^{\text{n4}}}{\text{A4}^{\text{n4}} + \text{K4}^{\text{n4}}} \right) - \text{Vr} \cdot \text{p}\end{aligned} \tag{190}$$

Table 217: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Vf	Vf		0.100		☑
K	K		0.508		☑

Id	Name	SBO	Value	Unit	Constant
K1	K1		0.100		☑
K2	K2		0.001		☑
K3	K3		0.645		☑
K4	K4		100.000		☑
Vr	Vr		0.100		☑

10 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.

10.1 Species s22

Name eIFNg

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

Initial assignment s22

This species takes part in five reactions (as a reactant in re11 and as a product in re12, reaction_8 and as a modifier in re11, reaction_8).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s22} = v_8 + v_{44} - v_7 \tag{191}$$

10.2 Species s11

Name eIL12

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

Initial assignment s11

This species takes part in five reactions (as a reactant in re8 and as a product in re6, reaction_7 and as a modifier in re8, reaction_7).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s11} = v_3 + v_{43} - v_4 \tag{192}$$

10.3 Species s51

Name eIL21

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

Initial assignment s51

This species takes part in five reactions (as a reactant in re32 and as a product in re33, reaction_9 and as a modifier in re32, reaction_9).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s51} = v_{27} + v_{45} - v_{26} \tag{193}$$

10.4 Species s55

Name eIL23

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

Initial assignment s55

This species takes part in four reactions (as a reactant in re34 and as a product in reaction_10 and as a modifier in re34, reaction_10).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s55} = v_{46} - v_{28} \tag{194}$$

10.5 Species s30

Name eIL4

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

Initial assignment s30

This species takes part in five reactions (as a reactant in re19 and as a product in re18, reaction_16 and as a modifier in re19, reaction_16).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s30} = v_{14} + v_{52} - v_{15} \tag{195}$$

10.6 Species s87

Name eTGFb

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

Initial assignment s87

This species takes part in five reactions (as a reactant in re28 and as a product in re44, reaction_15 and as a modifier in re28, reaction_15).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s87} = v_{34} + v_{51} - v_{22} \tag{196}$$

10.7 Species s89

Name eIL2

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

Initial assignment s89

This species takes part in five reactions (as a reactant in re25 and as a product in re45, reaction_14 and as a modifier in re25, reaction_14).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s89} = v_{35} + v_{50} - v_{19} \tag{197}$$

10.8 Species s90

Name eIL6

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

Initial assignment s90

This species takes part in five reactions (as a reactant in re29 and as a product in re46, reaction_13 and as a modifier in re29, reaction_13).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s90} = v_{36} + v_{49} - v_{23} \tag{198}$$

10.9 Species species_1

Name eIL17

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

Initial assignment species_1

This species takes part in three reactions (as a reactant in reaction_3 and as a product in reaction_2 and as a modifier in reaction_3).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_1} = v_{38} - v_{39} \tag{199}$$

10.10 Species species_2

Name eIL10

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

Initial assignment species_2

This species takes part in five reactions (as a reactant in re39 and as a product in reaction_1, reaction_12 and as a modifier in re39, reaction_12).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_2} = v_{37} + v_{48} - v_{32} \tag{200}$$

10.11 Species species_12

Name eIL18

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

Initial assignment species_12

This species takes part in five reactions (as a reactant in re2 and as a product in reaction_4, reaction_6 and as a modifier in re2, reaction_6).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_12} = v_{40} + v_{42} - v_{1} \tag{201}$$

10.12 Species species_13

Name anti-IL4

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

This species takes part in two reactions (as a modifier in re20, re20), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_13} = 0 \tag{202}$$

10.13 Species species_14

Name anti-IFNg

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

This species takes part in two reactions (as a modifier in re14, re14), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_14} = 0 \tag{203}$$

10.14 Species species_15

Name pIL4

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

This species takes part in two reactions (as a reactant in re20 and as a modifier in re20), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_15} = 0 \tag{204}$$

10.15 Species species_16

Name IL18_pool

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

This species takes part in two reactions (as a reactant in reaction_6 and as a modifier in reaction_6), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_16} = 0 \tag{205}$$

10.16 Species species_17

Name IL12_pool

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

This species takes part in two reactions (as a reactant in reaction_7 and as a modifier in reaction_7), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_17} = 0 \tag{206}$$

10.17 Species species_18

Name IFNg_pool

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

This species takes part in two reactions (as a reactant in reaction_8 and as a modifier in reaction_8), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_18} = 0 \tag{207}$$

