

SBML Model Report

Model name:
“Yamada2003_JAK_STAT_SOCS1_knockout”



May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by Harish Dharuri¹ at January 26th 2007 at 6:57 p. m. and last time modified at November 27th 2013 at 11:45 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	45	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. This is the knockout version of Jak-Stat pathway in this model the SOCS1 has been knocked out i.e it formation is not shown. The graphs are almost similar to the graphs as shown in the paper but STAT1n graph has some ambiguities. Thanks

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to Dr Satoshi Yamada for clarifying some of those ambiguities and providing the values used in simulations.

Biomodels Curation Comments: The model reproduces the figures 2 (B,D,F,H,J,L,N) corresponding to JAK/STAT activation in SOCS1 knock out cells. The model was successfully tested on MathSBML

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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 $\text{nmol} \cdot \text{l}^{-1} \cdot \text{s}^{-1}$

2.3 Unit `sec_inv`

Name `sec_inv`

Definition s^{-1}

2.4 Unit `nM_inv_sec_inv`

Name `nM_inv_sec_inv`

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

2.5 Unit `nM`

Name nM

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

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	<input checked="" type="checkbox"/>	
nucleus	nucleus		3	1	litre	<input checked="" type="checkbox"/>	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 Condi- tion
R	Receptor	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
JAK	JAK	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
RJ	Receptor JAK complex	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
IFNRJ	Interferon-Receptor-JAK complex	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
IFNRJ2	IFNRJ dimer	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
IFNRJ2_star	Activated IFNRJ complex	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
STAT1c	STAT1c	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
IFNRJ2_star- _STAT1c	IFNRJ2_star_STAT1c	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
STAT1c_star	STAT1c_star	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
IFNRJ2_star- _STAT1c_star	IFNRJ2_star_STAT1c_star	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
STAT1c_star- _STAT1c_star	STAT1c_star_STAT1c_star	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
SHP2	SHP2	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
IFNRJ2_star_SHP2	IFNRJ2_star_SHP2	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
PPX	PPX	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
STAT1c_star_PPX	STAT1c_star_PPX	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
STAT1c_STAT1c- _star	STAT1c_STAT1c_star	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
STAT1n_star- _STAT1n_star	STAT1n_star_STAT1n_star	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
STAT1n_star	STAT1n_star	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
PPN	PPN	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
STAT1n_star_PPN	STAT1n_star_PPN	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
STAT1n	STAT1n	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
STAT1n_STAT1n- _star	STAT1n_STAT1n_star	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
mRNAn	mRNAn	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
mRNAc	mRNAc	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
SOCS1	SOCS1	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
IFNRJ2_star_SOCS1	IFNRJ2_star_SOCS1	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
IFNRJ2_star_SHP2- _SOCS1_STAT1c	IFNRJ2_star_SHP2_SOCS1_STAT1c	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
STAT1c_star- _STAT1c_star_PPX	STAT1c_star_STAT1c_star_PPX	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
STAT1n_star- _STAT1n_star_PPN	STAT1n_star_STAT1n_star_PPN	nucleus	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
IFNRJ2_star- _SOCS1_STAT1c	IFNRJ2_star_SOCS1_STAT1c	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
IFN	IFN	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
IFNRJ2_star_SHP2- _STAT1c	IFNRJ2_star_SHP2_STAT1c	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
IFNRJ2_star_SHP2- _SOCS1	IFNRJ2_star_SHP2_SOCS1	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
IFNR	IFNR	cytoplasm	$\text{nmol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>

5 Reactions

This model contains 45 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

Nº	Id	Name	Reaction Equation	SBO
1	v1	Receptor-JAK Binding	$JAK + R \longrightarrow RJ$	
2	v2	Interferon-Receptor Binding	$RJ + IFN \longrightarrow IFNRJ$	
3	v3	IFN-Receptor complex dimerization	$2 IFNRJ \longrightarrow IFNRJ2$	
4	v4	INF-Receptor complex activation	$IFNRJ2 \longrightarrow IFNRJ2_star$	
5	v5	Activated INFRJ2-STAT1c binding	$IFNRJ2_star + STAT1c \longrightarrow IFNRJ2_star_STAT1c$	
6	v6	STAT1c activation	$IFNRJ2_star_STAT1c \longrightarrow STAT1c_star$	+
			$IFNRJ2_star$	
7	v7	Activated IFNRJ2-STAT1c binding	$STAT1c_star + IFNRJ2_star \longrightarrow IFNRJ2_star_STAT1c_star$	
8	v8	Activated STAT1c dimerization	$2 STAT1c_star \longrightarrow STAT1c_star_STAT1c_star$	
9	v9	SHP2 binding	$SHP2 + IFNRJ2_star \longrightarrow IFNRJ2_star_SHP2$	
10	v10	IFNJR2 dephosphorylation	$IFNRJ2_star_SHP2 \longrightarrow SHP2 + IFNRJ2$	
11	v11	Phosphorylated STAT1c-PPX binding	$STAT1c_star + PPX \longrightarrow STAT1c_star_PPX$	
12	v12	STAT1c dephosphorylation	$STAT1c_star_PPX \longrightarrow STAT1c + PPX$	
13	v13	PPX binding	$STAT1c_star_STAT1c_star$	+
			$PPX \longrightarrow STAT1c_star_STAT1c_star_PPX$	
14	v14	STAT1c dimer dephosphorylation	$STAT1c_star_STAT1c_star_PPX \longrightarrow STAT1c_star_STAT1c_star + PPX$	
15	v15	STAT1c-phosphorylated STAT1c binding	$STAT1c_star + STAT1c \longrightarrow STAT1c_star_STAT1c$	
16	v16	STAT1c-nuclear transport	$STAT1c_star_STAT1c_star \longrightarrow STAT1n_star_STAT1n_star$	
17	v17	Phosphorylated STAT1n dimerization	$2 STAT1n_star \longrightarrow STAT1n_star_STAT1n_star$	
18	v18	PPN binding	$STAT1n_star + PPN \longrightarrow STAT1n_star_PPN$	
19	v19	STAT1n dephosphorylation	$STAT1n_star_PPN \longrightarrow STAT1n + PPN$	

