SBML Model Report

Model name: "Yamada2003_JAK_STAT_pathway"

May 5, 2016

1 General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by Harish Dharuri[1] at March seventh 2007 at 6:40 p. m. and last time modified at May 16th 2012 at 10:16 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	34
events	0	constraints	0
reactions	46	function definitions	0
global parameters	0	unit definitions	5
rules	0	initial assignments	0

Model Notes

NCBS Curation Comments This model shows the control mechanism of Jak-Stat pathway, here SOCS1 (Suppressor of cytokine signaling-I) was identified as the negative regulator of Jak and STAT signal transduction pathway. Note: There are a few ambiguities in the paper like initial concentration of IFN and some reactions were missing in the paper that were employed for obtaining the results. The graphs are almost similar to the graphs as shown in the paper but

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still some ambiguities regarding the concentration are there. Thanks to Dr Satoshi Yamada for clarifying some of those ambiguities and providing the values used in simulations.

Biomodels Curation Comments The model reproduces Fig 2 (A,C,E,G,I,K,M) of the paper. The set of equations present in the paper are inadequate to reproduce the figures mentioned . The model appears to have been fine tuned after correspondence between the curators at NCBS and the authors. There is however a slight discrepancy between the simulation results and the plots in the paper. The model was tested on MathSBML.

2 Unit Definitions

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

2.1 Unit substance

Name nanomoles

Definition nmol

2.2 Unit nM_per_second

Definition $\mathrm{nmol} \cdot \mathrm{l}^{-1} \cdot \mathrm{s}^{-1}$

2.3 Unit sec_inv

Name sec_inv

Definition s^{-1}

2.4 Unit nM_inv_sec_inv

Name nM_inv_sec_inv

Definition $\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$

2.5 Unit nM

Name nM

Definition $\mathrm{nmol} \cdot \mathrm{l}^{-1}$

2.6 Unit volume

Notes Litre is the predefined SBML unit for volume.

Definition l

2.7 Unit area

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

Definition m^2

2.8 Unit length

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

Definition m

2.9 Unit time

Notes Second is the predefined SBML unit for time.

Definition s

3 Compartments

This model contains two compartments.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
cytoplasm	cytoplasm		3	1	litre	☑	
nucleus	nucleus		3	1	litre	☑	cytoplasm

3.1 Compartment cytoplasm

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

Name cytoplasm

3.2 Compartment nucleus

This is a three dimensional compartment with a constant size of one litre, which is surrounded by cytoplasm (cytoplasm).

Name nucleus

4 Species

This model contains 34 species. The boundary condition of one of these species is set to `true` so that this species' amount cannot be changed by any reaction. Section 6 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
R	Receptor	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
JAK	JAK	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
RJ	Receptor JAK complex	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IFNRJ	Interferon-Receptor-JAK complex	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IFNRJ2	IFNRJ dimer	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IFNRJ2_star	Activated IFNRJ complex	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
STAT1c	STAT1c	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IFNRJ2_star_STAT1c	IFNRJ2_star_STAT1c	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
STAT1c_star	STAT1c_star	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IFNRJ2_star_STAT1c_star	IFNRJ2_star_STAT1c_star	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
STAT1c_star_STAT1c_star	STAT1c_star_STAT1c_star	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
SHP2	SHP2	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IFNRJ2_star_SHP2	IFNRJ2_star_SHP2	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
PPX	PPX	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
STAT1c_star_PPX	STAT1c_star_PPX	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
STAT1c_STAT1c_star	STAT1c_STAT1c_star	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
STAT1n_star_STAT1n_star	STAT1n_star_STAT1n_star	nucleus	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
STAT1n_star	STAT1n_star	nucleus	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
PPN	PPN	nucleus	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
STAT1n_star_PPN	STAT1n_star_PPN	nucleus	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
STAT1n	STAT1n	nucleus	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
STAT1n_STAT1n_star	STAT1n_STAT1n_star	nucleus	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
mRNAn	mRNAn	nucleus	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
mRNAc	mRNAc	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
SOCS1	SOCS1	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IFNRJ2_star_SOCS1	IFNRJ2_star_SOCS1	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IFNRJ2_star_SHP2_SOCS1_STAT1c	IFNRJ2_star_SHP2_SOCS1_STAT1c	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
STAT1c_star_STAT1c_star_PPX	STAT1c_star_STAT1c_star_PPX	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
STAT1n_star_STAT1n_star_PPN	STAT1n_star_STAT1n_star_PPN	nucleus	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IFNRJ2_star_SOCS1_STAT1c	IFNRJ2_star_SOCS1_STAT1c	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IFN	IFN	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	☑	☑
IFNRJ2_star_SHP2_STAT1c	IFNRJ2_star_SHP2_STAT1c	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IFNRJ2_star_SHP2_SOCS1	IFNRJ2_star_SHP2_SOCS1	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IFNR	IFNR	cytoplasm	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	⊟	⊟

5 Reactions

This model contains 46 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 4: Overview of all reactions

№	Id	Name	Reaction Equation	SBO
1	v1	Receptor-JAK Binding	JAK + R ⟶ RJ	
2	v2	Interferon-Receptor Binding	RJ + IFN ⟶ IFNRJ	
3	v3	IFN-Receptor complex dimerization	2 IFNRJ ⟶ IFNRJ2	
4	v4	INF-Receptor complex activation	IFNRJ2 ⟶ IFNRJ2_star	
5	v5	Activated INFRJ2-STAT1c binding	IFNRJ2_star + STAT1c ⟶ IFNRJ2_star_STAT1c	
6	v6	STAT1c activation	IFNRJ2_star_STAT1c ⟶ STAT1c_star + IFNRJ2_star	
7	v7	Activated IFNRJ2-STAT1c binding	STAT1c_star + IFNRJ2_star ⟶ IFNRJ2_star_STAT1c_star	
8	v8	Activated STAT1c dimerization	2 STAT1c_star ⟶ STAT1c_star_STAT1c_star	
9	v9	SHP2 binding	SHP2 + IFNRJ2_star ⟶ IFNRJ2_star_SHP2	
10	v10	IFNJR2 dephosphorylation	IFNRJ2_star_SHP2 ⟶ SHP2 + IFNRJ2	
11	v11	Phosphorylated STAT1c-PPX binding	STAT1c_star + PPX ⟶ STAT1c_star_PPX	
12	v12	STAT1c dephosphorylation	STAT1c_star_PPX ⟶ STAT1c + PPX	
13	v13	PPX binding	STAT1c_star_STAT1c_star + PPX ⟶ STAT1c_star_STAT1c_star_PPX	
14	v14	STAT1c dimer dephosphorylation	STAT1c_star_STAT1c_star_PPX ⟶ STAT1c_STAT1c_star + PPX	
15	v15	STAT1c-phosphorylated STAT1c binding	STAT1c_star + STAT1c ⟶ STAT1c_STAT1c_star	
16	v16	STAT1c-nuclear transport	STAT1c_star_STAT1c_star ⟶ STAT1n_star_STAT1n_star	
17	v17	Phosphorylated STAT1n dimerization	2 STAT1n_star ⟶ STAT1n_star_STAT1n_star	
18	v18	PPN binding	STAT1n_star + PPN ⟶ STAT1n_star_PPN	
19	v19	STAT1n dephosphorylation	STAT1n_star_PPN ⟶ STAT1n + PPN	

