SBML Model Report

Model name: "Schliemann2011_TNF_ProAntiApoptosis"

May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 4 format. This model was created by the following two authors: Vijayalakshmi Chelliah[1] and Monica Schliemann[2] at January 16th 2012 at 2:48 p. m. and last time modified at March eighth 2012 at 11:11 a. m. Table 1 provides 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	3
species types	0	species	47
events	0	constraints	0
reactions	88	function definitions	0
global parameters	0	unit definitions	6
rules	0	initial assignments	0

Model Notes

This model is from the article:
Heterogeneity Reduces Sensitivity of Cell Death for TNF-Stimuli
Schliemann M, Bullinger E, Borchers S, Allgower F, Findeisen R, Scheurich P. BMC Syst Biol. 2011 Dec 28;5(1):204. 22204418 ,

[1]EMBL-EBI, viji@ebi.ac.uk
[2]Otto-von-Guericke-Universitt Magdeburg, monica.schliemann@systems-biology.eu

Abstract:
BACKGROUND:Apoptosis is a form of programmed cell death essential for the maintenance of homeostasis and the removal of potentially damaged cells in multicellular organisms. By binding its cognate membrane receptor, TNF receptor type 1 (TNF-R1), the proinflammatory cytokine Tumor Necrosis Factor (TNF) activates pro-apoptotic signaling via caspase activation, but at the same time also stimulates nuclear factor kappaB (NF-kappaB)-mediated survival pathways. Differential dose-response relationships of these two major TNF signaling pathways have been described experimentally and using mathematical modeling. However, the quantitative analysis of the complex interplay between pro- and anti-apoptotic signaling pathways is an open question as it is challenging for several reasons: the overall signaling network is complex, various time scales are present, and cells respond quantitatively and qualitatively in a heterogeneous manner.RESULTS:This study analyzes the complex interplay of the crosstalk of TNF-R1 induced pro- and anti-apoptotic signaling pathways based on an experimentally validated mathematical model. The mathematical model describes the temporal responses on both the single cell level as well as the level of a heterogeneous cell population, as observed in the respective quantitative experiments using TNF-R1 stimuli of different strengths and durations. Global sensitivity of the heterogeneous population was quantified by measuring the average gradient of time of death versus each population parameter. This global sensitivity analysis uncovers the concentrations of Caspase-8 and Caspase-3, and their respective inhibitors BAR and XIAP, as key elements for deciding the cell's fate. A simulated knockout of the NF-kappaB-mediated anti-apoptotic signaling reveals the importance of this pathway for delaying the time of death, reducing the death rate in the case of pulse stimulation and significantly increasing cell-to-cell variability.CONCLUSIONS:Cell ensemble modeling of a heterogeneous cell population including a global sensitivity analysis presented here allowed us to illuminate the role of the different elements and parameters on apoptotic signaling. The receptors serve to transmit the external stimulus; procaspases and their inhibitors control the switching from life to death, while NF-kappaB enhances the heterogeneity of the cell population. The global sensitivity analysis of the cell population model further revealed an unexpected impact of heterogeneity, i.e. the reduction of parametric sensitivity.

Note: SBML model generated from Matlab system description on 12-July-2011 21:08:15 by exportSBML Copyright Eric Bullinger 2007-2011

2 Unit Definitions

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

2.1 Unit `a_mole`

Definition amol

2.2 Unit per_second

Definition s^{-1}

2.3 Unit pl

Definition pl

2.4 Unit a_mole_per_second

Definition $amol \cdot s^{-1}$

2.5 Unit per_a_mole_per_second

Definition $amol^{-1} \cdot s^{-1}$

2.6 Unit per_a_mole_squared_per_second

Definition $amol^{-2} \cdot s^{-1}$

2.7 Unit substance

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

Definition mol

2.8 Unit volume

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

Definition l

2.9 Unit area

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

Definition m^2

2.10 Unit length

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

Definition m

2.11 Unit time

Notes Second is the predefined SBML unit for `time`.

Definition s

3 Compartments

This model contains three compartments.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
`cytoplasm`		0000290	3	3.2	pl	☑	
`extracellular`		0000290	3	1344	pl	☑	
`nucleus`		0000290	3	1.056	pl	☑	

3.1 Compartment `cytoplasm`

This is a three dimensional compartment with a constant size of 3.2 pl.

SBO:0000290 physical compartment

3.2 Compartment `extracellular`

This is a three dimensional compartment with a constant size of 1344 pl.

SBO:0000290 physical compartment

3.3 Compartment `nucleus`

This is a three dimensional compartment with a constant size of 1.056 pl.

SBO:0000290 physical compartment

4 Species

This model contains 47 species. 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
TNFR_E	TNFR_E	extracellular	amol	⊟	⊟
TNF_E	TNF_E	extracellular	amol	⊟	⊟
TNF_TNFR_E	TNF:TNFR_E	extracellular	amol	⊟	⊟
TNFR	TNFR	cytoplasm	amol	⊟	⊟
RIP	RIP	cytoplasm	amol	⊟	⊟
TRADD	TRADD	cytoplasm	amol	⊟	⊟
TRAF2	TRAF2	cytoplasm	amol	⊟	⊟
FADD	FADD	cytoplasm	amol	⊟	⊟
TNF_TNFR_TRADD	TNF:TNFR:TRADD	cytoplasm	amol	⊟	⊟
TNFRC1	TNFRC1	cytoplasm	amol	⊟	⊟
TNFRCint1	TNFRCint1	cytoplasm	amol	⊟	⊟
TNFRCint2	TNFRCint2	cytoplasm	amol	⊟	⊟
TNFRCint3	TNFRCint3	cytoplasm	amol	⊟	⊟
TNFRC2	TNFRC2	cytoplasm	amol	⊟	⊟
FLIP	FLIP	cytoplasm	amol	⊟	⊟
TNFRC2_FLIP	TNFRC2:FLIP	cytoplasm	amol	⊟	⊟
TNFRC2_pCasp8	TNFRC2:pCasp8	cytoplasm	amol	⊟	⊟
TNFRC2_FLIP_FLIP	TNFRC2:FLIP:FLIP	cytoplasm	amol	⊟	⊟
TNFRC2_pCasp8-_pCasp8	TNFRC2:pCasp8:pCasp8	cytoplasm	amol	⊟	⊟
TNFRC2_FLIP-_pCasp8	TNFRC2:FLIP:pCasp8	cytoplasm	amol	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
TNFRC2_FLIP-_pCasp8_RIP_TRAF2	TNFRC2:FLIP:pCasp8:RIP:TRAF2	cytoplasm	amol	⊟	⊟
IKK	IKK	cytoplasm	amol	⊟	⊟
IKKa	IKKa	cytoplasm	amol	⊟	⊟
A20	A20	cytoplasm	amol	⊟	⊟
NFkB	NFkB	cytoplasm	amol	⊟	⊟
IkBa	IkBa	cytoplasm	amol	⊟	⊟
IkBa_NFkB	IkBa:NFkB	cytoplasm	amol	⊟	⊟
PIkBa	PIkBa	cytoplasm	amol	⊟	⊟
NFkB_N	NFkB_N	nucleus	amol	⊟	⊟
IkBa_N	IkBa_N	nucleus	amol	⊟	⊟
IkBa_NFkB_N	IkBa:NFkB_N	nucleus	amol	⊟	⊟
A20_mRNA	A20_mRNA	nucleus	amol	⊟	⊟
IkBa_mRNA	IkBa_mRNA	nucleus	amol	⊟	⊟
XIAP_mRNA	XIAP_mRNA	nucleus	amol	⊟	⊟
FLIP_mRNA	FLIP_mRNA	nucleus	amol	⊟	⊟
BAR	BAR	cytoplasm	amol	⊟	⊟
XIAP	XIAP	cytoplasm	amol	⊟	⊟
pCasp8	pCasp8	cytoplasm	amol	⊟	⊟
pCasp3	pCasp3	cytoplasm	amol	⊟	⊟
pCasp6	pCasp6	cytoplasm	amol	⊟	⊟
Casp8	Casp8	cytoplasm	amol	⊟	⊟
Casp3	Casp3	cytoplasm	amol	⊟	⊟
Casp6	Casp6	cytoplasm	amol	⊟	⊟
BAR_Casp8	BAR:Casp8	cytoplasm	amol	⊟	⊟
XIAP_Casp3	XIAP:Casp3	cytoplasm	amol	⊟	⊟
PARP	PARP	cytoplasm	amol	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
cPARP	cPARP	cytoplasm	amol	⊟	⊟

5 Reactions

This model contains 88 reactions. All reactions are listed in the following table and are subsequently described in detail. If a reaction is affected by a modifier, the identifier of this species is written above the reaction arrow.