Nº	Id	Name	Reaction Equation	SBO
20	v20	PPN binding	$\text{STAT1n_star_STAT1n_star} + \text{PPN} \longrightarrow \text{STAT1n_star_STAT1n_star_PPN}$	
21	v21	STAT1n dephosphorylation	$\text{STAT1n_star_STAT1n_star_PPN} \longrightarrow \text{STAT1n_star_STAT1n_star} + \text{PPN}$	
22	v22	STAT1n-phosphorylated STAT1n dimerization	$\text{STAT1n_star} + \text{STAT1n} \longrightarrow \text{STAT1n_star_STAT1n_star}$	
23	v23	STAT1n transport to cytoplasm	$\text{STAT1n} \longrightarrow \text{STAT1c}$	
24	v25	mRNA transport to cytoplasm	$\text{mRNAn} \longrightarrow \text{mRNAc}$	
25	v26	SOCS1 synthesis	$\emptyset \xrightarrow{\text{mRNAc}} \text{SOCS1}$	
26	v27	mRNAc degradation	$\text{mRNAc} \longrightarrow \emptyset$	
27	v28	SOCS1 degradation	$\text{SOCS1} \longrightarrow \emptyset$	
28	v29	phosphorylated IFNRJ2-SOCS1 binding	$\text{IFNRJ2_star} + \text{SOCS1} \longrightarrow \text{IFNRJ2_star_SOCS1}$	
29	v30	STAT1c binding	$\text{IFNRJ2_star_SOCS1} + \text{STAT1c} \longrightarrow \text{IFNRJ2_star_SOCS1_STAT1c}$	+
30	v31	SHP2 binding	$\text{IFNRJ2_star_SOCS1_STAT1c} + \text{SHP2} \longrightarrow \text{IFNRJ2_star_SHP2_SOCS1_STAT1c}$	+
31	v32	IFNRJ2 dephosphorylation	$\text{IFNRJ2_star_SHP2_SOCS1_STAT1c} \longrightarrow \text{IFNRJ2_star_SHP2_SOCS1} + \text{STAT1c} + \text{SHP2}$	
32	v33	SOCS1 unbinding	$\text{IFNRJ2_star_SHP2_SOCS1_STAT1c} \longrightarrow \text{IFNRJ2_star_SHP2_STAT1c} + \text{SOCS1}$	
33	v34	SHP2 binding	$\text{IFNRJ2_star_SOCS1} + \text{SHP2} \longrightarrow \text{IFNRJ2_star_SHP2_SOCS1}$	+
34	v35	STAT1c binding	$\text{IFNRJ2_star_SHP2_SOCS1} + \text{STAT1c} \longrightarrow \text{IFNRJ2_star_SHP2_SOCS1_STAT1c}$	+
35	v36	SHP2 binding	$\text{IFNRJ2_star_STAT1c} + \text{SHP2} \longrightarrow \text{IFNRJ2_star_SHP2_STAT1c}$	+
36	v37		$\text{IFNRJ2_star_SHP2_STAT1c} \longrightarrow \text{STAT1c} + \text{SHP2} + \text{IFNRJ2}$	
37	v38	SOCS1 unbinding	$\text{IFNRJ2_star_SOCS1_STAT1c} \longrightarrow \text{IFNRJ2_star_STAT1c} + \text{SOCS1}$	
38	v39	SOCS1 unbinding	$\text{IFNRJ2_star_SHP2_SOCS1} \longrightarrow \text{IFNRJ2_star_SHP2} + \text{SOCS1}$	

Nº	Id	Name	Reaction Equation	SBO
39	v40	IFNRJ2 dephosphorylation	$\text{IFNRJ2_star_SHP2_SOCS1} \longrightarrow \text{SHP2} + \text{IFNRJ2} + \text{SOCS1}$	
40	v41	SOCS1 unbinding	$\text{IFNRJ2_star_SOCS1} \longrightarrow \text{IFNRJ2_star}$	
41	v42	SOCS1 binding	$\text{IFNRJ2_star_STAT1c} + \text{SOCS1} \longrightarrow \text{IFNRJ2_star_SOCS1_STAT1c}$	
42	v43	SOCS1 binding	$\text{IFNRJ2_star_SHP2} + \text{SOCS1} \longrightarrow \text{IFNRJ2_star_SHP2_SOCS1}$	
43	v44	SOCS1 binding	$\text{IFNRJ2_star_SHP2_STAT1c} + \text{SOCS1} \longrightarrow \text{IFNRJ2_star_SHP2_SOCS1_STAT1c}$	
44	v45	Interferon-receptor binding	$\text{R} + \text{IFN} \longrightarrow \text{IFNR}$	
45	v46	IFNR-JAK binding	$\text{JAK} + \text{IFNR} \longrightarrow \text{IFNRJ}$	

5.1 Reaction v1

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

Name Receptor-JAK Binding

Reaction equation



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

$$v_1 = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{R}] \cdot [\text{JAK}] - k_b \cdot [\text{RJ}]) \quad (2)$$

Table 7: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.10	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.05	s^{-1}	<input checked="" type="checkbox"/>

5.2 Reaction v2

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

Name Interferon-Receptor Binding

Reaction equation



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

$$v_2 = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{IFN}] \cdot [\text{RJ}] - k_b \cdot [\text{IFNRJ}]) \quad (4)$$

Table 10: Properties of each parameter.