№	Id	Name	Reaction Equation	SBO
20	v20	PPN binding	STAT1n_star_STAT1n_star + PPN ⟶ STAT1n_star_STAT1n_star_PPN	
21	v21	STAT1n dephosphorylation	STAT1n_star_STAT1n_star_PPN ⟶ STAT1n_STAT1n_star + PPN	
22	v22	STAT1n-phosphorylated STAT1n dimerization	STAT1n_star + STAT1n ⟶ STAT1n_STAT1n_star	
23	v23	STAT1n transport to cytoplasm	STAT1n ⟶ STAT1c	
24	v24	Transcription	$\emptyset \xrightarrow{\text{STAT1n\_star\_STAT1n\_star}}$ mRNAn	
25	v25	mRNA transport to cytoplasm	mRNAn ⟶ mRNAc	
26	v26	SOCS1 synthesis	$\emptyset \xrightarrow{\text{mRNAc}}$ SOCS1	
27	v27	mRNAc degradation	mRNAc ⟶ ∅	
28	v28	SOCS1 degradation	SOCS1 ⟶ ∅	
29	v29	phosphorylated IFNRJ2-SOCS1 binding	IFNRJ2_star + SOCS1 ⟶ IFNRJ2_star_SOCS1	
30	v30	STAT1c binding	IFNRJ2_star_SOCS1 + STAT1c ⟶ IFNRJ2_star_SOCS1_STAT1c	
31	v31	SHP2 binding	IFNRJ2_star_SOCS1_STAT1c + SHP2 ⟶ IFNRJ2_star_SHP2_SOCS1_STAT1c	
32	v32	IFNRJ2 dephosphorylation	IFNRJ2_star_SHP2_SOCS1_STAT1c ⟶ IFNRJ2 + SOCS1 + STAT1c + SHP2	
33	v33	SOCS1 unbinding	IFNRJ2_star_SHP2_SOCS1_STAT1c ⟶ IFNRJ2_star_SHP2_STAT1c	
34	v34	SHP2 binding	IFNRJ2_star_SOCS1 + SHP2 ⟶ IFNRJ2_star_SHP2_SOCS1	
35	v35	STAT1c binding	IFNRJ2_star_SHP2_SOCS1 + STAT1c ⟶ IFNRJ2_star_SHP2_SOCS1_STAT1c	
36	v36	SHP2 binding	IFNRJ2_star_STAT1c + SHP2 ⟶ IFNRJ2_star_SHP2_STAT1c	
37	v37		IFNRJ2_star_SHP2_STAT1c ⟶ STAT1c + SHP2 + IFNRJ2	

№	Id	Name	Reaction Equation	SBO
38	v38	SOCS1 unbinding	IFNRJ2_star_SOCS1_STAT1c ⟶ IFNRJ2_star_STAT1c	
39	v39	SOCS1 unbinding	IFNRJ2_star_SHP2_SOCS1 ⟶ IFNRJ2_star_SHP2	
40	v40	IFNRJ2 dephosphorylation	IFNRJ2_star_SHP2_SOCS1 ⟶ SHP2 + IFNRJ2 + SOCS1	
41	v41	SOCS1 unbinding	IFNRJ2_star_SOCS1 ⟶ IFNRJ2_star	
42	v42	SOCS1 binding	IFNRJ2_star_STAT1c + SOCS1 ⟶ IFNRJ2_star_SOCS1_STAT1c	
43	v43	SOCS1 binding	IFNRJ2_star_SHP2 + SOCS1 ⟶ IFNRJ2_star_SHP2_SOCS1	
44	v44	SOCS1 binding	IFNRJ2_star_SHP2_STAT1c + SOCS1 ⟶ IFNRJ2_star_SHP2_SOCS1_STAT1c	
45	v45	Interferon-receptor binding	R + IFN ⟶ IFNR	
46	v46	IFNR-JAK binding	JAK + IFNR ⟶ IFNRJ	

5.1 Reaction v1

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

Name Receptor-JAK Binding

Reaction equation

$$\mathrm{JAK} + \mathrm{R} \longrightarrow \mathrm{RJ} \tag{1}$$

Reactants

Table 5: Properties of each reactant.

Id	Name	SBO
JAK	JAK	
R	Receptor	

Product

Table 6: Properties of each product.

Id	Name	SBO
RJ	Receptor JAK complex	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_1 = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{R}] \cdot [\mathrm{JAK}] - \mathrm{kb} \cdot [\mathrm{RJ}]) \tag{2}$$

Table 7: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.10	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.05	s^{-1}	☑

5.2 Reaction v2

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

Name Interferon-Receptor Binding

Reaction equation

$$\mathrm{RJ} + \mathrm{IFN} \longrightarrow \mathrm{IFNRJ} \tag{3}$$

Reactants

Table 8: Properties of each reactant.

Id	Name	SBO
RJ	Receptor JAK complex	
IFN	IFN	

Product

Table 9: Properties of each product.

Id	Name	SBO
IFNRJ	Interferon-Receptor-JAK complex	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_2 = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{IFN}] \cdot [\mathrm{RJ}] - \mathrm{kb} \cdot [\mathrm{IFNRJ}]) \tag{4}$$

Table 10: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.02	s^{-1}	☑

5.3 Reaction v3

This is an irreversible reaction of one reactant forming one product.

Name IFN-Receptor complex dimerization

Reaction equation

$$2\,\mathrm{IFNRJ} \longrightarrow \mathrm{IFNRJ2} \tag{5}$$

Reactant

Table 11: Properties of each reactant.

Id	Name	SBO
IFNRJ	Interferon-Receptor-JAK complex	

Product

Table 12: Properties of each product.

Id	Name	SBO
IFNRJ2	IFNRJ dimer	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_3 = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{IFNRJ}] \cdot [\mathrm{IFNRJ}] - \mathrm{kb} \cdot [\mathrm{IFNRJ2}]) \tag{6}$$

Table 13: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.04	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.20	s^{-1}	☑

5.4 Reaction v4

This is an irreversible reaction of one reactant forming one product.

Name INF-Receptor complex activation

Reaction equation

$$\mathrm{IFNRJ2} \longrightarrow \mathrm{IFNRJ2\_star} \tag{7}$$

Reactant

Table 14: Properties of each reactant.

Id	Name	SBO
IFNRJ2	IFNRJ dimer	

Product

Table 15: Properties of each product.

Id	Name	SBO
IFNRJ2_star	Activated IFNRJ complex	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_4 = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{kf} \cdot [\mathrm{IFNRJ2}] \tag{8}$$

Table 16: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.005	s^{-1}	☑

5.5 Reaction v5

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

Name Activated INFRJ2-STAT1c binding

Reaction equation

$$\mathrm{IFNRJ2\_star} + \mathrm{STAT1c} \longrightarrow \mathrm{IFNRJ2\_star\_STAT1c} \tag{9}$$

Reactants

Table 17: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star	Activated IFNRJ complex	
STAT1c	STAT1c	

Product

Table 18: Properties of each product.