Table 4: Overview of all reactions

№	Id	Name	Reaction Equation	SBO
1	J1	TNFR transport into membrane	TNFR $\longrightarrow$ TNFR_E	0000185
2	J2	TNFR production	$\emptyset \longrightarrow$ TNFR	0000393
3	J3	TNFR degradation	TNFR_E $\longrightarrow \emptyset$	0000179
4	J4	RIP turnover	$\emptyset \rightleftharpoons$ RIP	0000357
5	J5	TRADD turnover	$\emptyset \rightleftharpoons$ TRADD	0000357
6	J6	TRAF2 turnover	$\emptyset \rightleftharpoons$ TRAF2	0000357
7	J7	FADD turnover	$\emptyset \rightleftharpoons$ FADD	0000357
8	J8	TNFT̃NFR degradation	TNF_TNFR_E $\longrightarrow \emptyset$	0000179
9	J9	TNF:TNFR:TRADD degradation	TNF_TNFR_TRADD $\longrightarrow \emptyset$	0000179
10	J10	TNFR Complex1 degradation	TNFRC1 $\longrightarrow \emptyset$	0000179
11	J11	TNFR Complex2 degradation	TNFRC2 $\longrightarrow \emptyset$	0000179
12	J12	TNFR Complex2F̃LIP degradation	TNFRC2_FLIP $\longrightarrow \emptyset$	0000179
13	J13	TNFR Complex2F̃LIPF̃LIP degradation	TNFRC2_FLIP_FLIP $\longrightarrow \emptyset$	0000179
14	J14	TNFR Complex2P̃rocaspase-8 degradation	TNFRC2_pCasp8 $\longrightarrow \emptyset$	0000179
15	J15	TNFR Complex2P̃rocaspase-8P̃rocaspase-8 degradation	TNFRC2_pCasp8_pCasp8 $\longrightarrow \emptyset$	0000179
16	J16	TNFR Complex2F̃LIPP̃rocaspase-8 degradation	TNFRC2_FLIP_pCasp8 $\longrightarrow \emptyset$	0000179
17	J17	TNFR Complex2F̃LIPP̃rocaspase-8R̃IP-T̃RAF2 degradation	TNFRC2_FLIP_pCasp8_RIP_TRAF2 $\longrightarrow \emptyset$	0000179
18	J18	TNFT̃NFR binding and release	TNFR_E + TNF_E $\rightleftharpoons$ TNF_TNFR_E	0000526
19	J19	TNFT̃NFRT̃RADD building	TNF_TNFR_E + TRADD $\longrightarrow$ TNF_TNFR_TRADD	0000526
20	J20	TNFR Complex1 building	RIP + TRAF2 + TNF_TNFR_TRADD $\longrightarrow$ TNFRC1	0000526

№	Id	Name	Reaction Equation	SBO
21	J21	Receptor internalisation step1	$\mathrm{TNFRC1} \longrightarrow \mathrm{TNFRCint1}$	0000395
22	J22	Receptor internalisation step2	$\mathrm{TNFRCint1} \longrightarrow \mathrm{RIP} + \mathrm{TRAF2} + \mathrm{TNFRCint2}$	0000395
23	J23	Receptor internalisation step3	$2\,\mathrm{FADD} + \mathrm{TNFRCint2} \longrightarrow \mathrm{TNFRCint3}$	0000395
24	J24	Receptor internalisation step4	$\mathrm{TNFRCint3} \longrightarrow \mathrm{TNFRC2}$	0000395
25	J25	FLIP recruitment to TNFR Complex2	$\mathrm{TNFRC2} + \mathrm{FLIP} \longrightarrow \mathrm{TNFRC2\_FLIP}$	0000526
26	J26	FLIP recruitment to TNFR Complex2FLIP	$\mathrm{FLIP} + \mathrm{TNFRC2\_FLIP} \longrightarrow \mathrm{TNFRC2\_FLIP\_FLIP}$	0000526
27	J27	Procaspase-8 recruitment to TNFR Complex2	$\mathrm{TNFRC2} + \mathrm{pCasp8} \longrightarrow \mathrm{TNFRC2\_pCasp8}$	0000526
28	J28	Procaspase-8 recruitment to TNFR Complex2Procaspase-8	$\mathrm{TNFRC2\_pCasp8} + \mathrm{pCasp8} \longrightarrow \mathrm{TNFRC2\_pCasp8\_pCasp8}$	0000526
29	J29	Caspase-8 activation by TNFR Complex2	$\mathrm{TNFRC2\_pCasp8\_pCasp8} \longrightarrow \mathrm{TNFRC2} + \mathrm{Casp8}$	0000180
30	J30	FLIP recruitment to TNFR Complex2-Procaspase-8	$\mathrm{FLIP} + \mathrm{TNFRC2\_pCasp8} \longrightarrow \mathrm{TNFRC2\_FLIP\_pCasp8}$	0000526
31	J31	Procaspase-8 recruitment to TNFR Complex2FLIP	$\mathrm{TNFRC2\_FLIP} + \mathrm{pCasp8} \longrightarrow \mathrm{TNFRC2\_FLIP\_pCasp8}$	0000526
32	J32	Caspase-8 activation by TNFR Complex2-FLIPProcaspase-8	$\mathrm{TNFRC2\_FLIP\_pCasp8} \longrightarrow \mathrm{TNFRC2} + \mathrm{Casp8}$	0000180
33	J33	RIPTRAF2 recruitment at TNFR Complex2-FLIPProcaspase-8	$\mathrm{RIP} + \mathrm{TRAF2} + \mathrm{TNFRC2\_FLIP\_pCasp8} \longrightarrow \mathrm{TNFRC2\_FLIP\_pCasp8\_RIP\_TRAF2}$	0000526
34	J34	IKK activation by TNFR Complex2FLIP-Procaspase-8RIPTRAF2	$\mathrm{IKK} \xrightarrow{\mathrm{TNFRC2\_FLIP\_pCasp8\_RIP\_TRAF2}} \mathrm{IKKa}$	0000170
35	J35	IKK turnover	$\emptyset \rightleftharpoons \mathrm{IKK}$	0000357
36	J36	NF-kappaB turnover	$\emptyset \rightleftharpoons \mathrm{NFkB}$	0000357
37	J37	FLIP turnover	$\emptyset \rightleftharpoons \mathrm{FLIP}$	0000357
38	J38	XIAP turnover	$\emptyset \rightleftharpoons \mathrm{XIAP}$	0000357
39	J39	A20 turnover	$\emptyset \rightleftharpoons \mathrm{A20}$	0000357
40	J40	IKK* degradation	$\mathrm{IKKa} \longrightarrow \emptyset$	0000179
41	J41	IkappaBalphaNF-kappaB complex degradation	$\mathrm{IkBa\_NFkB} \longrightarrow \emptyset$	0000179

№	Id	Name	Reaction Equation	SBO
42	J42	nuclear NF-kappaB degradation	$\mathrm{NFkB\_N} \longrightarrow \emptyset$	0000179
43	J43	IkappaBalpha-mRNA degradation	$\mathrm{IkBa\_mRNA} \longrightarrow \emptyset$	0000179
44	J44	IkappaBalpha degradation	$\mathrm{IkBa} \longrightarrow \emptyset$	0000179
45	J45	free nuclear IkappaBalpha degradation	$\mathrm{IkBa\_N} \longrightarrow \emptyset$	0000179
46	J46	nuclear IkappaBalphaÑF-kappaB complex degradation	$\mathrm{IkBa\_NFkB\_N} \longrightarrow \emptyset$	0000179
47	J47	P-IkappaBa degradation	$\mathrm{PIkBa} \longrightarrow \emptyset$	0000179
48	J48	A20-mRNA degradation	$\mathrm{A20\_mRNA} \longrightarrow \emptyset$	0000179
49	J49	XIAP-mRNA degradation	$\mathrm{XIAP\_mRNA} \longrightarrow \emptyset$	0000179
50	J50	FLIP-mRNA degradation	$\mathrm{FLIP\_mRNA} \longrightarrow \emptyset$	0000179
51	J51	IKK activation by TNFR Complex1	$\mathrm{IKK} \xrightarrow{\mathrm{TNFRC1}} \mathrm{IKKa}$	0000170
52	J52	IKK* inactivation	$\mathrm{IKKa} \longrightarrow \mathrm{IKK}$	0000169
53	J53	TNFR Complex1 inactivation by A20	$\mathrm{TNFRC1} \xrightarrow{\mathrm{A20}} \mathrm{TRAF2} + \mathrm{TNF\_TNFR\_TRADD}$	0000169
54	J54	IkappaBalpha NF-kappaB association	$\mathrm{NFkB} + \mathrm{IkBa} \longrightarrow \mathrm{IkBa\_NFkB}$	0000526
55	J55	release and degradation of bound IkappaBalpha	$\mathrm{IkBa\_NFkB} \xrightarrow{\mathrm{IKKa}} \mathrm{NFkB} + \mathrm{PIkBa}$	0000179
56	J56	NF-kappaB nuclear translocation	$\mathrm{NFkB} \longrightarrow \mathrm{NFkB\_N}$	0000185
57	J57	IkappaBalpha-mRNA transcription	$\emptyset \xrightarrow{\mathrm{NFkB\_N}} \mathrm{IkBa\_mRNA}$	0000183
58	J58	IkappaBalpha translation	$\emptyset \xrightarrow{\mathrm{IkBa\_mRNA}} \mathrm{IkBa}$	0000184
59	J59	IkappaBalpha nuclear translocation	$\mathrm{IkBa} \rightleftharpoons \mathrm{IkBa\_N}$	0000526
60	J60	IkappaBalpha binding NF-kappaB in nucleus	$\mathrm{NFkB\_N} + \mathrm{IkBa\_N} \longrightarrow \mathrm{IkBa\_NFkB\_N}$	0000526
61	J61	IkappaBalpha_NF-kappaB N-C export	$\mathrm{IkBa\_NFkB\_N} \longrightarrow \mathrm{IkBa\_NFkB}$	0000185
62	J62	A20-mRNA transcription	$\emptyset \xrightarrow{\mathrm{NFkB\_N}} \mathrm{A20\_mRNA}$	0000183
63	J63	A20 translation	$\emptyset \xrightarrow{\mathrm{A20\_mRNA}} \mathrm{A20}$	0000184
64	J64	XIAP-mRNA transcription	$\emptyset \xrightarrow{\mathrm{NFkB\_N}} \mathrm{XIAP\_mRNA}$	0000183
65	J65	XIAP translation	$\emptyset \xrightarrow{\mathrm{XIAP\_mRNA}} \mathrm{XIAP}$	0000184