10.18 Species species_19

Name IL21_pool

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

This species takes part in two reactions (as a reactant in reaction_9 and as a modifier in reaction_9), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_19} = 0 \tag{208}$$

10.19 Species species_20

Name IL23_pool

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

This species takes part in two reactions (as a reactant in reaction_10 and as a modifier in reaction_10), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_20} = 0 \tag{209}$$

10.20 Species species_21

Name IL17_pool

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

This species takes part in two reactions (as a reactant in reaction_11 and as a modifier in reaction_11), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_21} = 0 \tag{210}$$

10.21 Species species_22

Name IL10_pool

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

This species takes part in two reactions (as a reactant in reaction_12 and as a modifier in reaction_12), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_22} = 0 \tag{211}$$

10.22 Species species_23

Name IL6_pool

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

This species takes part in two reactions (as a reactant in reaction_13 and as a modifier in reaction_13), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_23} = 0 \tag{212}$$

10.23 Species species_24

Name IL2_pool

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

This species takes part in two reactions (as a reactant in reaction_14 and as a modifier in reaction_14), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_24} = 0 \tag{213}$$

10.24 Species species_25

Name TGFb_pool

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

This species takes part in two reactions (as a reactant in reaction_15 and as a modifier in reaction_15), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_25} = 0 \tag{214}$$

10.25 Species species_26

Name IL4_pool

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

This species takes part in two reactions (as a reactant in reaction_16 and as a modifier in reaction_16), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_26} = 0 \tag{215}$$

10.26 Species species_27

Name pIL10

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

This species takes part in two reactions (as a reactant in reaction_17 and as a modifier in reaction_17), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_27} = 0 \tag{216}$$

10.27 Species s48

Name IL6-IL6R

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

This species takes part in eight reactions (as a product in re29 and as a modifier in re27, re27, re29, re30, re30, re36, re36).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s48} = v_{23} \tag{217}$$

10.28 Species s47

Name IL6R

Initial concentration $0.9999999518\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re29 and as a modifier in re29).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s47} = -v_{23} \tag{218}$$

10.29 Species s46

Name IL6

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

This species takes part in two reactions (as a reactant in re46 and as a modifier in re46).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s46} = -v_{36} \tag{219}$$

10.30 Species s45

Name TGFb-TGFbR

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

This species takes part in ten reactions (as a product in re28 and as a modifier in re15, re15, re23, re23, re27, re27, re28, re31, re31).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s45} = v_{22} \tag{220}$$

10.31 Species s44

Name TGFbR

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re28 and as a modifier in re28).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s44} = -v_{22} \tag{221}$$

10.32 Species s43

Name TGFb

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

This species takes part in two reactions (as a reactant in re44 and as a modifier in re44).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s43} = -v_{34} \tag{222}$$

10.33 Species s38

Name IL2-IL2R

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

This species takes part in four reactions (as a product in re25 and as a modifier in re25, re26, re26).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s38} = v_{19} \tag{223}$$

10.34 Species s37

Name IL2R

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re25 and as a modifier in re25).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s37} = -v_{19} \tag{224}$$

10.35 Species s36

Name IL2

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

This species takes part in two reactions (as a reactant in re45 and as a modifier in re45).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s36} = -v_{35} \tag{225}$$

10.36 Species s33

Name IL4-IL4R

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

This species takes part in six reactions (as a product in re19 and as a modifier in re19, re24, re24, re42, re42).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s33} = v_{15} \tag{226}$$

10.37 Species s32

Name IL4R

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re19 and as a modifier in re19).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s32} = -v_{15} \tag{227}$$

10.38 Species s31

Name IL4

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

This species takes part in five reactions (as a reactant in re18 and as a product in re20 and as a modifier in re18, re20, re20).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s31} = v_{16} - v_{14} \tag{228}$$

10.39 Species s25

Name IFNg-IFNgR

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

This species takes part in ten reactions (as a product in re11 and as a modifier in re11, re13, re13, re16, re16, re24, re24, re42, re42).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s25} = v_{7} \tag{229}$$

10.40 Species s24

Name IFNgR

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

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

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s24} = -v_7 \tag{230}$$

10.41 Species s14

Name IL12-IL12R

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

This species takes part in four reactions (as a product in re8 and as a modifier in re8, re10, re10).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s14} = v_4 \tag{231}$$

10.42 Species s13

Name IL12R

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re8 and as a modifier in re8).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s13} = -v_4 \tag{232}$$

10.43 Species s12

Name IL12

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

This species takes part in two reactions (as a reactant in re6 and as a modifier in re6).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s12} = -v_3 \tag{233}$$