Id	Name	SBO
IFNRJ2_star_STAT1c	IFNRJ2_star_STAT1c	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_5 = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{STAT1c}] \cdot [\mathrm{IFNRJ2\_star}] - \mathrm{kb} \cdot [\mathrm{IFNRJ2\_star\_STAT1c}]) \quad (10)$$

Table 19: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.008	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.800	s^{-1}	☑

5.6 Reaction v6

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

Name STAT1c activation

Reaction equation

$$\mathrm{IFNRJ2\_star\_STAT1c} \longrightarrow \mathrm{STAT1c\_star} + \mathrm{IFNRJ2\_star} \quad (11)$$

Reactant

Table 20: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_STAT1c	IFNRJ2_star_STAT1c	

Products

Table 21: Properties of each product.

Id	Name	SBO
STAT1c_star	STAT1c_star	
IFNRJ2_star	Activated IFNRJ complex	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_6 = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{kf} \cdot [\mathrm{IFNRJ2\_star\_STAT1c}] \tag{12}$$

Table 22: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.4	s^{-1}	☑

5.7 Reaction v7

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

Name Activated IFNRJ2-STAT1c binding

Reaction equation

$$\mathrm{STAT1c\_star} + \mathrm{IFNRJ2\_star} \longrightarrow \mathrm{IFNRJ2\_star\_STAT1c\_star} \tag{13}$$

Reactants

Table 23: Properties of each reactant.

Id	Name	SBO
STAT1c_star	STAT1c_star	
IFNRJ2_star	Activated IFNRJ complex	

Product

Table 24: Properties of each product.

Id	Name	SBO
IFNRJ2_star_STAT1c_star	IFNRJ2_star_STAT1c_star	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_7 = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{IFNRJ2\_star}] \cdot [\mathrm{STAT1c\_star}] - \mathrm{kb} \cdot [\mathrm{IFNRJ2\_star\_STAT1c\_star}]) \tag{14}$$

Table 25: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.005	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.500	s^{-1}	☑

5.8 Reaction v8

This is an irreversible reaction of one reactant forming one product.

Name Activated STAT1c dimerization

Reaction equation

$$2\,\mathrm{STAT1c\_star} \longrightarrow \mathrm{STAT1c\_star\_STAT1c\_star} \tag{15}$$

Reactant

Table 26: Properties of each reactant.

Id	Name	SBO
STAT1c_star	STAT1c_star	

Product

Table 27: Properties of each product.

Id	Name	SBO
STAT1c_star_STAT1c_star	STAT1c_star_STAT1c_star	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_8 = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{STAT1c\_star}] \cdot [\mathrm{STAT1c\_star}] - \mathrm{kb} \cdot [\mathrm{STAT1c\_star\_STAT1c\_star}]) \tag{16}$$

Table 28: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.10	s^{-1}	☑

5.9 Reaction v9

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

Name SHP2 binding

Reaction equation

$$\mathrm{SHP2} + \mathrm{IFNRJ2\_star} \longrightarrow \mathrm{IFNRJ2\_star\_SHP2} \tag{17}$$

Reactants

Table 29: Properties of each reactant.

Id	Name	SBO
SHP2	SHP2	
IFNRJ2_star	Activated IFNRJ complex	

Product

Table 30: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2	IFNRJ2_star_SHP2	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_9 = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{IFNRJ2\_star}] \cdot [\mathrm{SHP2}] - \mathrm{kb} \cdot [\mathrm{IFNRJ2\_star\_SHP2}]) \tag{18}$$

Table 31: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.200	s^{-1}	☑

5.10 Reaction v10

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

Name IFNJR2 dephosphorylation

Reaction equation

$$\mathrm{IFNRJ2\_star\_SHP2} \longrightarrow \mathrm{SHP2} + \mathrm{IFNRJ2} \tag{19}$$

Reactant

Table 32: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2	IFNRJ2_star_SHP2	

Products

Table 33: Properties of each product.

Id	Name	SBO
SHP2	SHP2	
IFNRJ2	IFNRJ dimer	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{10} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{kf} \cdot [\mathrm{IFNRJ2\_star\_SHP2}] \tag{20}$$

Table 34: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.003	s^{-1}	☑

5.11 Reaction v11

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

Name Phosphorylated STAT1c-PPX binding

Reaction equation

$$\text{STAT1c\_star} + \text{PPX} \longrightarrow \text{STAT1c\_star\_PPX} \tag{21}$$

Reactants

Table 35: Properties of each reactant.

Id	Name	SBO
STAT1c_star	STAT1c_star	
PPX	PPX	

Product

Table 36: Properties of each product.

Id	Name	SBO
STAT1c_star_PPX	STAT1c_star_PPX	

Kinetic Law

Derived unit $\text{s}^{-1} \cdot \text{nmol}$

$$v_{11} = \text{vol}\,(\text{cytoplasm}) \cdot (\text{kf} \cdot [\text{PPX}] \cdot [\text{STAT1c\_star}] - \text{kb} \cdot [\text{STAT1c\_star\_PPX}]) \tag{22}$$

Table 37: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\text{nmol}^{-1} \cdot 1 \cdot \text{s}^{-1}$	☑
kb			0.200	s^{-1}	☑

5.12 Reaction v12

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

Name STAT1c dephosphorylation

Reaction equation

$$\text{STAT1c\_star\_PPX} \longrightarrow \text{STAT1c} + \text{PPX} \tag{23}$$

Reactant

Table 38: Properties of each reactant.

Id	Name	SBO
STAT1c_star_PPX	STAT1c_star_PPX	

Products

Table 39: Properties of each product.

Id	Name	SBO
STAT1c	STAT1c	
PPX	PPX	

Kinetic Law

Derived unit $\text{s}^{-1} \cdot \text{nmol}$

$$v_{12} = \text{vol}\,(\text{cytoplasm}) \cdot \text{kf} \cdot [\text{STAT1c\_star\_PPX}] \tag{24}$$

Table 40: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.003	s^{-1}	☑

5.13 Reaction v13

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

Name PPX binding

Reaction equation

$$\text{STAT1c\_star\_STAT1c\_star} + \text{PPX} \longrightarrow \text{STAT1c\_star\_STAT1c\_star\_PPX} \tag{25}$$

Reactants

Table 41: Properties of each reactant.

Id	Name	SBO
STAT1c_star_STAT1c_star PPX	STAT1c_star_STAT1c_star PPX	

Product

Table 42: Properties of each product.

Id	Name	SBO
STAT1c_star_STAT1c_star_PPX	STAT1c_star_STAT1c_star_PPX	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{13} = \mathrm{vol}(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{PPX}] \cdot [\mathrm{STAT1c\_star\_STAT1c\_star}] - \mathrm{kb} \cdot [\mathrm{STAT1c\_star\_STAT1c\_star\_PPX}]) \tag{26}$$

Table 43: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.200	s^{-1}	☑

5.14 Reaction v14

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

Name STAT1c dimer dephosphorylation

Reaction equation

$$\mathrm{STAT1c\_star\_STAT1c\_star\_PPX} \longrightarrow \mathrm{STAT1c\_STAT1c\_star} + \mathrm{PPX} \tag{27}$$

Reactant

Table 44: Properties of each reactant.