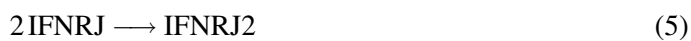
Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.02	s^{-1}	<input checked="" type="checkbox"/>

5.3 Reaction v3

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

Name IFN-Receptor complex dimerization

Reaction equation



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

$$v_3 = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{IFNRJ}] \cdot [\text{IFNRJ}] - k_b \cdot [\text{IFNRJ2}]) \quad (6)$$

Table 13: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.04	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.20	s^{-1}	<input checked="" type="checkbox"/>

5.4 Reaction v4

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

Name INF-Receptor complex activation

Reaction equation



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

$$v_4 = \text{vol}(\text{cytoplasm}) \cdot k_f \cdot [\text{IFNRJ2}] \quad (8)$$

Table 16: Properties of each parameter.

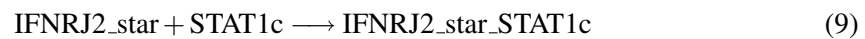
Id	Name	SBO	Value	Unit	Constant
kf			0.005	s^{-1}	<input checked="" type="checkbox"/>

5.5 Reaction v5

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

Name Activated INFRJ2-STAT1c binding

Reaction equation



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

$$v_5 = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{STAT1c}] \cdot [\text{IFNRJ2_star}] - k_b \cdot [\text{IFNRJ2_star_STAT1c}]) \quad (10)$$

Table 19: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.008	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.800	s^{-1}	<input checked="" type="checkbox"/>

5.6 Reaction v6

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

Name STAT1c activation

Reaction equation



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

$$v_6 = \text{vol}(\text{cytoplasm}) \cdot k_f \cdot [\text{IFNRJ2_star_STAT1c}] \quad (12)$$

Table 22: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.4	s^{-1}	<input checked="" type="checkbox"/>

5.7 Reaction v7

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

Name Activated IFNRJ2-STAT1c binding

Reaction equation



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

$$v_7 = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{IFNRJ2_star}] \cdot [\text{STAT1c_star}] - k_b \cdot [\text{IFNRJ2_star_STAT1c_star}]) \quad (14)$$

Table 25: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.005	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.500	s^{-1}	<input checked="" type="checkbox"/>

5.8 Reaction v8

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

Name Activated STAT1c dimerization

Reaction equation



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

$$v_8 = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{STAT1c_star}] \cdot [\text{STAT1c_star}] - k_b \cdot [\text{STAT1c_star_STAT1c_star}]) \quad (16)$$

Table 28: Properties of each parameter.

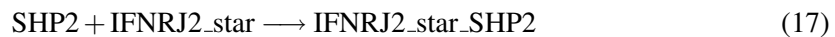
Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.10	s^{-1}	<input checked="" type="checkbox"/>

5.9 Reaction v9

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

Name SHP2 binding

Reaction equation



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

$$v_9 = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{IFNRJ2_star}] \cdot [\text{SHP2}] - k_b \cdot [\text{IFNRJ2_star_SHP2}]) \quad (18)$$

Table 31: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.200	s^{-1}	<input checked="" type="checkbox"/>

5.10 Reaction v10

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

Name IFNRJ2 dephosphorylation

Reaction equation



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

$$v_{10} = \text{vol}(\text{cytoplasm}) \cdot \text{kf} \cdot [\text{IFNRJ2_star_SHP2}] \quad (20)$$

Table 34: Properties of each parameter.

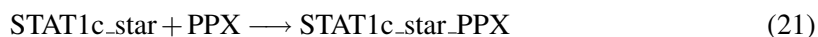
Id	Name	SBO	Value	Unit	Constant
kf			0.003	s^{-1}	<input checked="" type="checkbox"/>

5.11 Reaction v11

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

Name Phosphorylated STAT1c-PPX binding

Reaction equation



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

$$v_{11} = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{PPX}] \cdot [\text{STAT1c_star}] - k_b \cdot [\text{STAT1c_star_PPX}]) \quad (22)$$

Table 37: Properties of each parameter.

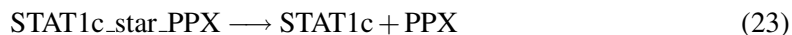
Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.200	s^{-1}	<input checked="" type="checkbox"/>

5.12 Reaction v12

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

Name STAT1c dephosphorylation

Reaction equation



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

$$v_{12} = \text{vol}(\text{cytoplasm}) \cdot k_f \cdot [\text{STAT1c_star_PPX}] \quad (24)$$

Table 40: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.003	s^{-1}	<input checked="" type="checkbox"/>

5.13 Reaction v13

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

Name PPX binding

Reaction equation



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

$$v_{13} = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{PPX}] \cdot [\text{STAT1c_star_STAT1c_star}] - k_b \cdot [\text{STAT1c_star_STAT1c_star_PPX}]) \quad (26)$$

Table 43: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.200	s^{-1}	<input checked="" type="checkbox"/>

5.14 Reaction v14

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

Name STAT1c dimer dephosphorylation

Reaction equation



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

$$v_{14} = \text{vol}(\text{cytoplasm}) \cdot k_f \cdot [\text{STAT1c_star_STAT1c_star_PPX}] \quad (28)$$

Table 46: Properties of each parameter.