№	Id	Name	Reaction Equation	SBO
66	J66	FLIP-mRNA transcription	$\emptyset \xrightarrow{\text{NFkB\_N}} \text{FLIP\_mRNA}$	0000183
67	J67	FLIP translation	$\emptyset \xrightarrow{\text{FLIP\_mRNA}} \text{FLIP}$	0000184
68	J68	Procaspase-8 turnover	$\emptyset \rightleftharpoons \text{pCasp8}$	0000357
69	J69	Procaspase-3 turnover	$\emptyset \rightleftharpoons \text{pCasp3}$	0000357
70	J70	Procaspase-6 turnover	$\emptyset \rightleftharpoons \text{pCasp6}$	0000357
71	J71	Caspase-8 degradation	$\text{Casp8} \longrightarrow \emptyset$	0000179
72	J72	Caspase-3 degradation	$\text{Casp3} \longrightarrow \emptyset$	0000179
73	J73	Caspase-6 degradation	$\text{Casp6} \longrightarrow \emptyset$	0000179
74	J74	XIAP$\tilde{\text{C}}$aspase-3 complex degradation	$\text{XIAP\_Casp3} \longrightarrow \emptyset$	0000179
75	J75	BAR turnover	$\emptyset \rightleftharpoons \text{BAR}$	0000357
76	J76	BAR$\tilde{\text{C}}$aspase-8 complex degradation	$\text{BAR\_Casp8} \longrightarrow \emptyset$	0000179
77	J77	PARP turnover	$\text{PARP} \rightleftharpoons \emptyset$	0000357
78	J78	CPARP degradation	$\text{cPARP} \longrightarrow \emptyset$	0000179
79	J79	Caspase-3 activation	$\text{pCasp3} \xrightarrow{\text{Casp8}} \text{Casp3}$	0000170
80	J80	Caspase-6 activation	$\text{pCasp6} \xrightarrow{\text{Casp3}} \text{Casp6}$	0000170
81	J81	Caspase-8 activation	$\text{pCasp8} \xrightarrow{\text{Casp6}} \text{Casp8}$	0000170
82	J82	XIAP$\tilde{\text{C}}$aspase-3 complex formation	$\text{XIAP} + \text{Casp3} \rightleftharpoons \text{XIAP\_Casp3}$	0000526
83	J83	XIAP degradation due to Caspase-3	$\text{XIAP} \xrightarrow{\text{Casp3}} \emptyset$	0000179
84	J84	XIAP$\tilde{\text{C}}$aspase-3 complex breakup	$\text{XIAP\_Casp3} \longrightarrow \text{XIAP}$	0000180
85	J85	negative feedback loop Caspase-3 on TNFR Complex1	$\text{RIP} \xrightarrow{\text{Casp3}} \emptyset$	0000169
86	J86	FLIP degradation by Caspase-3	$\text{FLIP} \xrightarrow{\text{Casp3}} \emptyset$	0000179
87	J87	PARP cleavage as Casp3 substrate	$\text{PARP} \xrightarrow{\text{Casp3}} \text{cPARP}$	0000178
88	J88	BAR$\tilde{\text{C}}$aspase-8 complex formation	$\text{BAR} + \text{Casp8} \rightleftharpoons \text{BAR\_Casp8}$	0000526

5.1 Reaction J1

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

Name TNFR transport into membrane

SBO:0000185 transport reaction

Reaction equation

$$\text{TNFR} \longrightarrow \text{TNFR\_E} \tag{1}$$

Reactant

Table 5: Properties of each reactant.

Id	Name	SBO
TNFR	TNFR	

Product

Table 6: Properties of each product.

Id	Name	SBO
TNFR_E	TNFR_E	

Kinetic Law

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

$$v_1 = \text{ka\_1} \cdot \text{TNFR} \tag{2}$$

Table 7: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_1	TNFR transport into membrane ka	0000009	0.001	s^{-1}	☑

5.2 Reaction J2

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

Name TNFR production

SBO:0000393 production

Reaction equation

$$\emptyset \longrightarrow \text{TNFR} \tag{3}$$

Product

Table 8: Properties of each product.

Id	Name	SBO
TNFR	TNFR	

Kinetic Law

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

$$v_2 = \text{ka\_2} \tag{4}$$

Table 9: Properties of each parameter.

Id	Name		SBO	Value	Unit	Constant
ka_2	TNFR ka	production	0000009	$2.8 \cdot 10^{-7}$	$\text{amol} \cdot \text{s}^{-1}$	☑

5.3 Reaction J3

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

Name TNFR degradation

SBO:0000179 degradation

Reaction equation

$$\text{TNFR\_E} \longrightarrow \emptyset \tag{5}$$

Reactant

Table 10: Properties of each reactant.

Id	Name	SBO
TNFR_E	TNFR_E	

Kinetic Law

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

$$v_3 = \mathrm{ka\_3} \cdot \mathrm{TNFR\_E} \tag{6}$$

Table 11: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_3	TNFR degradation ka	0000356	$5.6 \cdot 10^{-5}$	s^{-1}	☑

5.4 Reaction J4

This is a reversible reaction of no reactant forming one product.

Name RIP turnover

SBO:0000357 biological effect of a perturbation

Reaction equation

$$\emptyset \rightleftharpoons \mathrm{RIP} \tag{7}$$

Product

Table 12: Properties of each product.

Id	Name	SBO
RIP	RIP	

Kinetic Law

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

$$v_4 = \mathrm{ka\_4} - \mathrm{kd\_4} \cdot \mathrm{RIP} \tag{8}$$

Table 13: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_4	RIP turnover ka	0000009	$2.0256 \cdot 10^{-5}$	$\text{amol} \cdot \text{s}^{-1}$	☑
kd_4	RIP turnover kd	0000009	10^{-4}	s^{-1}	☑

5.5 Reaction J5

This is a reversible reaction of no reactant forming one product.

Name TRADD turnover

SBO:0000357 biological effect of a perturbation

Reaction equation

$$\emptyset \rightleftharpoons \text{TRADD} \tag{9}$$

Product

Table 14: Properties of each product.

Id	Name	SBO
TRADD	TRADD	

Kinetic Law

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

$$v_5 = \text{ka\_5} - \text{kd\_5} \cdot \text{TRADD} \tag{10}$$

Table 15: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_5	TRADD turnover ka	0000009	$2.9344 \cdot 10^{-5}$	$\text{amol} \cdot \text{s}^{-1}$	☑
kd_5	TRADD turnover kd	0000009	10^{-4}	s^{-1}	☑

5.6 Reaction J6

This is a reversible reaction of no reactant forming one product.

Name TRAF2 turnover

SBO:0000357 biological effect of a perturbation

Reaction equation

$$\emptyset \rightleftharpoons \text{TRAF2} \tag{11}$$

Product

Table 16: Properties of each product.

Id	Name	SBO
TRAF2	TRAF2	

Kinetic Law

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

$$v_6 = \text{ka\_6} - \text{kd\_6} \cdot \text{TRAF2} \tag{12}$$

Table 17: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_6	TRAF2 turnover ka	0000009	$3.3056 \cdot 10^{-5}$	$\text{amol} \cdot \text{s}^{-1}$	☑
kd_6	TRAF2 turnover kd	0000009	10^{-4}	s^{-1}	☑

5.7 Reaction J7

This is a reversible reaction of no reactant forming one product.

Name FADD turnover

SBO:0000357 biological effect of a perturbation

Reaction equation

$$\emptyset \rightleftharpoons \text{FADD} \tag{13}$$

Product

Table 18: Properties of each product.

Id	Name	SBO
FADD	FADD	

Kinetic Law

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

$$v_7 = \text{ka\_7} - \text{kd\_7} \cdot \text{FADD} \tag{14}$$

Table 19: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_7	FADD turnover ka	0000009	$3.0944 \cdot 10^{-5}$	$\text{amol} \cdot \text{s}^{-1}$	☑
kd_7	FADD turnover kd	0000009	10^{-4}	s^{-1}	☑

5.8 Reaction J8

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

Name TNFT̃NFR degradation

SBO:0000179 degradation

Reaction equation

$$\text{TNF\_TNFR\_E} \longrightarrow \emptyset \tag{15}$$

Reactant

Table 20: Properties of each reactant.

Id	Name	SBO
TNF_TNFR_E	TNF:TNFR_E	

Kinetic Law

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

$$v_8 = \text{ka\_8} \cdot \text{TNF\_TNFR\_E} \tag{16}$$

Table 21: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_8	TNF$\tilde{\text{T}}$NFR degradation ka	0000356	$5.6 \cdot 10^{-5}$	s^{-1}	☑

5.9 Reaction J9

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

Name TNF:TNFR:TRADD degradation

SBO:0000179 degradation

Reaction equation

$$\text{TNF\_TNFR\_TRADD} \longrightarrow \emptyset \tag{17}$$

Reactant

Table 22: Properties of each reactant.

Id	Name	SBO
TNF_TNFR_TRADD	TNF:TNFR:TRADD	

Kinetic Law

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

$$v_9 = \text{ka\_9} \cdot \text{TNF\_TNFR\_TRADD} \tag{18}$$

Table 23: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_9	TNF:TNFR:TRADD degradation ka	0000356	0.024	s^{-1}	☑

5.10 Reaction J10

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

Name TNFR Complex1 degradation

SBO:0000179 degradation

Reaction equation

$$\text{TNFRC1} \longrightarrow \emptyset \tag{19}$$

Reactant

Table 24: Properties of each reactant.

Id	Name	SBO
TNFRC1	TNFRC1	

Kinetic Law

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

$$v_{10} = \text{ka\_10} \cdot \text{TNFRC1} \tag{20}$$

Table 25: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_10	TNFR Complex1 degradation ka	0000356	$5.6 \cdot 10^{-5}$	s^{-1}	☑

5.11 Reaction J11

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

Name TNFR Complex2 degradation

SBO:0000179 degradation

Reaction equation

$$\text{TNFRC2} \longrightarrow \emptyset \tag{21}$$

Reactant

Table 26: Properties of each reactant.

Id	Name	SBO
TNFRC2	TNFRC2	

Kinetic Law

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

$$v_{11} = \text{ka\_11} \cdot \text{TNFRC2} \tag{22}$$

Table 27: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_11	TNFR Complex2 degradation ka	0000356	$5.6 \cdot 10^{-5}$	s^{-1}	☑

5.12 Reaction J12

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

Name TNFR Complex2F̃LIP degradation

SBO:0000179 degradation

Reaction equation

$$\text{TNFRC2\_FLIP} \longrightarrow \emptyset \tag{23}$$

Reactant

Table 28: Properties of each reactant.

Id	Name	SBO
TNFRC2_FLIP	TNFRC2:FLIP	

Kinetic Law

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

$$v_{12} = \text{ka\_12} \cdot \text{TNFRC2\_FLIP} \tag{24}$$

Table 29: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_12	TNFR Complex2-FLIP degradation ka	0000356	$5.6 \cdot 10^{-5}$	s^{-1}	☑

5.13 Reaction J13

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

Name TNFR Complex2FLIPFLIP degradation

SBO:0000179 degradation

Reaction equation

$$\text{TNFRC2\_FLIP\_FLIP} \longrightarrow \emptyset \tag{25}$$

Reactant

Table 30: Properties of each reactant.