10.44 Species s3

Name IL18-IL18R

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

This species takes part in four reactions (as a product in re2 and as a modifier in re2, re3, re3).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s3} = v_1 \tag{234}$$

10.45 Species s2

Name IL18R

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re2 and as a modifier in re2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s2} = -v_1 \tag{235}$$

10.46 Species s1

Name IL18

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

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

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s1} = -v_{40} \tag{236}$$

10.47 Species s52

Name IL21

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

This species takes part in four reactions (as a reactant in re33 and as a product in re37 and as a modifier in re33, re37).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s52} = v_{31} - v_{27} \tag{237}$$

10.48 Species s54

Name IL21-IL21R

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

This species takes part in ten reactions (as a product in re32 and as a modifier in re10, re10, re13, re13, re30, re30, re32, reaction_17, reaction_17).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s54} = v_{26} \tag{238}$$

10.49 Species s53

Name IL21R

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re32 and as a modifier in re32).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s53} = -\,v_{26} \tag{239}$$

10.50 Species s58

Name IL23R

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re35 and as a modifier in re35).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s58} = -\,v_{29} \tag{240}$$

10.51 Species s59

Name IL23-IL23R

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

This species takes part in ten reactions (as a product in re35 and as a modifier in re10, re10, re30, re30, re35, reaction_5, reaction_5, reaction_17, reaction_17).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s59} = v_{29} \tag{241}$$

10.52 Species s62

Name IL10R

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re39 and as a modifier in re39).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s62} = -\,v_{32} \tag{242}$$

10.53 Species s63

Name IL10-IL10R

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

This species takes part in four reactions (as a product in re39 and as a modifier in re30, re30, re39).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s63} = v_{32} \tag{243}$$

10.54 Species s65

Name IRAK1

Initial concentration $0.5\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re3 and as a modifier in re3), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s65} = 0 \tag{244}$$

10.55 Species s10

Name IRAK1-P

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

This species takes part in four reactions (as a product in re3 and as a modifier in re3, re9, re9).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s10} = v_{2} \tag{245}$$

10.56 Species s20

Name p50/p65 dimer

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

This species takes part in four reactions (as a product in re9 and as a modifier in re9, re14, re14).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s20} = v_{5} \tag{246}$$

10.57 Species s67

Name STAT4

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re10 and as a modifier in re10), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s67} = 0 \tag{247}$$

10.58 Species s21

Name STAT4-P

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

This species takes part in eight reactions (as a product in re10 and as a modifier in re10, re14, re14, re15, re15, reaction_5, reaction_5).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s21} = v_6 \tag{248}$$

10.59 Species s68

Name IFNg

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

This species takes part in four reactions (as a reactant in re12 and as a product in re14 and as a modifier in re12, re14).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s68} = v_{10} - v_8 \tag{249}$$

10.60 Species s69

Name JAK1

Initial concentration $0.5\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re16 and as a modifier in re16), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s69} = 0 \tag{250}$$

10.61 Species s28

Name JAK1-P

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

This species takes part in four reactions (as a product in re16 and as a modifier in re13, re13, re16).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s28} = v_{12} \tag{251}$$

10.62 Species s70

Name STAT1

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re13 and as a modifier in re13), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s70} = 0 \tag{252}$$

10.63 Species s26

Name STAT1-P

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

This species takes part in ten reactions (as a product in re13 and as a modifier in re13, re15, re15, re17, re17, re20, re20, re27, re27).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s26} = v_{9} \tag{253}$$

10.64 Species s57

Name p40/p19 dimer

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

This species takes part in six reactions (as a reactant in re35 and as a product in re34, re36 and as a modifier in re34, re35, re36).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s57} = v_{28} + v_{30} - v_{29} \tag{254}$$

10.65 Species s73

Name IL17

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

This species takes part in six reactions (as a reactant in reaction_2 and as a product in reaction_5, reaction_11 and as a modifier in reaction_2, reaction_5, reaction_11).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s73} = v_{41} + v_{47} - v_{38} \tag{255}$$

10.66 Species s74

Name IL10

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

This species takes part in four reactions (as a reactant in reaction_1 and as a product in reaction_17 and as a modifier in reaction_1, reaction_17).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s74} = v_{53} - v_{37} \tag{256}$$

10.67 Species s75

Name RORgt

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re31 and as a modifier in re31), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s75} = 0 \tag{257}$$

10.68 Species s50

Name RORgt-ligand

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

This species takes part in four reactions (as a product in re31 and as a modifier in re31, reaction_5, reaction_5).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s50} = v_{25} \tag{258}$$