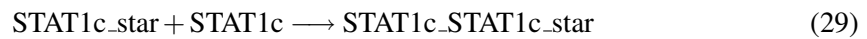
Id	Name	SBO	Value	Unit	Constant
kf			0.003	s^{-1}	<input checked="" type="checkbox"/>

5.15 Reaction v15

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

Name STAT1c-phosphorylated STAT1c binding

Reaction equation



Reactants

Table 47: Properties of each reactant.

Id	Name	SBO
STAT1c_star	STAT1c_star	
STAT1c	STAT1c	

Product

Table 48: Properties of each product.

Id	Name	SBO
STAT1c_STAT1c_star	STAT1c_STAT1c_star	

Kinetic Law

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

$$v_{15} = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{STAT1c}] \cdot [\text{STAT1c_star}] - k_b \cdot [\text{STAT1c_STAT1c_star}]) \quad (30)$$

Table 49: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			$2 \cdot 10^{-7}$	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.200	s^{-1}	<input checked="" type="checkbox"/>

5.16 Reaction v16

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

Name STAT1c-nuclear transport

Reaction equation



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

$$v_{16} = \text{vol}(\text{cytoplasm}) \cdot k_f \cdot [\text{STAT1c_star_STAT1c_star}] \quad (32)$$

Table 52: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.005	s^{-1}	<input checked="" type="checkbox"/>

5.17 Reaction v17

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

Name Phosphorylated STAT1n dimerization

Reaction equation



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

$$v_{17} = \text{vol}(\text{nucleus}) \cdot (k_f \cdot [\text{STAT1n_star}] \cdot [\text{STAT1n_star}] - k_b \cdot [\text{STAT1n_star_STAT1n_star}]) \quad (34)$$

Table 55: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.10	s^{-1}	<input checked="" type="checkbox"/>

5.18 Reaction v18

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

Name PPN binding

Reaction equation



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

$$v_{18} = \text{vol}(\text{nucleus}) \cdot (k_f \cdot [\text{PPN}] \cdot [\text{STAT1n_star}] - k_b \cdot [\text{STAT1n_star_PPN}]) \quad (36)$$

Table 58: Properties of each parameter.

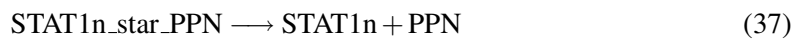
Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.200	s^{-1}	<input checked="" type="checkbox"/>

5.19 Reaction v19

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

Name STAT1n dephosphorylation

Reaction equation



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

$$v_{19} = \text{vol}(\text{nucleus}) \cdot \text{kf} \cdot [\text{STAT1n_star_PPN}] \quad (38)$$

Table 61: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.005	s^{-1}	<input checked="" type="checkbox"/>

5.20 Reaction v20

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

Name PPN binding

Reaction equation



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

$$v_{20} = \text{vol}(\text{nucleus}) \cdot (k_f \cdot [\text{PPN}] \cdot [\text{STAT1n_star_STAT1n_star}] - k_b \cdot [\text{STAT1n_star_STAT1n_star_PPN}]) \quad (40)$$

Table 64: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.200	s^{-1}	<input checked="" type="checkbox"/>

5.21 Reaction v21

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

Name STAT1n dephosphorylation

Reaction equation



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

$$v_{21} = \text{vol}(\text{nucleus}) \cdot k_f \cdot [\text{STAT1n_star_STAT1n_star_PPN}] \quad (42)$$

Table 67: Properties of each parameter.

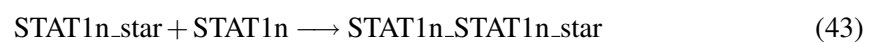
Id	Name	SBO	Value	Unit	Constant
kf			0.005	s^{-1}	<input checked="" type="checkbox"/>

5.22 Reaction v22

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

Name STAT1n-phosphorylated STAT1n dimerization

Reaction equation



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

$$v_{22} = \text{vol}(\text{nucleus}) \cdot (k_f \cdot [\text{STAT1n}] \cdot [\text{STAT1n_star}] - k_b \cdot [\text{STAT1n_STAT1n_star}]) \quad (44)$$

Table 70: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			$2 \cdot 10^{-7}$	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.200	s^{-1}	<input checked="" type="checkbox"/>

5.23 Reaction v23

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

Name STAT1n transport to cytoplasm

Reaction equation



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

$$v_{23} = \text{vol}(\text{nucleus}) \cdot k_f \cdot [\text{STAT1n}] \quad (46)$$

Table 73: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.05	s^{-1}	<input checked="" type="checkbox"/>

5.24 Reaction v25

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

Name mRNA transport to cytoplasm

Reaction equation



Reactant

Table 74: Properties of each reactant.

Id	Name	SBO
mRNA _n	mRNA _n	

Product

Table 75: Properties of each product.

Id	Name	SBO
mRNAc	mRNAc	

Kinetic Law

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

$$v_{24} = \text{vol}(\text{nucleus}) \cdot k_f \cdot [\text{mRNAn}] \quad (48)$$

Table 76: Properties of each parameter.