Id	Name	SBO
TNFRC2_FLIP_FLIP	TNFRC2:FLIP:FLIP	

Kinetic Law

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

$$v_{13} = \text{ka\_13} \cdot \text{TNFRC2\_FLIP\_FLIP} \tag{26}$$

Table 31: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_13	TNFR Complex2-FLIPFLIP degradation ka	0000356	$5.6 \cdot 10^{-5}$	s^{-1}	☑

5.14 Reaction J14

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

Name TNFR Complex2P̃rocaspase-8 degradation

SBO:0000179 degradation

Reaction equation

$$\text{TNFRC2\_pCasp8} \longrightarrow \emptyset \tag{27}$$

Reactant

Table 32: Properties of each reactant.

Id	Name	SBO
TNFRC2_pCasp8	TNFRC2:pCasp8	

Kinetic Law

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

$$v_{14} = \text{ka\_14} \cdot \text{TNFRC2\_pCasp8} \tag{28}$$

Table 33: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_14	TNFR Complex2-P̃rocaspase-8 degradation ka	0000356	$5.6 \cdot 10^{-5}$	s^{-1}	☑

5.15 Reaction J15

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

Name TNFR Complex2P̃rocaspase-8P̃rocaspase-8 degradation

SBO:0000179 degradation

Reaction equation

$$\text{TNFRC2\_pCasp8\_pCasp8} \longrightarrow \emptyset \tag{29}$$

Reactant

Table 34: Properties of each reactant.

Id	Name	SBO
TNFRC2_pCasp8_pCasp8	TNFRC2:pCasp8:pCasp8	

Kinetic Law

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

$$v_{15} = \text{ka\_15} \cdot \text{TNFRC2\_pCasp8\_pCasp8} \tag{30}$$

Table 35: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_15	TNFR Complex2-P̃rocaspase-8-P̃rocaspase-8 degradation ka	0000356	$5.6 \cdot 10^{-5}$	s^{-1}	☑

5.16 Reaction J16

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

Name TNFR Complex2F̃LIPP̃rocaspase-8 degradation

SBO:0000179 degradation

Reaction equation

$$\text{TNFRC2\_FLIP\_pCasp8} \longrightarrow \emptyset \tag{31}$$

Reactant

Table 36: Properties of each reactant.

Id	Name	SBO
TNFRC2_FLIP_pCasp8	TNFRC2:FLIP:pCasp8	

Kinetic Law

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

$$v_{16} = \text{ka\_16} \cdot \text{TNFRC2\_FLIP\_pCasp8} \tag{32}$$

Table 37: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_16	TNFR Complex2-FLIPProcaspase-8 degradation ka	0000356	$5.6 \cdot 10^{-5}$	s^{-1}	☑

5.17 Reaction J17

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

Name TNFR Complex2FLIPProcaspase-8RIPTRAF2 degradation

SBO:0000179 degradation

Reaction equation

$$\text{TNFRC2\_FLIP\_pCasp8\_RIP\_TRAF2} \longrightarrow \emptyset \tag{33}$$

Reactant

Table 38: Properties of each reactant.

Id	Name	SBO
TNFRC2_FLIP_pCasp8_RIP_TRAF2	TNFRC2:FLIP:pCasp8:RIP:TRAF2	

Kinetic Law

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

$$v_{17} = \text{ka\_17} \cdot \text{TNFRC2\_FLIP\_pCasp8\_RIP\_TRAF2} \tag{34}$$

Table 39: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_17	TNFR Complex2-FLIPProcaspase-8RIPTRAF2 degradation ka	0000356	$5.6 \cdot 10^{-5}$	s^{-1}	☑

5.18 Reaction J18

This is a reversible reaction of two reactants forming one product.

Name TNFT̃NFR binding and release

SBO:0000526 protein complex formation

Reaction equation

$$\text{TNFR\_E} + \text{TNF\_E} \rightleftharpoons \text{TNF\_TNFR\_E} \tag{35}$$

Reactants

Table 40: Properties of each reactant.

Id	Name	SBO
TNFR_E	TNFR_E	
TNF_E	TNF_E	

Product

Table 41: Properties of each product.

Id	Name	SBO
TNF_TNFR_E	TNF:TNFR_E	

Kinetic Law

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

$$v_{18} = \text{ka\_18} \cdot \text{TNFR\_E} \cdot \text{TNF\_E} - \text{kd\_18} \cdot \text{TNF\_TNFR\_E} \tag{36}$$

Table 42: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_18	TNFT̃NFR binding and release ka	0000337	0.010	$\text{amol}^{-1} \cdot \text{s}^{-1}$	☑
kd_18	TNFT̃NFR binding and release kd	0000337	$6.60377 \cdot 10^{-5}$	s^{-1}	☑

5.19 Reaction J19

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

Name TNFT̃NFRT̃RADD building

SBO:0000526 protein complex formation

Reaction equation

$$\text{TNF\_TNFR\_E} + \text{TRADD} \longrightarrow \text{TNF\_TNFR\_TRADD} \tag{37}$$

Reactants

Table 43: Properties of each reactant.

Id	Name	SBO
TNF_TNFR_E	TNF:TNFR_E	
TRADD	TRADD	

Product

Table 44: Properties of each product.

Id	Name	SBO
TNF_TNFR_TRADD	TNF:TNFR:TRADD	

Kinetic Law

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

$$v_{19} = \text{ka\_19} \cdot \text{TNF\_TNFR\_E} \cdot \text{TRADD} \tag{38}$$

Table 45: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_19	TNFT̃NFR-T̃RADD building ka	0000337	0.004	$\text{amol}^{-1} \cdot \text{s}^{-1}$	☑

5.20 Reaction J20

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

Name TNFR Complex1 building

SBO:0000526 protein complex formation

Reaction equation

$$\mathrm{RIP} + \mathrm{TRAF2} + \mathrm{TNF\_TNFR\_TRADD} \longrightarrow \mathrm{TNFRC1} \tag{39}$$

Reactants

Table 46: Properties of each reactant.

Id	Name	SBO
RIP	RIP	
TRAF2	TRAF2	
TNF_TNFR_TRADD	TNF:TNFR:TRADD	

Product

Table 47: Properties of each product.

Id	Name	SBO
TNFRC1	TNFRC1	

Kinetic Law

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

$$v_{20} = \mathrm{ka\_20} \cdot \mathrm{RIP} \cdot \mathrm{TRAF2} \cdot \mathrm{TNF\_TNFR\_TRADD} \tag{40}$$

Table 48: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_20	TNFR Complex1 building ka	0000337	0.098	$\mathrm{amol}^{-2} \cdot \mathrm{s}^{-1}$	☑

5.21 Reaction J21

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

Name Receptor internalisation step1

SBO:0000395 encapsulating process

Reaction equation

$$\text{TNFRC1} \longrightarrow \text{TNFRCint1} \tag{41}$$

Reactant

Table 49: Properties of each reactant.

Id	Name	SBO
TNFRC1	TNFRC1	

Product

Table 50: Properties of each product.

Id	Name	SBO
TNFRCint1	TNFRCint1	

Kinetic Law

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

$$v_{21} = \text{ka\_21} \cdot \text{TNFRC1} \tag{42}$$

Table 51: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_21	Receptor internalisation step1 ka	0000009	0.001	s^{-1}	☑

5.22 Reaction J22

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

Name Receptor internalisation step2

SBO:0000395 encapsulating process

Reaction equation

$$\text{TNFRCint1} \longrightarrow \text{RIP} + \text{TRAF2} + \text{TNFRCint2} \tag{43}$$

Reactant

Table 52: Properties of each reactant.

Id	Name	SBO
TNFRCint1	TNFRCint1	

Products

Table 53: Properties of each product.

Id	Name	SBO
RIP	RIP	
TRAF2	TRAF2	
TNFRCint2	TNFRCint2	

Kinetic Law

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

$$v_{22} = \text{ka\_22} \cdot \text{TNFRCint1} \tag{44}$$

Table 54: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_22	Receptor internalisation step2 ka	0000009	0.001	s^{-1}	☑

5.23 Reaction J23

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

Name Receptor internalisation step3

SBO:0000395 encapsulating process

Reaction equation

$$2\,\mathrm{FADD} + \mathrm{TNFRCint2} \longrightarrow \mathrm{TNFRCint3} \tag{45}$$

Reactants

Table 55: Properties of each reactant.

Id	Name	SBO
FADD	FADD	
TNFRCint2	TNFRCint2	

Product

Table 56: Properties of each product.

Id	Name	SBO
TNFRCint3	TNFRCint3	

Kinetic Law

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

$$v_{23} = \mathrm{ka\_23} \cdot \mathrm{FADD}^2 \cdot \mathrm{TNFRCint2} \tag{46}$$

Table 57: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_23	Receptor internalisation step3 ka	0000009	0.012	$\mathrm{amol}^{-2} \cdot \mathrm{s}^{-1}$	☑

5.24 Reaction J24

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

Name Receptor internalisation step4

SBO:0000395 encapsulating process

Reaction equation

$$\mathrm{TNFRCint3} \longrightarrow \mathrm{TNFRC2} \tag{47}$$

Reactant

Table 58: Properties of each reactant.

Id	Name	SBO
TNFRCint3	TNFRCint3	

Product

Table 59: Properties of each product.

Id	Name	SBO
TNFRC2	TNFRC2	

Kinetic Law

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

$$v_{24} = \text{ka\_24} \cdot \text{TNFRCint3} \tag{48}$$

Table 60: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_24	Receptor internalisation step4 ka	0000009	0.114	s^{-1}	☑

5.25 Reaction J25

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

Name FLIP recruitment to TNFR Complex2

SBO:0000526 protein complex formation

Reaction equation

$$\text{TNFRC2} + \text{FLIP} \longrightarrow \text{TNFRC2\_FLIP} \tag{49}$$

Reactants

Table 61: Properties of each reactant.