10.69 Species s49

Name STAT3-P

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

This species takes part in 14 reactions (as a product in re30 and as a modifier in re14, re14, re15, re15, re23, re23, re27, re27, re30, re31, re31, re37, re37).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s49} = v_{24} \tag{259}$$

10.70 Species s76

Name STAT3

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re30 and as a modifier in re30), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s76} = 0 \tag{260}$$

10.71 Species s39

Name STAT5-P

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

This species takes part in ten reactions (as a product in re26 and as a modifier in re20, re20, re26, re27, re27, re32, re32, reaction_17, reaction_17).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s39} = v_{20} \tag{261}$$

10.72 Species s77

Name STAT5

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re26 and as a modifier in re26), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s77} = 0 \tag{262}$$

10.73 Species s78

Name FOXP3

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re27 and as a modifier in re27), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s78} = 0 \tag{263}$$

10.74 Species s79

Name SOCS1

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re17 and as a modifier in re17), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s79} = 0 \tag{264}$$

10.75 Species s29

Name SOCS1-JAKs

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

This species takes part in eight reactions (as a product in re17 and as a modifier in re11, re11, re16, re16, re17, re19, re19).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s29} = v_{13} \tag{265}$$

10.76 Species s27

Name Tbet-P

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

This species takes part in eleven reactions (as a product in re15 and as a modifier in re14, re14, re15, re15, re17, re17, re23, re23, re35, re35).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s27} = v_{11} \tag{266}$$

10.77 Species s80

Name Tbet

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re15 and as a modifier in re15), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s80} = 0 \tag{267}$$

10.78 Species s81

Name GATA3

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re23 and as a modifier in re23), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s81} = 0 \tag{268}$$

10.79 Species s35

Name GATA3-P

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

This species takes part in eight reactions (as a product in re23 and as a modifier in re10, re10, re20, re20, re23, reaction_17, reaction_17).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s35} = v_{17} \tag{269}$$

10.80 Species s34

Name STAT6-P

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

This species takes part in ten reactions (as a product in re24 and as a modifier in re2, re2, re8, re8, re23, re23, re24, re27, re27).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s34} = v_{18} \tag{270}$$

10.81 Species s82

Name STAT6

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

This species takes part in two reactions (as a reactant in re24 and as a modifier in re24), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s82} = 0 \tag{271}$$

10.82 Species s85

Name PPARg

Initial concentration $0.08\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re42 and as a modifier in re42).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s85} = -v_{33} \tag{272}$$

10.83 Species s83

Name L-PPARg

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

This species takes part in 26 reactions (as a product in re42 and as a modifier in re8, re8, re9, re9, re13, re13, re14, re14, re16, re16, re23, re23, re27, re27, re30, re30, re31, re31, re36, re36, re42, reaction_5, reaction_5, reaction_17, reaction_17).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s83} = v_{33} \tag{273}$$

10.84 Species s86

Name Ligand

Initial concentration $0.9999999518\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re42 and as a modifier in re42), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s86} = 0 \tag{274}$$

10.85 Species s40

Name acetylated FOXP3

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

This species takes part in six reactions (as a product in re27 and as a modifier in re9, re9, re27, re31, re31).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{s40} = v_{21} \tag{275}$$

10.86 Species species_8

Name p19

Initial concentration $0.9999999518\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re36 and as a modifier in re36), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_8} = 0 \tag{276}$$

10.87 Species species_9

Name p40

Initial concentration $0.9999999518\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re36 and as a modifier in re36), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_9} = 0 \tag{277}$$

10.88 Species species_10

Name p50

Initial concentration $0.5\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re9 and as a modifier in re9), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_10} = 0 \tag{278}$$

10.89 Species species_11

Name p65

Initial concentration $0.5\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re9 and as a modifier in re9), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_11} = 0 \tag{279}$$

10.90 Species species_4

Name IL17R

Initial concentration $0.9999999518\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in reaction_3 and as a modifier in reaction_3).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_4} = -v_{39} \tag{280}$$

10.91 Species species_3

Name IL17-IL17R

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

This species takes part in four reactions (as a product in reaction_3 and as a modifier in re32, re32, reaction_3).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_3} = v_{39} \tag{281}$$

10.92 Species species_5

Name pIFNg

Initial concentration $0.9999999518\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re14 and as a modifier in re14), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_5} = 0 \tag{282}$$

10.93 Species species_6

Name pIL21

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in re37 and as a modifier in re37), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_6} = 0 \tag{283}$$

10.94 Species species_7

Name pIL17

Initial concentration $0.999999951844375\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in reaction_5 and as a modifier in reaction_5), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{species\_7} = 0 \tag{284}$$

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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