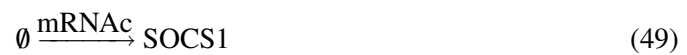
Id	Name	SBO	Value	Unit	Constant
kf			0.001	s^{-1}	<input checked="" type="checkbox"/>

5.25 Reaction v26

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

Name SOCS1 synthesis

Reaction equation



Modifier

Table 77: Properties of each modifier.

Id	Name	SBO
mRNAc	mRNAc	

Product

Table 78: Properties of each product.

Id	Name	SBO
SOCS1	SOCS1	

Id	Name	SBO
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Kinetic Law

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

$$v_{25} = \text{vol}(\text{cytoplasm}) \cdot k_f \cdot [\text{mRNAC}] \quad (50)$$

Table 79: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.01	s^{-1}	<input checked="" type="checkbox"/>

5.26 Reaction v27

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

Name mRNAc degradation

Reaction equation



Reactant

Table 80: Properties of each reactant.

Id	Name	SBO
mRNAC	mRNAC	

Kinetic Law

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

$$v_{26} = \text{vol}(\text{cytoplasm}) \cdot k_f \cdot [\text{mRNAC}] \quad (52)$$

Table 81: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			$5 \cdot 10^{-4}$	s^{-1}	<input checked="" type="checkbox"/>

5.27 Reaction v28

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

Name SOCS1 degradation

Reaction equation



Reactant

Table 82: Properties of each reactant.

Id	Name	SBO
SOCS1	SOCS1	

Kinetic Law

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

$$v_{27} = \text{vol}(\text{cytoplasm}) \cdot k_f \cdot [\text{SOCS1}] \quad (54)$$

Table 83: Properties of each parameter.

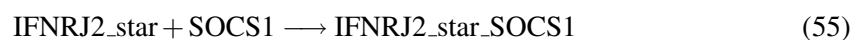
Id	Name	SBO	Value	Unit	Constant
kf			$5 \cdot 10^{-4}$	s^{-1}	<input checked="" type="checkbox"/>

5.28 Reaction v29

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

Name phosphorylated IFNRJ2-SOCS1 binding

Reaction equation



Reactants

Table 84: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star	Activated IFNRJ complex	
SOCS1	SOCS1	

Product

Table 85: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SOCS1	IFNRJ2_star_SOCS1	

Kinetic Law

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

$$v_{28} = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{SOCS1}] \cdot [\text{IFNRJ2_star}] - k_b \cdot [\text{IFNRJ2_star_SOCS1}]) \quad (56)$$

Table 86: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.10	s^{-1}	<input checked="" type="checkbox"/>

5.29 Reaction v30

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

Name STAT1c binding

Reaction equation



Reactants

Table 87: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SOCS1	IFNRJ2_star_SOCS1	

Id	Name	SBO
STAT1c	STAT1c	

Product

Table 88: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SOCS1_STAT1c	IFNRJ2_star_SOCS1_STAT1c	

Kinetic Law

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

$$v_{29} = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{STAT1c}] \cdot [\text{IFNRJ2_star_SOCS1}] - k_b \cdot [\text{IFNRJ2_star_SOCS1_STAT1c}]) \quad (58)$$

Table 89: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.008	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.800	s^{-1}	<input checked="" type="checkbox"/>

5.30 Reaction v31

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

Name SHP2 binding

Reaction equation



Reactants

Table 90: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SOCS1_STAT1c	IFNRJ2_star_SOCS1_STAT1c	
SHP2	SHP2	

Product

Table 91: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1_STAT1c	IFNRJ2_star_SHP2_SOCS1_STAT1c	

Kinetic Law

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

$$v_{30} = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{SHP2}] \cdot [\text{IFNRJ2_star_SOCS1_STAT1c}] - k_b \cdot [\text{IFNRJ2_star_SHP2_SOCS1_STAT1c}]) \quad (60)$$

Table 92: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.200	s^{-1}	<input checked="" type="checkbox"/>

5.31 Reaction v32

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

Name IFNRJ2 dephosphorylation

Reaction equation



Reactant

Table 93: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1_STAT1c	IFNRJ2_star_SHP2_SOCS1_STAT1c	

Products

Table 94: Properties of each product.

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

Kinetic Law

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

$$v_{31} = \text{vol}(\text{nucleus}) \cdot k_f \cdot [\text{IFNRJ2_star_SHP2_SOCS1_STAT1c}] \quad (62)$$

Table 95: Properties of each parameter.

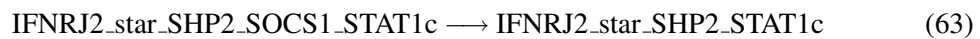
Id	Name	SBO	Value	Unit	Constant
kf			0.003	s^{-1}	<input checked="" type="checkbox"/>

5.32 Reaction v_{33}

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

Name SOCS1 unbinding

Reaction equation



Reactant

Table 96: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1_STAT1c	IFNRJ2_star_SHP2_SOCS1_STAT1c	

Product

Table 97: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2_STAT1c	IFNRJ2_star_SHP2_STAT1c	

Kinetic Law

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

$$v_{32} = \text{vol}(\text{cytoplasm}) \cdot k_f \cdot [\text{IFNRJ2_star_SHP2_SOCS1_STAT1c}] \quad (64)$$

Table 98: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			$5 \cdot 10^{-4}$	s^{-1}	<input checked="" type="checkbox"/>