Id	Name	SBO
TNFRC2	TNFRC2	
FLIP	FLIP	

Product

Table 62: Properties of each product.

Id	Name	SBO
TNFRC2_FLIP	TNFRC2:FLIP	

Kinetic Law

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

$$v_{25} = \text{ka\_25} \cdot \text{TNFRC2} \cdot \text{FLIP} \tag{50}$$

Table 63: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_25	FLIP recruitment to TNFR Complex2 ka	0000009	0.313	$amol^{-1} \cdot s^{-1}$	☑

5.26 Reaction J26

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

Name FLIP recruitment to TNFR Complex2F̃LIP

SBO:0000526 protein complex formation

Reaction equation

$$\text{FLIP} + \text{TNFRC2\_FLIP} \longrightarrow \text{TNFRC2\_FLIP\_FLIP} \tag{51}$$

Reactants

Table 64: Properties of each reactant.

Id	Name	SBO
FLIP	FLIP	
TNFRC2_FLIP	TNFRC2:FLIP	

Product

Table 65: Properties of each product.

Id	Name	SBO
TNFRC2_FLIP_FLIP	TNFRC2:FLIP:FLIP	

Kinetic Law

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

$$v_{26} = \mathrm{ka\_26} \cdot \mathrm{FLIP} \cdot \mathrm{TNFRC2\_FLIP} \tag{52}$$

Table 66: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_26	FLIP recruitment to TNFR Complex2F̃LIP ka	0000009	0.313	$\mathrm{amol}^{-1} \cdot \mathrm{s}^{-1}$	☑

5.27 Reaction J27

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

Name Procaspase-8 recruitment to TNFR Complex2

SBO:0000526 protein complex formation

Reaction equation

$$\mathrm{TNFRC2} + \mathrm{pCasp8} \longrightarrow \mathrm{TNFRC2\_pCasp8} \tag{53}$$

Reactants

Table 67: Properties of each reactant.

Id	Name	SBO
TNFRC2	TNFRC2	
pCasp8	pCasp8	

Product

Table 68: Properties of each product.

Id	Name	SBO
TNFRC2_pCasp8	TNFRC2:pCasp8	

Kinetic Law

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

$$v_{27} = \text{ka\_27} \cdot \text{TNFRC2} \cdot \text{pCasp8} \tag{54}$$

Table 69: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_27	Procaspase-8 recruitment to TNFR Complex2 ka	0000009	0.031	$amol^{-1} \cdot s^{-1}$	☑

5.28 Reaction J28

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

Name Procaspase-8 recruitment to TNFR Complex2P̃rocaspase-8

SBO:0000526 protein complex formation

Reaction equation

$$\text{TNFRC2\_pCasp8} + \text{pCasp8} \longrightarrow \text{TNFRC2\_pCasp8\_pCasp8} \tag{55}$$

Reactants

Table 70: Properties of each reactant.

Id	Name	SBO
TNFRC2_pCasp8	TNFRC2:pCasp8	
pCasp8	pCasp8	

Product

Table 71: Properties of each product.

Id	Name	SBO
TNFRC2_pCasp8_pCasp8	TNFRC2:pCasp8:pCasp8	

Kinetic Law

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

$$v_{28} = \mathrm{ka\_28} \cdot \mathrm{TNFRC2\_pCasp8} \cdot \mathrm{pCasp8} \tag{56}$$

Table 72: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_28	Procaspase-8 recruitment to TNFR Complex2-P̃rocaspase-8 ka	0000009	0.031	$\mathrm{amol}^{-1} \cdot \mathrm{s}^{-1}$	☑

5.29 Reaction J29

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

Name Caspase-8 activation by TNFR Complex2

SBO:0000180 dissociation

Reaction equation

$$\mathrm{TNFRC2\_pCasp8\_pCasp8} \longrightarrow \mathrm{TNFRC2} + \mathrm{Casp8} \tag{57}$$

Reactant

Table 73: Properties of each reactant.

Id	Name	SBO
TNFRC2_pCasp8_pCasp8	TNFRC2:pCasp8:pCasp8	

Products

Table 74: Properties of each product.

Id	Name	SBO
TNFRC2	TNFRC2	
Casp8	Casp8	

Kinetic Law

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

$$v_{29} = \text{ka\_29} \cdot \text{TNFRC2\_pCasp8\_pCasp8} \tag{58}$$

Table 75: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_29	Caspase-8 activation by TNFR Complex2 ka	0000363	0.45	s^{-1}	☑

5.30 Reaction J30

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

Name FLIP recruitment to TNFR Complex2P̃rocaspase-8

SBO:0000526 protein complex formation

Reaction equation

$$\text{FLIP} + \text{TNFRC2\_pCasp8} \longrightarrow \text{TNFRC2\_FLIP\_pCasp8} \tag{59}$$

Reactants

Table 76: Properties of each reactant.

Id	Name	SBO
FLIP	FLIP	
TNFRC2_pCasp8	TNFRC2:pCasp8	

Product

Table 77: Properties of each product.

Id	Name	SBO
TNFRC2_FLIP_pCasp8	TNFRC2:FLIP:pCasp8	

Kinetic Law

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

$$v_{30} = \mathrm{ka\_30} \cdot \mathrm{FLIP} \cdot \mathrm{TNFRC2\_pCasp8} \tag{60}$$

Table 78: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_30	FLIP recruitment to TNFR Complex2-P̃rocaspase-8 ka	0000009	0.313	$\mathrm{amol}^{-1} \cdot \mathrm{s}^{-1}$	☑

5.31 Reaction J31

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

Name Procaspase-8 recruitment to TNFR Complex2F̃LIP

SBO:0000526 protein complex formation

Reaction equation

$$\mathrm{TNFRC2\_FLIP} + \mathrm{pCasp8} \longrightarrow \mathrm{TNFRC2\_FLIP\_pCasp8} \tag{61}$$

Reactants

Table 79: Properties of each reactant.

Id	Name	SBO
TNFRC2_FLIP	TNFRC2:FLIP	
pCasp8	pCasp8	

Product

Table 80: Properties of each product.

Id	Name	SBO
TNFRC2_FLIP_pCasp8	TNFRC2:FLIP:pCasp8	

Kinetic Law

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

$$v_{31} = \text{ka\_31} \cdot \text{TNFRC2\_FLIP} \cdot \text{pCasp8} \tag{62}$$

Table 81: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_31	Procaspase-8 recruitment to TNFR Complex2F̃LIP ka	0000009	0.313	$amol^{-1} \cdot s^{-1}$	☑

5.32 Reaction J32

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

Name Caspase-8 activation by TNFR Complex2F̃LIPP̃rocaspase-8

SBO:0000180 dissociation

Reaction equation

$$\text{TNFRC2\_FLIP\_pCasp8} \longrightarrow \text{TNFRC2} + \text{Casp8} \tag{63}$$

Reactant

Table 82: Properties of each reactant.

Id	Name	SBO
TNFRC2_FLIP_pCasp8	TNFRC2:FLIP:pCasp8	

Products

Table 83: Properties of each product.

Id	Name	SBO
TNFRC2 Casp8	TNFRC2 Casp8	

Kinetic Law

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

$$v_{32} = \text{ka\_32} \cdot \text{TNFRC2\_FLIP\_pCasp8} \tag{64}$$

Table 84: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_32	Caspase-8 activation by TNFR Complex2F̃LIP-P̃rocaspase-8 ka	0000363	0.3	s^{-1}	☑

5.33 Reaction J33

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

Name RIPT̃RAF2 recruitment at TNFR Complex2F̃LIPP̃rocaspase-8

SBO:0000526 protein complex formation

Reaction equation

$$\text{RIP} + \text{TRAF2} + \text{TNFRC2\_FLIP\_pCasp8} \longrightarrow \text{TNFRC2\_FLIP\_pCasp8\_RIP\_TRAF2} \tag{65}$$

Reactants

Table 85: Properties of each reactant.

Id	Name	SBO
RIP	RIP	
TRAF2	TRAF2	
TNFRC2_FLIP_pCasp8	TNFRC2:FLIP:pCasp8	

Product

Table 86: Properties of each product.

Id	Name	SBO
TNFRC2_FLIP_pCasp8_RIP_TRAF2	TNFRC2:FLIP:pCasp8:RIP:TRAF2	

Kinetic Law

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

$$v_{33} = \mathrm{ka\_33} \cdot \mathrm{RIP} \cdot \mathrm{TRAF2} \cdot \mathrm{TNFRC2\_FLIP\_pCasp8} \tag{66}$$

Table 87: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_33	RIPT̃RAF2 recruitment at TNFR Complex2F̃LIP-P̃rocaspase-8 ka	0000009	0.010	$\mathrm{amol}^{-2} \cdot \mathrm{s}^{-1}$	☑

5.34 Reaction J34

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

Name IKK activation by TNFR Complex2F̃LIPP̃rocaspase-8R̃IPT̃RAF2

SBO:0000170 stimulation

Reaction equation

$$\mathrm{IKK} \xrightarrow{\mathrm{TNFRC2\_FLIP\_pCasp8\_RIP\_TRAF2}} \mathrm{IKKa} \tag{67}$$

Reactant

Table 88: Properties of each reactant.

Id	Name	SBO
IKK	IKK	

Modifier

Table 89: Properties of each modifier.

Id	Name	SBO
TNFRC2_FLIP_pCasp8_RIP_TRAF2	TNFRC2:FLIP:pCasp8:RIP:TRAF2	

Product

Table 90: Properties of each product.

Id	Name	SBO
IKKa	IKKa	

Kinetic Law

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

$$v_{34} = \mathrm{ka\_34} \cdot \mathrm{TNFRC2\_FLIP\_pCasp8\_RIP\_TRAF2} \cdot \mathrm{IKK} \tag{68}$$

Table 91: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_34	IKK activation by TNFR Complex2-FLIPProcaspase-8-RIPTRAF2 ka	0000363	0.031	$\mathrm{amol}^{-1} \cdot \mathrm{s}^{-1}$	☑

5.35 Reaction J35

This is a reversible reaction of no reactant forming one product.