Id	Name	SBO
STAT1c_star_STAT1c_star_PPX	STAT1c_star_STAT1c_star_PPX	

Products

Table 45: Properties of each product.

Id	Name	SBO
STAT1c_STAT1c_star PPX	STAT1c_STAT1c_star PPX	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{14} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{kf} \cdot [\mathrm{STAT1c\_star\_STAT1c\_star\_PPX}] \tag{28}$$

Table 46: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.003	s^{-1}	☑

5.15 Reaction v15

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

Name STAT1c-phosphorylated STAT1c binding

Reaction equation

$$\mathrm{STAT1c\_star} + \mathrm{STAT1c} \longrightarrow \mathrm{STAT1c\_STAT1c\_star} \tag{29}$$

Reactants

Table 47: Properties of each reactant.

Id	Name	SBO
STAT1c_star STAT1c	STAT1c_star STAT1c	

Product

Table 48: Properties of each product.

Id	Name	SBO
STAT1c_STAT1c_star	STAT1c_STAT1c_star	

Kinetic Law

Derived unit $s^{-1} \cdot nmol$

$$v_{15} = \text{vol}(\text{cytoplasm}) \cdot (\text{kf} \cdot [\text{STAT1c}] \cdot [\text{STAT1c\_star}] - \text{kb} \cdot [\text{STAT1c\_STAT1c\_star}]) \quad (30)$$

Table 49: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			$2 \cdot 10^{-7}$	$nmol^{-1} \cdot 1 \cdot s^{-1}$	☑
kb			0.200	s^{-1}	☑

5.16 Reaction v16

This is an irreversible reaction of one reactant forming one product.

Name STAT1c-nuclear transport

Reaction equation

$$\text{STAT1c\_star\_STAT1c\_star} \longrightarrow \text{STAT1n\_star\_STAT1n\_star} \quad (31)$$

Reactant

Table 50: Properties of each reactant.

Id	Name	SBO
STAT1c_star_STAT1c_star	STAT1c_star_STAT1c_star	

Product

Table 51: Properties of each product.

Id	Name	SBO
STAT1n_star_STAT1n_star	STAT1n_star_STAT1n_star	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{16} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{kf} \cdot [\mathrm{STAT1c\_star\_STAT1c\_star}] \tag{32}$$

Table 52: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.005	s^{-1}	☑

5.17 Reaction v17

This is an irreversible reaction of one reactant forming one product.

Name Phosphorylated STAT1n dimerization

Reaction equation

$$2\,\mathrm{STAT1n\_star} \longrightarrow \mathrm{STAT1n\_star\_STAT1n\_star} \tag{33}$$

Reactant

Table 53: Properties of each reactant.

Id	Name	SBO
STAT1n_star	STAT1n_star	

Product

Table 54: Properties of each product.

Id	Name	SBO
STAT1n_star_STAT1n_star	STAT1n_star_STAT1n_star	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{17} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot (\mathrm{kf} \cdot [\mathrm{STAT1n\_star}] \cdot [\mathrm{STAT1n\_star}] - \mathrm{kb} \cdot [\mathrm{STAT1n\_star\_STAT1n\_star}]) \quad (34)$$

Table 55: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.10	s^{-1}	☑

5.18 Reaction v18

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

Name PPN binding

Reaction equation

$$\mathrm{STAT1n\_star} + \mathrm{PPN} \longrightarrow \mathrm{STAT1n\_star\_PPN} \quad (35)$$

Reactants

Table 56: Properties of each reactant.

Id	Name	SBO
STAT1n_star	STAT1n_star	
PPN	PPN	

Product

Table 57: Properties of each product.

Id	Name	SBO
STAT1n_star_PPN	STAT1n_star_PPN	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{18} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot (\mathrm{kf} \cdot [\mathrm{PPN}] \cdot [\mathrm{STAT1n\_star}] - \mathrm{kb} \cdot [\mathrm{STAT1n\_star\_PPN}]) \quad (36)$$

Table 58: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.200	s^{-1}	☑

5.19 Reaction v19

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

Name STAT1n dephosphorylation

Reaction equation

$$\mathrm{STAT1n\_star\_PPN} \longrightarrow \mathrm{STAT1n} + \mathrm{PPN} \tag{37}$$

Reactant

Table 59: Properties of each reactant.

Id	Name	SBO
STAT1n_star_PPN	STAT1n_star_PPN	

Products

Table 60: Properties of each product.

Id	Name	SBO
STAT1n	STAT1n	
PPN	PPN	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{19} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{kf} \cdot [\mathrm{STAT1n\_star\_PPN}] \tag{38}$$

Table 61: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.005	s^{-1}	☑

5.20 Reaction v20

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

Name PPN binding

Reaction equation

$$\text{STAT1n\_star\_STAT1n\_star} + \text{PPN} \longrightarrow \text{STAT1n\_star\_STAT1n\_star\_PPN} \tag{39}$$

Reactants

Table 62: Properties of each reactant.

Id	Name	SBO
STAT1n_star_STAT1n_star	STAT1n_star_STAT1n_star	
PPN	PPN	

Product

Table 63: Properties of each product.

Id	Name	SBO
STAT1n_star_STAT1n_star_PPN	STAT1n_star_STAT1n_star_PPN	

Kinetic Law

Derived unit $\text{s}^{-1} \cdot \text{nmol}$

$$\begin{aligned} v_{20} = {} & \text{vol}(\text{nucleus}) \\ & \cdot (\text{kf} \cdot [\text{PPN}] \cdot [\text{STAT1n\_star\_STAT1n\_star}] - \text{kb} \cdot [\text{STAT1n\_star\_STAT1n\_star\_PPN}]) \end{aligned} \tag{40}$$

Table 64: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\text{nmol}^{-1} \cdot 1 \cdot \text{s}^{-1}$	☑
kb			0.200	s^{-1}	☑

5.21 Reaction v21

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

Name STAT1n dephosphorylation

Reaction equation

$$\text{STAT1n\_star\_STAT1n\_star\_PPN} \longrightarrow \text{STAT1n\_STAT1n\_star} + \text{PPN} \tag{41}$$

Reactant

Table 65: Properties of each reactant.

Id	Name	SBO
STAT1n_star_STAT1n_star_PPN	STAT1n_star_STAT1n_star_PPN	

Products

Table 66: Properties of each product.

Id	Name	SBO
STAT1n_STAT1n_star PPN	STAT1n_STAT1n_star PPN	

Kinetic Law

Derived unit $\text{s}^{-1} \cdot \text{nmol}$

$$v_{21} = \text{vol}\,(\text{nucleus}) \cdot \text{kf} \cdot [\text{STAT1n\_star\_STAT1n\_star\_PPN}] \tag{42}$$

Table 67: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.005	s^{-1}	☑

5.22 Reaction v22

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

Name STAT1n-phosphorylated STAT1n dimerization

Reaction equation

$$\text{STAT1n\_star} + \text{STAT1n} \longrightarrow \text{STAT1n\_STAT1n\_star} \tag{43}$$

Reactants

Table 68: Properties of each reactant.

Id	Name	SBO
STAT1n_star	STAT1n_star	
STAT1n	STAT1n	

Product

Table 69: Properties of each product.