5.33 Reaction v34

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

Name SHP2 binding

Reaction equation



Reactants

Table 99: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SOCS1	IFNRJ2_star_SOCS1	
SHP2	SHP2	

Product

Table 100: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1	IFNRJ2_star_SHP2_SOCS1	

Kinetic Law

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

$$v_{33} = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{SHP2}] \cdot [\text{IFNRJ2_star_SOCS1}] - k_b \cdot [\text{IFNRJ2_star_SHP2_SOCS1}]) \quad (66)$$

Table 101: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.200	s^{-1}	<input checked="" type="checkbox"/>

5.34 Reaction v35

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

Name STAT1c binding

Reaction equation



Reactants

Table 102: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1	IFNRJ2_star_SHP2_SOCS1	
STAT1c	STAT1c	

Product

Table 103: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1_STAT1c	IFNRJ2_star_SHP2_SOCS1_STAT1c	

Kinetic Law

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

$$v_{34} = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{STAT1c}] \cdot [\text{IFNRJ2_star_SHP2_SOCS1}] - k_b \cdot [\text{IFNRJ2_star_SHP2_SOCS1_STAT1c}]) \quad (68)$$

Table 104: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.008	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.800	s^{-1}	<input checked="" type="checkbox"/>

5.35 Reaction v36

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

Name SHP2 binding

Reaction equation



Reactants

Table 105: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_STAT1c	IFNRJ2_star_STAT1c	
SHP2	SHP2	

Product

Table 106: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2_STAT1c	IFNRJ2_star_SHP2_STAT1c	

Kinetic Law

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

$$v_{35} = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{SHP2}] \cdot [\text{IFNRJ2_star_STAT1c}] - k_b \cdot [\text{IFNRJ2_star_SHP2_STAT1c}]) \quad (70)$$

Table 107: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.001	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.200	s^{-1}	<input checked="" type="checkbox"/>

5.36 Reaction v37

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

Reaction equation



Reactant

Table 108: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2_STAT1c	IFNRJ2_star_SHP2_STAT1c	

Products

Table 109: Properties of each product.

Id	Name	SBO
STAT1c	STAT1c	
SHP2	SHP2	
IFNRJ2	IFNRJ dimer	

Kinetic Law

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

$$v_{36} = \text{vol}(\text{cytoplasm}) \cdot \text{kf} \cdot [\text{IFNRJ2_star_SHP2_STAT1c}] \quad (72)$$

Table 110: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.003	s^{-1}	<input checked="" type="checkbox"/>

5.37 Reaction v38

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

Name SOCS1 unbinding

Reaction equation



Reactant

Table 111: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SOCS1_STAT1c	IFNRJ2_star_SOCS1_STAT1c	

Product

Table 112: Properties of each product.

Id	Name	SBO
IFNRJ2_star_STAT1c	IFNRJ2_star_STAT1c	

Kinetic Law

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

$$v_{37} = \text{vol}(\text{cytoplasm}) \cdot k_f \cdot [\text{IFNRJ2_star_SOCS1_STAT1c}] \quad (74)$$

Table 113: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			$5 \cdot 10^{-4}$	s^{-1}	<input checked="" type="checkbox"/>

5.38 Reaction v39

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

Name SOCS1 unbinding

Reaction equation



Reactant

Table 114: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1	IFNRJ2_star_SHP2_SOCS1	

Product

Table 115: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2	IFNRJ2_star_SHP2	

Kinetic Law

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

$$v_{38} = \text{vol}(\text{cytoplasm}) \cdot k_f \cdot [\text{IFNRJ2_star_SHP2_SOCS1}] \quad (76)$$

Table 116: Properties of each parameter.

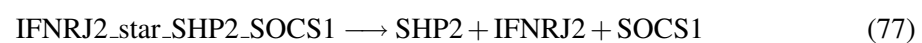
Id	Name	SBO	Value	Unit	Constant
kf			$5 \cdot 10^{-4}$	s^{-1}	<input checked="" type="checkbox"/>

5.39 Reaction v40

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

Name IFNRJ2 dephosphorylation

Reaction equation



Reactant

Table 117: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1	IFNRJ2_star_SHP2_SOCS1	

Products

Table 118: Properties of each product.

Id	Name	SBO
SHP2	SHP2	
IFNRJ2	IFNRJ dimer	
SOCS1	SOCS1	

Kinetic Law

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

$$v_{39} = \text{vol}(\text{cytoplasm}) \cdot k_f \cdot [\text{IFNRJ2_star_SHP2_SOCS1}] \quad (78)$$

Table 119: Properties of each parameter.

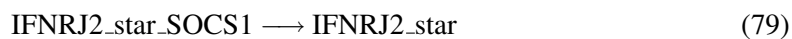
Id	Name	SBO	Value	Unit	Constant
kf			0.003	s^{-1}	<input checked="" type="checkbox"/>

5.40 Reaction v41

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

Name SOCS1 unbinding

Reaction equation



Reactant

Table 120: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SOCS1	IFNRJ2_star_SOCS1	

Product

Table 121: Properties of each product.