Name IKK turnover

SBO:0000357 biological effect of a perturbation

Reaction equation

$$\emptyset \rightleftharpoons \mathrm{IKK} \tag{69}$$

Product

Table 92: Properties of each product.

Id	Name	SBO
IKK	IKK	

Kinetic Law

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

$$v_{35} = \mathrm{ka\_35} - \mathrm{kd\_35} \cdot \mathrm{IKK} \tag{70}$$

Table 93: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_35	IKK turnover ka	0000009	$6.4 \cdot 10^{-5}$	$\mathrm{amol} \cdot \mathrm{s}^{-1}$	☑
kd_35	IKK turnover kd	0000009	10^{-4}	s^{-1}	☑

5.36 Reaction J36

This is a reversible reaction of no reactant forming one product.

Name NF-kappaB turnover

SBO:0000357 biological effect of a perturbation

Reaction equation

$$\emptyset \rightleftharpoons \mathrm{NFkB} \tag{71}$$

Product

Table 94: Properties of each product.

Id	Name	SBO
NFkB	NFkB	

Kinetic Law

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

$$v_{36} = \text{ka\_36} - \text{kd\_36} \cdot \text{NFkB} \tag{72}$$

Table 95: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_36	NF-kappaB turnover ka	0000009	$1.6 \cdot 10^{-6}$	$\text{amol} \cdot \text{s}^{-1}$	☑
kd_36	NF-kappaB turnover kd	0000009	10^{-4}	s^{-1}	☑

5.37 Reaction J37

This is a reversible reaction of no reactant forming one product.

Name FLIP turnover

SBO:0000357 biological effect of a perturbation

Reaction equation

$$\emptyset \rightleftharpoons \text{FLIP} \tag{73}$$

Product

Table 96: Properties of each product.

Id	Name	SBO
FLIP	FLIP	

Kinetic Law

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

$$v_{37} = \text{ka\_37} - \text{kd\_37} \cdot \text{FLIP} \tag{74}$$

Table 97: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_37	FLIP turnover ka	0000009	$2.24902 \cdot 10^{-6}$	$\text{amol} \cdot \text{s}^{-1}$	☑
kd_37	FLIP turnover kd	0000009	10^{-4}	s^{-1}	☑

5.38 Reaction J38

This is a reversible reaction of no reactant forming one product.

Name XIAP turnover

SBO:0000357 biological effect of a perturbation

Reaction equation

$$\emptyset \rightleftharpoons \text{XIAP} \tag{75}$$

Product

Table 98: Properties of each product.

Id	Name	SBO
XIAP	XIAP	

Kinetic Law

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

$$v_{38} = \text{ka\_38} - \text{kd\_38} \cdot \text{XIAP} \tag{76}$$

Table 99: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_38	XIAP turnover ka	0000009	$7.72256 \cdot 10^{-4}$	$\text{amol} \cdot \text{s}^{-1}$	☑
kd_38	XIAP turnover kd	0000009	10^{-4}	s^{-1}	☑

5.39 Reaction J39

This is a reversible reaction of no reactant forming one product.

Name A20 turnover

SBO:0000357 biological effect of a perturbation

Reaction equation

$$\emptyset \rightleftharpoons \text{A20} \tag{77}$$

Product

Table 100: Properties of each product.

Id	Name	SBO
A20	A20	

Kinetic Law

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

$$v_{39} = \text{ka\_39} - \text{kd\_39} \cdot \text{A20} \tag{78}$$

Table 101: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_39	A20 turnover ka	0000009	$9.6 \cdot 10^{-6}$	$\text{amol} \cdot \text{s}^{-1}$	☑
kd_39	A20 turnover kd	0000009	10^{-4}	s^{-1}	☑

5.40 Reaction J40

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

Name IKK* degradation

SBO:0000179 degradation

Reaction equation

$$\text{IKKa} \longrightarrow \emptyset \tag{79}$$

Reactant

Table 102: Properties of each reactant.

Id	Name	SBO
IKKa	IKKa	

Kinetic Law

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

$$v_{40} = \text{ka\_40} \cdot \text{IKKa} \tag{80}$$

Table 103: Properties of each parameter.

Id	Name		SBO	Value	Unit	Constant
ka_40	IKK* ka	degradation	0000356	10^{-4}	s^{-1}	☑

5.41 Reaction J41

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

Name IkappaBalphaÑF-kappaB complex degradation

SBO:0000179 degradation

Reaction equation

$$\text{IkBa\_NFkB} \longrightarrow \emptyset \tag{81}$$

Reactant

Table 104: Properties of each reactant.

Id	Name	SBO
IkBa_NFkB	IkBa:NFkB	

Kinetic Law

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

$$v_{41} = \text{ka\_41} \cdot \text{IkBa\_NFkB} \tag{82}$$

Table 105: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_41	IkappaBalphaÑF-kappaB complex degradation ka	0000356	10^{-4}	s^{-1}	☑

5.42 Reaction J42

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

Name nuclear NF-kappaB degradation

SBO:0000179 degradation

Reaction equation

$$\text{NFkB\_N} \longrightarrow \emptyset \tag{83}$$

Reactant

Table 106: Properties of each reactant.

Id	Name	SBO
NFkB_N	NFkB_N	

Kinetic Law

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

$$v_{42} = \text{ka\_42} \cdot \text{NFkB\_N} \tag{84}$$

Table 107: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_42	nuclear NF-kappaB degradation ka	0000356	10^{-4}	s^{-1}	☑

5.43 Reaction J43

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

Name IkappaBalpha-mRNA degradation

SBO:0000179 degradation

Reaction equation

$$\text{IkBa\_mRNA} \longrightarrow \emptyset \tag{85}$$

Reactant

Table 108: Properties of each reactant.

Id	Name	SBO
IkBa_mRNA	IkBa_mRNA	

Kinetic Law

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

$$v_{43} = \text{ka\_43} \cdot \text{IkBa\_mRNA} \tag{86}$$

Table 109: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_43	IkappaBalpha-mRNA degradation ka	0000356	$3.94201 \cdot 10^{-4}$	s^{-1}	☑

5.44 Reaction J44

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

Name IkappaBalpha degradation

SBO:0000179 degradation

Reaction equation

$$\text{IkBa} \longrightarrow \emptyset \tag{87}$$

Reactant

Table 110: Properties of each reactant.

Id	Name	SBO
IkBa	IkBa	

Kinetic Law

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

$$v_{44} = \text{ka\_44} \cdot \text{IkBa} \tag{88}$$

Table 111: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_44	IkappaBalpha degradation ka	0000356	0.002	s^{-1}	☑

5.45 Reaction J45

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

Name free nuclear IkappaBalpha degradation

SBO:0000179 degradation

Reaction equation

$$\text{IkBa\_N} \longrightarrow \emptyset \tag{89}$$

Reactant

Table 112: Properties of each reactant.

Id	Name	SBO
IkBa_N	IkBa_N	

Kinetic Law

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

$$v_{45} = \text{ka\_45} \cdot \text{IkBa\_N} \tag{90}$$

Table 113: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_45	free nuclear IkappaBalpha degradation ka	0000356	10^{-4}	s^{-1}	☑

5.46 Reaction J46

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

Name nuclear IkappaBalphaÑF-kappaB complex degradation

SBO:0000179 degradation

Reaction equation

$$\text{IkBa\_NFkB\_N} \longrightarrow \emptyset \tag{91}$$

Reactant

Table 114: Properties of each reactant.

Id	Name	SBO
IkBa_NFkB_N	IkBa:NFkB_N	

Kinetic Law

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

$$v_{46} = \text{ka\_46} \cdot \text{IkBa\_NFkB\_N} \tag{92}$$

Table 115: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_46	nuclear IkappaBalphaÑF-kappaB complex degradation ka	0000356	10^{-4}	s^{-1}	☑

5.47 Reaction J47

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

Name P-IkappaBa degradation

SBO:0000179 degradation

Reaction equation

$$\text{PIkBa} \longrightarrow \emptyset \tag{93}$$

Reactant

Table 116: Properties of each reactant.

Id	Name	SBO
PIkBa	PIkBa	

Kinetic Law

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

$$v_{47} = \text{ka\_47} \cdot \text{PIkBa} \tag{94}$$

Table 117: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_47	P-IkappaBa degradation ka	0000356	0.012	s^{-1}	☑

5.48 Reaction J48

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

Name A20-mRNA degradation

SBO:0000179 degradation

Reaction equation

$$\text{A20\_mRNA} \longrightarrow \emptyset \tag{95}$$

Reactant

Table 118: Properties of each reactant.

Id	Name	SBO
A20_mRNA	A20_mRNA	

Kinetic Law

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

$$v_{48} = \text{ka\_48} \cdot \text{A20\_mRNA} \tag{96}$$

Table 119: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_48	A20-mRNA degradation ka	0000356	$4.70498 \cdot 10^{-4}$	s^{-1}	☑

5.49 Reaction J49

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

Name XIAP-mRNA degradation

SBO:0000179 degradation

Reaction equation

$$\text{XIAP\_mRNA} \longrightarrow \emptyset \tag{97}$$

Reactant

Table 120: Properties of each reactant.

Id	Name	SBO
XIAP_mRNA	XIAP_mRNA	

Kinetic Law

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

$$v_{49} = \text{ka\_49} \cdot \text{XIAP\_mRNA} \tag{98}$$

Table 121: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_49	XIAP-mRNA degradation ka	0000356	$1.04931 \cdot 10^{-4}$	s^{-1}	☑

5.50 Reaction J50

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

Name FLIP-mRNA degradation

SBO:0000179 degradation

Reaction equation

$$\text{FLIP\_mRNA} \longrightarrow \emptyset \tag{99}$$

Reactant

Table 122: Properties of each reactant.

Id	Name	SBO
FLIP_mRNA	FLIP_mRNA	

Kinetic Law

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

$$v_{50} = \text{ka\_50} \cdot \text{FLIP\_mRNA} \tag{100}$$

Table 123: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_50	FLIP-mRNA degradation ka	0000356	$1.65744 \cdot 10^{-4}$	s^{-1}	☑

5.51 Reaction J51

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

Name IKK activation by TNFR Complex1

SBO:0000170 stimulation

Reaction equation

$$\text{IKK} \xrightarrow{\text{TNFRC1}} \text{IKKa} \tag{101}$$

Reactant

Table 124: Properties of each reactant.