Id	Name	SBO
STAT1n_STAT1n_star	STAT1n_STAT1n_star	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{22} = \mathrm{vol}(\mathrm{nucleus}) \cdot (\mathrm{kf} \cdot [\mathrm{STAT1n}] \cdot [\mathrm{STAT1n\_star}] - \mathrm{kb} \cdot [\mathrm{STAT1n\_STAT1n\_star}]) \quad (44)$$

Table 70: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			$2 \cdot 10^{-7}$	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.200	s^{-1}	☑

5.23 Reaction v23

This is an irreversible reaction of one reactant forming one product.

Name STAT1n transport to cytoplasm

Reaction equation

$$\mathrm{STAT1n} \longrightarrow \mathrm{STAT1c} \quad (45)$$

Reactant

Table 71: Properties of each reactant.

Id	Name	SBO
STAT1n	STAT1n	

Product

Table 72: Properties of each product.

Id	Name	SBO
STAT1c	STAT1c	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{23} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{kf} \cdot [\mathrm{STAT1n}] \tag{46}$$

Table 73: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.05	s^{-1}	☑

5.24 Reaction v24

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

Name Transcription

Reaction equation

$$\emptyset \xrightarrow{\mathrm{STAT1n\_star\_STAT1n\_star}} \mathrm{mRNAn} \tag{47}$$

Modifier

Table 74: Properties of each modifier.

Id	Name	SBO
STAT1n_star_STAT1n_star	STAT1n_star_STAT1n_star	

Product

Table 75: Properties of each product.

Id	Name	SBO
mRNAn	mRNAn	

Kinetic Law

Derived unit $9.999999999999998 \cdot 10^{-10}\ \mathrm{mol} \cdot \mathrm{s}^{-1}$

$$v_{24} = \frac{\mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{ka} \cdot [\mathrm{STAT1n\_star\_STAT1n\_star}]}{\mathrm{kb} + [\mathrm{STAT1n\_star\_STAT1n\_star}]} \tag{48}$$

Table 76: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka			0.01	$\mathrm{nmol} \cdot \mathrm{l}^{-1} \cdot \mathrm{s}^{-1}$	☑
kb			400.00	$\mathrm{nmol} \cdot \mathrm{l}^{-1}$	☑

5.25 Reaction v25

This is an irreversible reaction of one reactant forming one product.

Name mRNA transport to cytoplasm

Reaction equation

$$\mathrm{mRNAn} \longrightarrow \mathrm{mRNAc} \tag{49}$$

Reactant

Table 77: Properties of each reactant.

Id	Name	SBO
mRNAn	mRNAn	

Product

Table 78: Properties of each product.

Id	Name	SBO
mRNAc	mRNAc	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{25} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{kf} \cdot [\mathrm{mRNAn}] \tag{50}$$

Table 79: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	s^{-1}	☑

5.26 Reaction v26

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

Name SOCS1 synthesis

Reaction equation

$$\emptyset \xrightarrow{\mathrm{mRNAc}} \mathrm{SOCS1} \tag{51}$$

Modifier

Table 80: Properties of each modifier.

Id	Name	SBO
mRNAc	mRNAc	

Product

Table 81: Properties of each product.

Id	Name	SBO
SOCS1	SOCS1	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{26} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{kf} \cdot [\mathrm{mRNAc}] \tag{52}$$

Table 82: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.01	s^{-1}	☑

5.27 Reaction v27

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

Name mRNAc degradation

Reaction equation

$$\mathrm{mRNAc} \longrightarrow \emptyset \tag{53}$$

Reactant

Table 83: Properties of each reactant.

Id	Name	SBO
mRNAc	mRNAc	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{27} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{kf} \cdot [\mathrm{mRNAc}] \tag{54}$$

Table 84: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			$5 \cdot 10^{-4}$	s^{-1}	☑

5.28 Reaction v28

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

Name SOCS1 degradation

Reaction equation

$$\text{SOCS1} \longrightarrow \emptyset \tag{55}$$

Reactant

Table 85: Properties of each reactant.

Id	Name	SBO
SOCS1	SOCS1	

Kinetic Law

Derived unit $\text{s}^{-1} \cdot \text{nmol}$

$$v_{28} = \text{vol}(\text{cytoplasm}) \cdot \text{kf} \cdot [\text{SOCS1}] \tag{56}$$

Table 86: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			$5 \cdot 10^{-4}$	s^{-1}	☑

5.29 Reaction v29

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

Name phosphorylated IFNRJ2-SOCS1 binding

Reaction equation

$$\text{IFNRJ2\_star} + \text{SOCS1} \longrightarrow \text{IFNRJ2\_star\_SOCS1} \tag{57}$$

Reactants

Table 87: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star	Activated IFNRJ complex	
SOCS1	SOCS1	

Product

Table 88: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SOCS1	IFNRJ2_star_SOCS1	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{29} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{SOCS1}] \cdot [\mathrm{IFNRJ2\_star}] - \mathrm{kb} \cdot [\mathrm{IFNRJ2\_star\_SOCS1}]) \quad (58)$$

Table 89: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.10	s^{-1}	☑

5.30 Reaction v30

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

Name STAT1c binding

Reaction equation

$$\mathrm{IFNRJ2\_star\_SOCS1} + \mathrm{STAT1c} \longrightarrow \mathrm{IFNRJ2\_star\_SOCS1\_STAT1c} \quad (59)$$

Reactants

Table 90: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SOCS1	IFNRJ2_star_SOCS1	

Id	Name	SBO
STAT1c	STAT1c	

Product

Table 91: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SOCS1_STAT1c	IFNRJ2_star_SOCS1_STAT1c	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{30} = \mathrm{vol}(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{STAT1c}] \cdot [\mathrm{IFNRJ2\_star\_SOCS1}] - \mathrm{kb} \cdot [\mathrm{IFNRJ2\_star\_SOCS1\_STAT1c}]) \quad (60)$$

Table 92: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.008	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.800	s^{-1}	☑

5.31 Reaction v31

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

Name SHP2 binding

Reaction equation

$$\mathrm{IFNRJ2\_star\_SOCS1\_STAT1c} + \mathrm{SHP2} \longrightarrow \mathrm{IFNRJ2\_star\_SHP2\_SOCS1\_STAT1c} \quad (61)$$

Reactants

Table 93: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SOCS1_STAT1c	IFNRJ2_star_SOCS1_STAT1c	
SHP2	SHP2	

Product

Table 94: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1_STAT1c	IFNRJ2_star_SHP2_SOCS1_STAT1c	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{31} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{SHP2}] \cdot [\mathrm{IFNRJ2\_star\_SOCS1\_STAT1c}] - \mathrm{kb} \cdot [\mathrm{IFNRJ2\_star\_SHP2\_SOCS1\_STAT1c}]) \tag{62}$$

Table 95: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.200	s^{-1}	☑

5.32 Reaction v32

This is an irreversible reaction of one reactant forming four products.