Id	Name	SBO
IFNRJ2_star	Activated IFNRJ complex	

Kinetic Law

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

$$v_{40} = \text{vol}(\text{cytoplasm}) \cdot k_f \cdot [\text{IFNRJ2_star_SOCS1}] \quad (80)$$

Table 122: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			$5 \cdot 10^{-4}$	s^{-1}	<input checked="" type="checkbox"/>

5.41 Reaction v42

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

Name SOCS1 binding

Reaction equation



Reactants

Table 123: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_STAT1c	IFNRJ2_star_STAT1c	
SOCS1	SOCS1	

Product

Table 124: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SOCS1_STAT1c	IFNRJ2_star_SOCS1_STAT1c	

Kinetic Law

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

$$v_{41} = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{SOCS1}] \cdot [\text{IFNRJ2_star_STAT1c}] - k_b \cdot [\text{IFNRJ2_star_SOCS1_STAT1c}]) \quad (82)$$

Table 125: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.10	s^{-1}	<input checked="" type="checkbox"/>

5.42 Reaction v43

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

Name SOCS1 binding

Reaction equation



Reactants

Table 126: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2	IFNRJ2_star_SHP2	
SOCS1	SOCS1	

Product

Table 127: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1	IFNRJ2_star_SHP2_SOCS1	

Kinetic Law

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

$$v_{42} = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{SOCS1}] \cdot [\text{IFNRJ2_star_SHP2}] - k_b \cdot [\text{IFNRJ2_star_SHP2_SOCS1}]) \quad (84)$$

Table 128: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.10	s^{-1}	<input checked="" type="checkbox"/>

5.43 Reaction v44

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

Name SOCS1 binding

Reaction equation



Reactants

Table 129: Properties of each reactant.

Id	Name	SBO
IFNRJ2_star_SHP2_STAT1c	IFNRJ2_star_SHP2_STAT1c	
SOCS1	SOCS1	

Product

Table 130: Properties of each product.

Id	Name	SBO
IFNRJ2_star_SHP2_SOCS1_STAT1c	IFNRJ2_star_SHP2_SOCS1_STAT1c	

Kinetic Law

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

$$v_{43} = \text{vol}(\text{cytoplasm}) \cdot (\text{kf} \cdot [\text{SOCS1}] \cdot [\text{IFNRJ2_star_SHP2_STAT1c}] - \text{kb} \cdot [\text{IFNRJ2_star_SHP2_SOCS1_STAT1c}]) \quad (86)$$

Table 131: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.10	s^{-1}	<input checked="" type="checkbox"/>

5.44 Reaction v_{45}

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

Name Interferon-receptor binding

Reaction equation



Reactants

Table 132: Properties of each reactant.

Id	Name	SBO
R	Receptor	
IFN	IFN	

Product

Table 133: Properties of each product.

Id	Name	SBO
IFNR	IFNR	

Kinetic Law

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

$$v_{44} = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{IFN}] \cdot [\text{R}] - k_b \cdot [\text{IFNR}]) \quad (88)$$

Table 134: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.02	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.02	s^{-1}	<input checked="" type="checkbox"/>

5.45 Reaction v46

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

Name IFNR-JAK binding

Reaction equation



Reactants

Table 135: Properties of each reactant.

Id	Name	SBO
JAK	JAK	
IFNR	IFNR	

Product

Table 136: Properties of each product.

Id	Name	SBO
IFNRJ	Interferon-Receptor-JAK complex	

Kinetic Law

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

$$v_{45} = \text{vol}(\text{cytoplasm}) \cdot (k_f \cdot [\text{IFNR}] \cdot [\text{JAK}] - k_b \cdot [\text{IFNRJ}]) \quad (90)$$

Table 137: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kf			0.10	$\text{nmol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
kb			0.05	s^{-1}	<input checked="" type="checkbox"/>

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 $10 \text{ nmol} \cdot \text{l}^{-1}$

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

$$\frac{d}{dt}R = -v_1 - v_{44} \quad (91)$$

6.2 Species JAK

Name JAK

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

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

$$\frac{d}{dt}JAK = -v_1 - v_{45} \quad (92)$$

6.3 Species RJ

Name Receptor JAK complex

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

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

$$\frac{d}{dt}RJ = v_1 - v_2 \quad (93)$$

6.4 Species IFNRJ

Name Interferon-Receptor-JAK complex

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{IFNRJ} = v_2 + v_{46} - 2v_3 \quad (94)$$

6.5 Species IFNRJ2

Name IFNRJ dimer

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{IFNRJ2} = v_3 + v_{10} + v_{31} + v_{36} + v_{39} - v_4 \quad (95)$$

6.6 Species IFNRJ2_star

Name Activated IFNRJ complex

Initial concentration 0 nmol · 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).

$$\frac{d}{dt}\text{IFNRJ2_star} = v_4 + v_6 + v_{40} - v_5 - v_7 - v_9 - v_{28} \quad (96)$$

6.7 Species STAT1c

Name STAT1c

Initial concentration 1000 nmol · 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).

$$\frac{d}{dt}\text{STAT1c} = v_{12} + v_{23} + v_{31} + v_{36} - v_5 - v_{15} - v_{29} - v_{34} \quad (97)$$

6.8 Species IFNRJ2_star_STAT1c

Name IFNRJ2_star_STAT1c

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{IFNRJ2_star_STAT1c} = v_5 + v_{37} - v_6 - v_{35} - v_{41} \quad (98)$$

6.9 Species STAT1c_star

Name STAT1c_star

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{STAT1c_star} = v_6 - v_7 - 2v_8 - v_{11} - v_{15} \quad (99)$$

6.10 Species IFNRJ2_star_STAT1c_star

Name IFNRJ2_star_STAT1c_star

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{IFNRJ2_star_STAT1c_star} = v_7 \quad (100)$$