Id	Name	SBO
IKK	IKK	

Modifier

Table 125: Properties of each modifier.

Id	Name	SBO
TNFRC1	TNFRC1	

Product

Table 126: Properties of each product.

Id	Name	SBO
IKKa	IKKa	

Kinetic Law

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

$$v_{51} = \text{ka\_51} \cdot \text{TNFRC1} \cdot \text{IKK} \tag{102}$$

Table 127: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_51	IKK activation by TNFR Complex1 ka	0000363	93.75	$\text{amol}^{-1} \cdot \text{s}^{-1}$	☑

5.52 Reaction J52

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

Name IKK* inactivation

SBO:0000169 inhibition

Reaction equation

$$\text{IKKa} \longrightarrow \text{IKK} \tag{103}$$

Reactant

Table 128: Properties of each reactant.

Id	Name	SBO
IKKa	IKKa	

Product

Table 129: Properties of each product.

Id	Name	SBO
IKK	IKK	

Kinetic Law

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

$$v_{52} = \text{ka\_52} \cdot \text{IKKa} \tag{104}$$

Table 130: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_52	IKK* inactivation ka	0000349	0.1	s^{-1}	☑

5.53 Reaction J53

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

Name TNFR Complex1 inactivation by A20

SBO:0000169 inhibition

Reaction equation

$$\text{TNFRC1} \xrightarrow{\text{A20}} \text{TRAF2} + \text{TNF\_TNFR\_TRADD} \tag{105}$$

Reactant

Table 131: Properties of each reactant.

Id	Name	SBO
TNFRC1	TNFRC1	

Modifier

Table 132: Properties of each modifier.

Id	Name	SBO
A20	A20	

Products

Table 133: Properties of each product.

Id	Name	SBO
TRAF2	TRAF2	
TNF_TNFR_TRADD	TNF:TNFR:TRADD	

Kinetic Law

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

$$v_{53} = \text{ka\_53} \cdot \text{TNFRC1} \cdot \text{A20} \tag{106}$$

Table 134: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_53	TNFR Complex1 inactivation by A20 ka	0000349	0.006	$\text{amol}^{-1} \cdot \text{s}^{-1}$	☑

5.54 Reaction J54

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

Name IkappaBalpha NF-kappaB association

SBO:0000526 protein complex formation

Reaction equation

$$\mathrm{NFkB} + \mathrm{IkBa} \longrightarrow \mathrm{IkBa\_NFkB} \tag{107}$$

Reactants

Table 135: Properties of each reactant.

Id	Name	SBO
NFkB	NFkB	
IkBa	IkBa	

Product

Table 136: Properties of each product.

Id	Name	SBO
IkBa_NFkB	IkBa:NFkB	

Kinetic Law

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

$$v_{54} = \mathrm{ka\_54} \cdot \mathrm{NFkB} \cdot \mathrm{IkBa} \tag{108}$$

Table 137: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_54	IkappaBalpha NF-kappaB association ka	0000337	1.25	$\mathrm{amol}^{-1} \cdot \mathrm{s}^{-1}$	☑

5.55 Reaction J55

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

Name release and degradation of bound IkappaBalpha

SBO:0000179 degradation

Reaction equation

$$\text{IkBa\_NFkB} \xrightarrow{\text{IKKa}} \text{NFkB} + \text{PIkBa} \tag{109}$$

Reactant

Table 138: Properties of each reactant.

Id	Name	SBO
IkBa_NFkB	IkBa:NFkB	

Modifier

Table 139: Properties of each modifier.

Id	Name	SBO
IKKa	IKKa	

Products

Table 140: Properties of each product.

Id	Name	SBO
NFkB	NFkB	
PIkBa	PIkBa	

Kinetic Law

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

$$v_{55} = \text{ka\_55} \cdot \text{IKKa} \cdot \text{IkBa\_NFkB} \tag{110}$$

Table 141: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_55	release and degradation of bound IkappaBalpha ka	0000356	0.104	$\mathrm{amol}^{-1} \cdot \mathrm{s}^{-1}$	☑

5.56 Reaction J56

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

Name NF-kappaB nuclear translocation

SBO:0000185 transport reaction

Reaction equation

$$\mathrm{NFkB} \longrightarrow \mathrm{NFkB\_N} \tag{111}$$

Reactant

Table 142: Properties of each reactant.

Id	Name	SBO
NFkB	NFkB	

Product

Table 143: Properties of each product.

Id	Name	SBO
NFkB_N	NFkB_N	

Kinetic Law

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

$$v_{56} = \mathrm{ka\_56} \cdot \mathrm{NFkB} \tag{112}$$

Table 144: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_56	NF-kappaB nuclear translocation ka	0000009	0.013	s^{-1}	☑

5.57 Reaction J57

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

Name IkappaBalpha-mRNA transcription

SBO:0000183 transcription

Reaction equation

$$\emptyset \xrightarrow{\text{NFkB\_N}} \text{IkBa\_mRNA} \tag{113}$$

Modifier

Table 145: Properties of each modifier.

Id	Name	SBO
NFkB_N	NFkB_N	

Product

Table 146: Properties of each product.

Id	Name	SBO
IkBa_mRNA	IkBa_mRNA	

Kinetic Law

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

$$v_{57} = \text{ka\_57} \cdot \text{NFkB\_N} \tag{114}$$

Table 147: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_57	IkappaBalpha-mRNA transcription ka	0000009	$3.0303 \cdot 10^{-5}$	s^{-1}	☑

5.58 Reaction J58

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

Name IkappaBalpha translation

SBO:0000184 translation

Reaction equation

$$\emptyset \xrightarrow{\text{IkBa\_mRNA}} \text{IkBa} \tag{115}$$

Modifier

Table 148: Properties of each modifier.

Id	Name	SBO
IkBa_mRNA	IkBa_mRNA	

Product

Table 149: Properties of each product.

Id	Name	SBO
IkBa	IkBa	

Kinetic Law

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

$$v_{58} = \text{ka\_58} \cdot \text{IkBa\_mRNA} \tag{116}$$

Table 150: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_58	IkappaBalpha translation ka	0000009	0.061	s^{-1}	☑

5.59 Reaction J59

This is a reversible reaction of one reactant forming one product.

Name IkappaBalpha nuclear translocation

SBO:0000526 protein complex formation

Reaction equation

$$\text{IkBa} \rightleftharpoons \text{IkBa\_N} \tag{117}$$

Reactant

Table 151: Properties of each reactant.

Id	Name	SBO
IkBa	IkBa	

Product

Table 152: Properties of each product.

Id	Name	SBO
IkBa_N	IkBa_N	

Kinetic Law

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

$$v_{59} = \text{ka\_59} \cdot \text{IkBa} - \text{kd\_59} \cdot \text{IkBa\_N} \tag{118}$$

Table 153: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_59	IkappaBalpha nuclear translocation ka	0000009	0.005	s^{-1}	☑
kd_59	IkappaBalpha nuclear translocation kd	0000009	0.003	s^{-1}	☑

5.60 Reaction J60

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

Name IkappaBalpha binding NF-kappaB in nucleus

SBO:0000526 protein complex formation

Reaction equation

$$\text{NFkB\_N} + \text{IkBa\_N} \longrightarrow \text{IkBa\_NFkB\_N} \tag{119}$$

Reactants

Table 154: Properties of each reactant.

Id	Name	SBO
NFkB_N	NFkB_N	
IkBa_N	IkBa_N	

Product

Table 155: Properties of each product.

Id	Name	SBO
IkBa_NFkB_N	IkBa:NFkB_N	

Kinetic Law

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

$$v_{60} = \text{ka\_60} \cdot \text{NFkB\_N} \cdot \text{IkBa\_N} \tag{120}$$

Table 156: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_60	IkappaBalpha binding NF-kappaB in nucleus ka	0000337	1.435	$\mathrm{amol}^{-1} \cdot \mathrm{s}^{-1}$	☑

5.61 Reaction J61

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

Name IkappaBalpha_NF-kappaB N-C export

SBO:0000185 transport reaction

Reaction equation

$$\mathrm{IkBa\_NFkB\_N} \longrightarrow \mathrm{IkBa\_NFkB} \tag{121}$$

Reactant

Table 157: Properties of each reactant.

Id	Name	SBO
IkBa_NFkB_N	IkBa:NFkB_N	

Product

Table 158: Properties of each product.

Id	Name	SBO
IkBa_NFkB	IkBa:NFkB	

Kinetic Law

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

$$v_{61} = \mathrm{ka\_61} \cdot \mathrm{IkBa\_NFkB\_N} \tag{122}$$

Table 159: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_61	IkappaBalpha_NF-kappaB N-C export ka	0000009	0.015	s^{-1}	☑

5.62 Reaction J62

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

Name A20-mRNA transcription

SBO:0000183 transcription

Reaction equation

$$\emptyset \xrightarrow{\text{NFkB\_N}} \text{A20\_mRNA} \tag{123}$$

Modifier

Table 160: Properties of each modifier.

Id	Name	SBO
NFkB_N	NFkB_N	

Product

Table 161: Properties of each product.

Id	Name	SBO
A20_mRNA	A20_mRNA	

Kinetic Law

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

$$v_{62} = \text{ka\_62} \cdot \text{NFkB\_N} \tag{124}$$

Table 162: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_62	A20-mRNA transcription ka	0000009	$3.78788 \cdot 10^{-5}$	s^{-1}	☑

5.63 Reaction J63

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

Name A20 translation

SBO:0000184 translation

Reaction equation

$$\emptyset \xrightarrow{\text{A20\_mRNA}} \text{A20} \tag{125}$$

Modifier

Table 163: Properties of each modifier.

Id	Name	SBO
A20_mRNA	A20_mRNA	

Product

Table 164: Properties of each product.