Name IFNRJ2 dephosphorylation

Reaction equation

$$\mathrm{IFNRJ2\_star\_SHP2\_SOCS1\_STAT1c} \longrightarrow \mathrm{IFNRJ2} + \mathrm{SOCS1} + \mathrm{STAT1c} + \mathrm{SHP2} \tag{63}$$

Reactant

Table 96: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1_STAT1c	IFNRJ2_star_SHP2_SOCS1_STAT1c	

Products

Table 97: Properties of each product.

Id	Name	SBO
IFNRJ2	IFNRJ dimer	
SOCS1	SOCS1	
STAT1c	STAT1c	
SHP2	SHP2	

Kinetic Law

Derived unit $s^{-1} \cdot nmol$

$$v_{32} = \text{vol}(\text{cytoplasm}) \cdot \text{kf} \cdot [\text{IFNRJ2\_star\_SHP2\_SOCS1\_STAT1c}] \quad (64)$$

Table 98: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.003	s^{-1}	☑

5.33 Reaction v33

This is an irreversible reaction of one reactant forming one product.

Name SOCS1 unbinding

Reaction equation

$$\text{IFNRJ2\_star\_SHP2\_SOCS1\_STAT1c} \longrightarrow \text{IFNRJ2\_star\_SHP2\_STAT1c} \quad (65)$$

Reactant

Table 99: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1_STAT1c	IFNRJ2_star_SHP2_SOCS1_STAT1c	

Product

Table 100: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2_STAT1c	IFNRJ2_star_SHP2_STAT1c	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{33} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{kf} \cdot [\mathrm{IFNRJ2\_star\_SHP2\_SOCS1\_STAT1c}] \tag{66}$$

Table 101: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			$5 \cdot 10^{-4}$	s^{-1}	☑

5.34 Reaction v34

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

Name SHP2 binding

Reaction equation

$$\mathrm{IFNRJ2\_star\_SOCS1} + \mathrm{SHP2} \longrightarrow \mathrm{IFNRJ2\_star\_SHP2\_SOCS1} \tag{67}$$

Reactants

Table 102: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SOCS1	IFNRJ2_star_SOCS1	
SHP2	SHP2	

Product

Table 103: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1	IFNRJ2_star_SHP2_SOCS1	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{34} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{SHP2}] \cdot [\mathrm{IFNRJ2\_star\_SOCS1}] - \mathrm{kb} \cdot [\mathrm{IFNRJ2\_star\_SHP2\_SOCS1}]) \tag{68}$$

Table 104: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.200	s^{-1}	☑

5.35 Reaction v35

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

Name STAT1c binding

Reaction equation

$$\mathrm{IFNRJ2\_star\_SHP2\_SOCS1} + \mathrm{STAT1c} \longrightarrow \mathrm{IFNRJ2\_star\_SHP2\_SOCS1\_STAT1c} \tag{69}$$

Reactants

Table 105: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1	IFNRJ2_star_SHP2_SOCS1	
STAT1c	STAT1c	

Product

Table 106: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1_STAT1c	IFNRJ2_star_SHP2_SOCS1_STAT1c	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{35} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{STAT1c}] \cdot [\mathrm{IFNRJ2\_star\_SHP2\_SOCS1}] - \mathrm{kb} \cdot [\mathrm{IFNRJ2\_star\_SHP2\_SOCS1\_STAT1c}]) \quad (70)$$

Table 107: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.008	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.800	s^{-1}	☑

5.36 Reaction v36

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

Name SHP2 binding

Reaction equation

$$\mathrm{IFNRJ2\_star\_STAT1c} + \mathrm{SHP2} \longrightarrow \mathrm{IFNRJ2\_star\_SHP2\_STAT1c} \quad (71)$$

Reactants

Table 108: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_STAT1c	IFNRJ2_star_STAT1c	
SHP2	SHP2	

Product

Table 109: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2_STAT1c	IFNRJ2_star_SHP2_STAT1c	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{36} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{SHP2}] \cdot [\mathrm{IFNRJ2\_star\_STAT1c}] - \mathrm{kb} \cdot [\mathrm{IFNRJ2\_star\_SHP2\_STAT1c}]) \quad (72)$$

Table 110: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.200	s^{-1}	☑

5.37 Reaction v37

This is an irreversible reaction of one reactant forming three products.

Reaction equation

$$\mathrm{IFNRJ2\_star\_SHP2\_STAT1c} \longrightarrow \mathrm{STAT1c} + \mathrm{SHP2} + \mathrm{IFNRJ2} \tag{73}$$

Reactant

Table 111: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2_STAT1c	IFNRJ2_star_SHP2_STAT1c	

Products

Table 112: Properties of each product.

Id	Name	SBO
STAT1c	STAT1c	
SHP2	SHP2	
IFNRJ2	IFNRJ dimer	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{37} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{kf} \cdot [\mathrm{IFNRJ2\_star\_SHP2\_STAT1c}] \tag{74}$$

Table 113: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.003	s^{-1}	☑

5.38 Reaction v38

This is an irreversible reaction of one reactant forming one product.

Name SOCS1 unbinding

Reaction equation

$$\text{IFNRJ2\_star\_SOCS1\_STAT1c} \longrightarrow \text{IFNRJ2\_star\_STAT1c} \tag{75}$$

Reactant

Table 114: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SOCS1_STAT1c	IFNRJ2_star_SOCS1_STAT1c	

Product

Table 115: Properties of each product.

Id	Name	SBO
IFNRJ2_star_STAT1c	IFNRJ2_star_STAT1c	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{38} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{kf} \cdot [\mathrm{IFNRJ2\_star\_SOCS1\_STAT1c}] \tag{76}$$

Table 116: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			$5 \cdot 10^{-4}$	s^{-1}	☑

5.39 Reaction v39

This is an irreversible reaction of one reactant forming one product.

Name SOCS1 unbinding

Reaction equation

$$\text{IFNRJ2\_star\_SHP2\_SOCS1} \longrightarrow \text{IFNRJ2\_star\_SHP2} \tag{77}$$

Reactant

Table 117: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1	IFNRJ2_star_SHP2_SOCS1	

Product

Table 118: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2	IFNRJ2_star_SHP2	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{39} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{kf} \cdot [\mathrm{IFNRJ2\_star\_SHP2\_SOCS1}] \tag{78}$$

Table 119: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			$5 \cdot 10^{-4}$	s^{-1}	☑

5.40 Reaction v40

This is an irreversible reaction of one reactant forming three products.

Name IFNRJ2 dephosphorylation

Reaction equation

$$\text{IFNRJ2\_star\_SHP2\_SOCS1} \longrightarrow \text{SHP2} + \text{IFNRJ2} + \text{SOCS1} \tag{79}$$

Reactant

Table 120: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1	IFNRJ2_star_SHP2_SOCS1	

Products

Table 121: Properties of each product.

Id	Name	SBO
SHP2	SHP2	
IFNRJ2	IFNRJ dimer	
SOCS1	SOCS1	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{40} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot \mathrm{kf} \cdot [\mathrm{IFNRJ2\_star\_SHP2\_SOCS1}] \tag{80}$$

Table 122: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.003	s^{-1}	☑

5.41 Reaction v41

This is an irreversible reaction of one reactant forming one product.

Name SOCS1 unbinding

Reaction equation

$$\mathrm{IFNRJ2\_star\_SOCS1} \longrightarrow \mathrm{IFNRJ2\_star} \tag{81}$$

Reactant

Table 123: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SOCS1	IFNRJ2_star_SOCS1	

Product

Table 124: Properties of each product.