6.11 Species STAT1c_star_STAT1c_star

Name STAT1c_star_STAT1c_star

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{STAT1c_star_STAT1c_star} = v_8 - v_{13} - v_{16} \quad (101)$$

6.12 Species SHP2

Name SHP2

Initial concentration 100 nmol · 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](#)).

$$\frac{d}{dt}\text{SHP2} = v_{10} + v_{31} + v_{36} + v_{39} - v_9 - v_{30} - v_{33} - v_{35} \quad (102)$$

6.13 Species IFNRJ2_star_SHP2

Name IFNRJ2_star_SHP2

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{IFNRJ2_star_SHP2} = v_9 + v_{38} - v_{10} - v_{42} \quad (103)$$

6.14 Species PPX

Name PPX

Initial concentration 50 nmol · l⁻¹

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

$$\frac{d}{dt}\text{PPX} = v_{12} + v_{14} - v_{11} - v_{13} \quad (104)$$

6.15 Species STAT1c_star_PPX

Name STAT1c_star_PPX

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{STAT1c_star_PPX} = v_{11} - v_{12} \quad (105)$$

6.16 Species STAT1c_STAT1c_star

Name STAT1c_STAT1c_star

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{STAT1c_STAT1c_star} = v_{14} + v_{15} \quad (106)$$

6.17 Species STAT1n_star_STAT1n_star

Name STAT1n_star_STAT1n_star

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{STAT1n_star_STAT1n_star} = v_{16} + v_{17} - v_{20} \quad (107)$$

6.18 Species STAT1n_star

Name STAT1n_star

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{STAT1n_star} = -2v_{17} - v_{18} - v_{22} \quad (108)$$

6.19 Species PPN

Name PPN

Initial concentration 60 nmol · l⁻¹

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

$$\frac{d}{dt}\text{PPN} = v_{19} + v_{21} - v_{18} - v_{20} \quad (109)$$

6.20 Species STAT1n_star_PPN

Name STAT1n_star_PPN

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{STAT1n_star_PPN} = v_{18} - v_{19} \quad (110)$$

6.21 Species STAT1n

Name STAT1n

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{STAT1n} = v_{19} - v_{22} - v_{23} \quad (111)$$

6.22 Species STAT1n_STAT1n_star

Name STAT1n_STAT1n_star

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{STAT1n_STAT1n_star} = v_{21} + v_{22} \quad (112)$$

6.23 Species mRNAn

Name mRNAn

Initial concentration 0 nmol · l⁻¹

This species takes part in one reaction (as a reactant in v25).

$$\frac{d}{dt}\text{mRNAn} = -v_{24} \quad (113)$$

6.24 Species mRNAC

Name mRNAC

Initial concentration 0 nmol · 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).

$$\frac{d}{dt}\text{mRNAC} = v_{24} - v_{26} \quad (114)$$

6.25 Species SOCS1

Name SOCS1

Initial concentration 0 nmol · 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).

$$\frac{d}{dt}\text{SOCS1} = v_{25} + v_{31} + v_{39} - v_{27} - v_{28} - v_{41} - v_{42} - v_{43} \quad (115)$$

6.26 Species IFNRJ2_star_SOCS1

Name IFNRJ2_star_SOCS1

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{IFNRJ2_star_SOCS1} = v_{28} - v_{29} - v_{33} - v_{40} \quad (116)$$

6.27 Species IFNRJ2_star_SHP2_SOCS1_STAT1c

Name IFNRJ2_star_SHP2_SOCS1_STAT1c

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{IFNRJ2_star_SHP2_SOCS1_STAT1c} = v_{30} + v_{34} + v_{43} - v_{31} - v_{32} \quad (117)$$

6.28 Species STAT1c_star_STAT1c_star_PPX

Name STAT1c_star_STAT1c_star_PPX

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{STAT1c_star_STAT1c_star_PPX} = v_{13} - v_{14} \quad (118)$$

6.29 Species STAT1n_star_STAT1n_star_PPN

Name STAT1n_star_STAT1n_star_PPN

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{STAT1n_star_STAT1n_star_PPN} = v_{20} - v_{21} \quad (119)$$

6.30 Species IFNRJ2_star_SOCS1_STAT1c

Name IFNRJ2_star_SOCS1_STAT1c

Initial concentration 0 nmol · l⁻¹

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

$$\frac{d}{dt}\text{IFNRJ2_star_SOCS1_STAT1c} = v_{29} + v_{41} - v_{30} - v_{37} \quad (120)$$

6.31 Species IFN

Name IFN

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

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:

$$\frac{d}{dt}\text{IFN} = 0 \quad (121)$$

6.32 Species IFNRJ2_star_SHP2_STAT1c

Name IFNRJ2_star_SHP2_STAT1c

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

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

$$\frac{d}{dt}\text{IFNRJ2_star_SHP2_STAT1c} = v_{32} + v_{35} - v_{36} - v_{43} \quad (122)$$

6.33 Species IFNRJ2_star_SHP2_SOCS1

Name IFNRJ2_star_SHP2_SOCS1

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

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

$$\frac{d}{dt}\text{IFNRJ2_star_SHP2_SOCS1} = v_{33} + v_{42} - v_{34} - v_{38} - v_{39} \quad (123)$$

6.34 Species IFNR

Name IFNR

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

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

$$\frac{d}{dt}\text{IFNR} = v_{44} - v_{45} \quad (124)$$

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