Id	Name	SBO
IFNRJ2_star	Activated IFNRJ complex	

Kinetic Law

Derived unit $s^{-1} \cdot nmol$

$$v_{41} = \text{vol}(\text{cytoplasm}) \cdot \text{kf} \cdot [\text{IFNRJ2\_star\_SOCS1}] \tag{82}$$

Table 125: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			$5 \cdot 10^{-4}$	s^{-1}	☑

5.42 Reaction v42

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

Name SOCS1 binding

Reaction equation

$$\text{IFNRJ2\_star\_STAT1c} + \text{SOCS1} \longrightarrow \text{IFNRJ2\_star\_SOCS1\_STAT1c} \tag{83}$$

Reactants

Table 126: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_STAT1c	IFNRJ2_star_STAT1c	
SOCS1	SOCS1	

Product

Table 127: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SOCS1_STAT1c	IFNRJ2_star_SOCS1_STAT1c	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{42} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{SOCS1}] \cdot [\mathrm{IFNRJ2\_star\_STAT1c}] - \mathrm{kb} \cdot [\mathrm{IFNRJ2\_star\_SOCS1\_STAT1c}]) \tag{84}$$

Table 128: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.10	s^{-1}	☑

5.43 Reaction v43

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

Name SOCS1 binding

Reaction equation

$$\mathrm{IFNRJ2\_star\_SHP2} + \mathrm{SOCS1} \longrightarrow \mathrm{IFNRJ2\_star\_SHP2\_SOCS1} \tag{85}$$

Reactants

Table 129: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2	IFNRJ2_star_SHP2	
SOCS1	SOCS1	

Product

Table 130: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1	IFNRJ2_star_SHP2_SOCS1	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{43} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{SOCS1}] \cdot [\mathrm{IFNRJ2\_star\_SHP2}] - \mathrm{kb} \cdot [\mathrm{IFNRJ2\_star\_SHP2\_SOCS1}]) \tag{86}$$

Table 131: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.10	s^{-1}	☑

5.44 Reaction v44

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

Name SOCS1 binding

Reaction equation

$$\mathrm{IFNRJ2\_star\_SHP2\_STAT1c} + \mathrm{SOCS1} \longrightarrow \mathrm{IFNRJ2\_star\_SHP2\_SOCS1\_STAT1c} \tag{87}$$

Reactants

Table 132: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2_STAT1c	IFNRJ2_star_SHP2_STAT1c	
SOCS1	SOCS1	

Product

Table 133: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1_STAT1c	IFNRJ2_star_SHP2_SOCS1_STAT1c	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{44} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{SOCS1}] \cdot [\mathrm{IFNRJ2\_star\_SHP2\_STAT1c}] - \mathrm{kb} \cdot [\mathrm{IFNRJ2\_star\_SHP2\_SOCS1\_STAT1c}]) \tag{88}$$

Table 134: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.10	s^{-1}	☑

5.45 Reaction v45

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

Name Interferon-receptor binding

Reaction equation

$$\mathrm{R} + \mathrm{IFN} \longrightarrow \mathrm{IFNR} \tag{89}$$

Reactants

Table 135: Properties of each reactant.

Id	Name	SBO
R	Receptor	
IFN	IFN	

Product

Table 136: Properties of each product.

Id	Name	SBO
IFNR	IFNR	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{45} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{IFN}] \cdot [\mathrm{R}] - \mathrm{kb} \cdot [\mathrm{IFNR}]) \tag{90}$$

Table 137: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\mathrm{nmol}^{-1} \cdot 1 \cdot \mathrm{s}^{-1}$	☑
kb			0.02	s^{-1}	☑

5.46 Reaction v46

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

Name IFNR-JAK binding

Reaction equation

$$\mathrm{JAK} + \mathrm{IFNR} \longrightarrow \mathrm{IFNRJ} \tag{91}$$

Reactants

Table 138: Properties of each reactant.

Id	Name	SBO
JAK	JAK	
IFNR	IFNR	

Product

Table 139: Properties of each product.

Id	Name	SBO
IFNRJ	Interferon-Receptor-JAK complex	

Kinetic Law

Derived unit $\mathrm{s}^{-1} \cdot \mathrm{nmol}$

$$v_{46} = \mathrm{vol}\,(\mathrm{cytoplasm}) \cdot (\mathrm{kf} \cdot [\mathrm{IFNR}] \cdot [\mathrm{JAK}] - \mathrm{kb} \cdot [\mathrm{IFNRJ}]) \tag{92}$$

Table 140: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.10	$\mathrm{nmol}^{-1} \cdot \mathrm{l} \cdot \mathrm{s}^{-1}$	☑
kb			0.05	s^{-1}	☑

6 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.

6.1 Species R

Name Receptor

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

This species takes part in two reactions (as a reactant in v1, v45).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{R} = -v_1 - v_{45} \tag{93}$$

6.2 Species JAK

Name JAK

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

This species takes part in two reactions (as a reactant in v1, v46).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{JAK} = -v_1 - v_{46} \tag{94}$$

6.3 Species RJ

Name Receptor JAK complex

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

This species takes part in two reactions (as a reactant in v2 and as a product in v1).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{RJ} = v_1 - v_2 \tag{95}$$

6.4 Species IFNRJ

Name Interferon-Receptor-JAK complex

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

This species takes part in three reactions (as a reactant in v3 and as a product in v2, v46).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IFNRJ} = v_2 + v_{46} - 2v_3 \tag{96}$$

6.5 Species IFNRJ2

Name IFNRJ dimer

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

This species takes part in six reactions (as a reactant in v4 and as a product in v3, v10, v32, v37, v40).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IFNRJ2} = v_3 + v_{10} + v_{32} + v_{37} + v_{40} - v_4 \tag{97}$$

6.6 Species IFNRJ2_star

Name Activated IFNRJ complex

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

This species takes part in seven reactions (as a reactant in v5, v7, v9, v29 and as a product in v4, v6, v41).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IFNRJ2\_star} = v_4 + v_6 + v_{41} - v_5 - v_7 - v_9 - v_{29} \tag{98}$$

6.7 Species STAT1c

Name STAT1c

Initial concentration $1000\ \mathrm{nmol}\cdot\mathrm{l}^{-1}$

This species takes part in eight reactions (as a reactant in v5, v15, v30, v35 and as a product in v12, v23, v32, v37).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{STAT1c} = v_{12} + v_{23} + v_{32} + v_{37} - v_5 - v_{15} - v_{30} - v_{35} \tag{99}$$

6.8 Species IFNRJ2_star_STAT1c

Name IFNRJ2_star_STAT1c

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

This species takes part in five reactions (as a reactant in v6, v36, v42 and as a product in v5, v38).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IFNRJ2\_star\_STAT1c} = v_5 + v_{38} - v_6 - v_{36} - v_{42} \tag{100}$$

6.9 Species STAT1c_star

Name STAT1c_star

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

This species takes part in five reactions (as a reactant in v7, v8, v11, v15 and as a product in v6).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{STAT1c\_star} = v_6 - v_7 - 2v_8 - v_{11} - v_{15} \tag{101}$$

6.10 Species IFNRJ2_star_STAT1c_star

Name IFNRJ2_star_STAT1c_star

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

This species takes part in one reaction (as a product in v7).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IFNRJ2\_star\_STAT1c\_star} = v_7 \tag{102}$$

6.11 Species STAT1c_star_STAT1c_star

Name STAT1c_star_STAT1c_star

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

This species takes part in three reactions (as a reactant in v13, v16 and as a product in v8).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{STAT1c\_star\_STAT1c\_star} = v_8 - v_{13} - v_{16} \tag{103}$$

6.12 Species SHP2

Name SHP2

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

This species takes part in eight reactions (as a reactant in v9, v31, v34, v36 and as a product in v10, v32, v37, v40).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{SHP2} = v_{10} + v_{32} + v_{37} + v_{40} - v_9 - v_{31} - v_{34} - v_{36} \tag{104}$$

6.13 Species IFNRJ2_star_SHP2

Name IFNRJ2_star_SHP2

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

This species takes part in four reactions (as a reactant in v10, v43 and as a product in v9, v39).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IFNRJ2\_star\_SHP2} = v_9 + v_{39} - v_{10} - v_{43} \tag{105}$$

6.14 Species PPX

Name PPX

Initial concentration $50\ \mathrm{nmol}\cdot\mathrm{l}^{-1}$

This species takes part in four reactions (as a reactant in v11, v13 and as a product in v12, v14).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{PPX} = v_{12} + v_{14} - v_{11} - v_{13} \tag{106}$$

6.15 Species STAT1c_star_PPX

Name STAT1c_star_PPX

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

This species takes part in two reactions (as a reactant in v12 and as a product in v11).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{STAT1c\_star\_PPX} = v_{11} - v_{12} \tag{107}$$

6.16 Species STAT1c_STAT1c_star

Name STAT1c_STAT1c_star

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

This species takes part in two reactions (as a product in v14, v15).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{STAT1c\_STAT1c\_star} = v_{14} + v_{15} \tag{108}$$

6.17 Species STAT1n_star_STAT1n_star

Name STAT1n_star_STAT1n_star

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

This species takes part in four reactions (as a reactant in v20 and as a product in v16, v17 and as a modifier in v24).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{STAT1n\_star\_STAT1n\_star} = v_{16} + v_{17} - v_{20} \tag{109}$$

6.18 Species STAT1n_star

Name STAT1n_star

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

This species takes part in three reactions (as a reactant in v17, v18, v22).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{STAT1n\_star} = -2v_{17} - v_{18} - v_{22} \tag{110}$$

6.19 Species PPN

Name PPN

Initial concentration $60\ \mathrm{nmol}\cdot\mathrm{l}^{-1}$

This species takes part in four reactions (as a reactant in v18, v20 and as a product in v19, v21).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{PPN} = v_{19} + v_{21} - v_{18} - v_{20} \tag{111}$$

6.20 Species STAT1n_star_PPN

Name STAT1n_star_PPN

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

This species takes part in two reactions (as a reactant in v19 and as a product in v18).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{STAT1n\_star\_PPN} = v_{18} - v_{19} \tag{112}$$

6.21 Species STAT1n

Name STAT1n

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

This species takes part in three reactions (as a reactant in v22, v23 and as a product in v19).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{STAT1n} = v_{19} - v_{22} - v_{23} \tag{113}$$

6.22 Species STAT1n_STAT1n_star

Name STAT1n_STAT1n_star

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

This species takes part in two reactions (as a product in v21, v22).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{STAT1n\_STAT1n\_star} = v_{21} + v_{22} \tag{114}$$

6.23 Species mRNAn

Name mRNAn

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

This species takes part in two reactions (as a reactant in v25 and as a product in v24).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{mRNAn} = v_{24} - v_{25} \tag{115}$$

6.24 Species mRNAc

Name mRNAc

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

This species takes part in three reactions (as a reactant in v27 and as a product in v25 and as a modifier in v26).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{mRNAc} = v_{25} - v_{27} \tag{116}$$

6.25 Species SOCS1

Name SOCS1

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

This species takes part in eight reactions (as a reactant in v28, v29, v42, v43, v44 and as a product in v26, v32, v40).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{SOCS1} = v_{26} + v_{32} + v_{40} - v_{28} - v_{29} - v_{42} - v_{43} - v_{44} \tag{117}$$

6.26 Species IFNRJ2_star_SOCS1

Name IFNRJ2_star_SOCS1

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

This species takes part in four reactions (as a reactant in v30, v34, v41 and as a product in v29).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IFNRJ2\_star\_SOCS1} = v_{29} - v_{30} - v_{34} - v_{41} \tag{118}$$

6.27 Species IFNRJ2_star_SHP2_SOCS1_STAT1c

Name IFNRJ2_star_SHP2_SOCS1_STAT1c

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

This species takes part in five reactions (as a reactant in v32, v33 and as a product in v31, v35, v44).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IFNRJ2\_star\_SHP2\_SOCS1\_STAT1c} = v_{31} + v_{35} + v_{44} - v_{32} - v_{33} \tag{119}$$

6.28 Species STAT1c_star_STAT1c_star_PPX

Name STAT1c_star_STAT1c_star_PPX

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

This species takes part in two reactions (as a reactant in v14 and as a product in v13).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{STAT1c\_star\_STAT1c\_star\_PPX} = v_{13} - v_{14} \tag{120}$$

6.29 Species STAT1n_star_STAT1n_star_PPN

Name STAT1n_star_STAT1n_star_PPN

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

This species takes part in two reactions (as a reactant in v21 and as a product in v20).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{STAT1n\_star\_STAT1n\_star\_PPN} = v_{20} - v_{21} \tag{121}$$

6.30 Species IFNRJ2_star_SOCS1_STAT1c

Name IFNRJ2_star_SOCS1_STAT1c

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

This species takes part in four reactions (as a reactant in v31, v38 and as a product in v30, v42).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IFNRJ2\_star\_SOCS1\_STAT1c} = v_{30} + v_{42} - v_{31} - v_{38} \tag{122}$$

6.31 Species IFN

Name IFN

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

This species takes part in two reactions (as a reactant in v2, v45), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IFN} = 0 \tag{123}$$

6.32 Species IFNRJ2_star_SHP2_STAT1c

Name IFNRJ2_star_SHP2_STAT1c

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

This species takes part in four reactions (as a reactant in v37, v44 and as a product in v33, v36).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IFNRJ2\_star\_SHP2\_STAT1c} = v_{33} + v_{36} - v_{37} - v_{44} \tag{124}$$

6.33 Species IFNRJ2_star_SHP2_SOCS1

Name IFNRJ2_star_SHP2_SOCS1

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

This species takes part in five reactions (as a reactant in v35, v39, v40 and as a product in v34, v43).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IFNRJ2\_star\_SHP2\_SOCS1} = v_{34} + v_{43} - v_{35} - v_{39} - v_{40} \tag{125}$$

6.34 Species IFNR

Name IFNR

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

This species takes part in two reactions (as a reactant in v46 and as a product in v45).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IFNR} = v_{45} - v_{46} \tag{126}$$

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