Id	Name	SBO
A20	A20	

Kinetic Law

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

$$v_{63} = \text{ka\_63} \cdot \text{A20\_mRNA} \tag{126}$$

Table 165: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_63	A20 translation ka	0000009	0.015	s^{-1}	☑

5.64 Reaction J64

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

Name XIAP-mRNA transcription

SBO:0000183 transcription

Reaction equation

$$\emptyset \xrightarrow{\text{NFkB\_N}} \text{XIAP\_mRNA} \tag{127}$$

Modifier

Table 166: Properties of each modifier.

Id	Name	SBO
NFkB_N	NFkB_N	

Product

Table 167: Properties of each product.

Id	Name	SBO
XIAP_mRNA	XIAP_mRNA	

Kinetic Law

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

$$v_{64} = \text{ka\_64} \cdot \text{NFkB\_N} \tag{128}$$

Table 168: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_64	XIAP-mRNA transcription ka	0000009	$3.33333 \cdot 10^{-5}$	s^{-1}	☑

5.65 Reaction J65

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

Name XIAP translation

SBO:0000184 translation

Reaction equation

$$\emptyset \xrightarrow{\text{XIAP\_mRNA}} \text{XIAP} \tag{129}$$

Modifier

Table 169: Properties of each modifier.

Id	Name	SBO
XIAP_mRNA	XIAP_mRNA	

Product

Table 170: Properties of each product.

Id	Name	SBO
XIAP	XIAP	

Kinetic Law

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

$$v_{65} = \text{ka\_65} \cdot \text{XIAP\_mRNA} \tag{130}$$

Table 171: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_65	XIAP translation ka	0000009	0.051	s^{-1}	☑

5.66 Reaction J66

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

Name FLIP-mRNA transcription

SBO:0000183 transcription

Reaction equation

$$\emptyset \xrightarrow{\text{NFkB\_N}} \text{FLIP\_mRNA} \tag{131}$$

Modifier

Table 172: Properties of each modifier.

Id	Name	SBO
NFkB_N	NFkB_N	

Product

Table 173: Properties of each product.

Id	Name	SBO
FLIP_mRNA	FLIP_mRNA	

Kinetic Law

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

$$v_{66} = \text{ka\_66} \cdot \text{NFkB\_N} \tag{132}$$

Table 174: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_66	FLIP-mRNA transcription ka	0000009	$3.33333 \cdot 10^{-5}$	s^{-1}	☑

5.67 Reaction J67

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

Name FLIP translation

SBO:0000184 translation

Reaction equation

$$\emptyset \xrightarrow{\text{FLIP\_mRNA}} \text{FLIP} \tag{133}$$

Modifier

Table 175: Properties of each modifier.

Id	Name	SBO
FLIP_mRNA	FLIP_mRNA	

Product

Table 176: Properties of each product.

Id	Name	SBO
FLIP	FLIP	

Kinetic Law

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

$$v_{67} = \text{ka\_67} \cdot \text{FLIP\_mRNA} \tag{134}$$

Table 177: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_67	FLIP translation ka	0000009	0.007	s^{-1}	☑

5.68 Reaction J68

This is a reversible reaction of no reactant forming one product.

Name Procaspase-8 turnover

SBO:0000357 biological effect of a perturbation

Reaction equation

$$\emptyset \rightleftharpoons \text{pCasp8} \tag{135}$$

Product

Table 178: Properties of each product.

Id	Name	SBO
pCasp8	pCasp8	

Kinetic Law

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

$$v_{68} = \text{ka\_68} - \text{kd\_68} \cdot \text{pCasp8} \tag{136}$$

Table 179: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_68	Procaspase-8 turnover ka	0000009	$1.97531 \cdot 10^{-4}$	$\text{amol} \cdot \text{s}^{-1}$	☑
kd_68	Procaspase-8 turnover kd	0000009	$6.17284 \cdot 10^{-5}$	s^{-1}	☑

5.69 Reaction J69

This is a reversible reaction of no reactant forming one product.

Name Procaspase-3 turnover

SBO:0000357 biological effect of a perturbation

Reaction equation

$$\emptyset \rightleftharpoons \text{pCasp3} \tag{137}$$

Product

Table 180: Properties of each product.

Id	Name	SBO
pCasp3	pCasp3	

Kinetic Law

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

$$v_{69} = \text{ka\_69} - \text{kd\_69} \cdot \text{pCasp3} \tag{138}$$

Table 181: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_69	Procaspase-3 turnover ka	0000009	$4.93827 \cdot 10^{-5}$	$\text{amol} \cdot \text{s}^{-1}$	☑
kd_69	Procaspase-3 turnover kd	0000009	$6.17284 \cdot 10^{-5}$	s^{-1}	☑

5.70 Reaction J70

This is a reversible reaction of no reactant forming one product.

Name Procaspase-6 turnover

SBO:0000357 biological effect of a perturbation

Reaction equation

$$\emptyset \rightleftharpoons \text{pCasp6} \tag{139}$$

Product

Table 182: Properties of each product.

Id	Name	SBO
pCasp6	pCasp6	

Kinetic Law

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

$$v_{70} = \text{ka\_70} - \text{kd\_70} \cdot \text{pCasp6} \tag{140}$$

Table 183: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_70	Procaspase-6 turnover ka	0000009	$3.95062 \cdot 10^{-6}$	$\text{amol} \cdot \text{s}^{-1}$	☑
kd_70	Procaspase-6 turnover kd	0000009	$6.17284 \cdot 10^{-5}$	s^{-1}	☑

5.71 Reaction J71

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

Name Caspase-8 degradation

SBO:0000179 degradation

Reaction equation

$$\text{Casp8} \longrightarrow \emptyset \tag{141}$$

Reactant

Table 184: Properties of each reactant.

Id	Name	SBO
Casp8	Casp8	

Kinetic Law

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

$$v_{71} = \text{ka\_71} \cdot \text{Casp8} \tag{142}$$

Table 185: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_71	Caspase-8 degradation ka	0000356	$5.78704 \cdot 10^{-5}$	s^{-1}	☑

5.72 Reaction J72

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

Name Caspase-3 degradation

SBO:0000179 degradation

Reaction equation

$$\text{Casp3} \longrightarrow \emptyset \tag{143}$$

Reactant

Table 186: Properties of each reactant.

Id	Name	SBO
Casp3	Casp3	

Kinetic Law

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

$$v_{72} = \text{ka\_72} \cdot \text{Casp3} \tag{144}$$

Table 187: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_72	Caspase-3 degradation ka	0000356	$5.78704 \cdot 10^{-5}$	s^{-1}	☑

5.73 Reaction J73

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

Name Caspase-6 degradation

SBO:0000179 degradation

Reaction equation

$$\text{Casp6} \longrightarrow \emptyset \tag{145}$$

Reactant

Table 188: Properties of each reactant.

Id	Name	SBO
Casp6	Casp6	

Kinetic Law

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

$$v_{73} = \text{ka\_73} \cdot \text{Casp6} \tag{146}$$

Table 189: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_73	Caspase-6 degradation ka	0000356	$5.78704 \cdot 10^{-5}$	s^{-1}	☑

5.74 Reaction J74

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

Name XIAP˜Caspase-3 complex degradation

SBO:0000179 degradation

Reaction equation

$$\text{XIAP\_Casp3} \longrightarrow \emptyset \tag{147}$$

Reactant

Table 190: Properties of each reactant.

Id	Name	SBO
XIAP_Casp3	XIAP:Casp3	

Kinetic Law

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

$$v_{74} = \mathrm{ka\_74} \cdot \mathrm{XIAP\_Casp3} \tag{148}$$

Table 191: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_74	XIAP˜caspase-3 complex degradation ka	0000356	$5.78704 \cdot 10^{-5}$	s^{-1}	☑

5.75 Reaction J75

This is a reversible reaction of no reactant forming one product.

Name BAR turnover

SBO:0000357 biological effect of a perturbation

Reaction equation

$$\emptyset \rightleftharpoons \mathrm{BAR} \tag{149}$$

Product

Table 192: Properties of each product.

Id	Name	SBO
BAR	BAR	

Kinetic Law

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

$$v_{75} = \mathrm{ka\_75} - \mathrm{kd\_75} \cdot \mathrm{BAR} \tag{150}$$

Table 193: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_75	BAR turnover ka	0000009	$1.66603 \cdot 10^{-6}$	$\text{amol} \cdot \text{s}^{-1}$	☑
kd_75	BAR turnover kd	0000009	$5.78704 \cdot 10^{-6}$	s^{-1}	☑

5.76 Reaction J76

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

Name BARC̃aspase-8 complex degradation

SBO:0000179 degradation

Reaction equation

$$\text{BAR\_Casp8} \longrightarrow \emptyset \tag{151}$$

Reactant

Table 194: Properties of each reactant.

Id	Name	SBO
BAR_Casp8	BAR:Casp8	

Kinetic Law

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

$$v_{76} = \text{ka\_76} \cdot \text{BAR\_Casp8} \tag{152}$$

Table 195: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_76	BARC̃aspase-8 complex degradation ka	0000356	$5.78704 \cdot 10^{-5}$	s^{-1}	☑

5.77 Reaction J77

This is a reversible reaction of one reactant forming no product.

Name PARP turnover

SBO:0000357 biological effect of a perturbation

Reaction equation

$$\text{PARP} \rightleftharpoons \emptyset \tag{153}$$

Reactant

Table 196: Properties of each reactant.

Id	Name	SBO
PARP	PARP	

Kinetic Law

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

$$v_{77} = \text{ka\_77} \cdot \text{PARP} - \text{kd\_77} \tag{154}$$

Table 197: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_77	PARP turnover ka	0000009	$5.78704 \cdot 10^{-6}$	s^{-1}	☑
kd_77	PARP turnover kd	0000009	$9.64506 \cdot 10^{-6}$	$\text{amol} \cdot \text{s}^{-1}$	☑

5.78 Reaction J78

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

Name CPARP degradation

SBO:0000179 degradation

Reaction equation

$$\text{cPARP} \longrightarrow \emptyset \tag{155}$$

Reactant

Table 198: Properties of each reactant.

Id	Name	SBO
cPARP	cPARP	

Kinetic Law

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

$$v_{78} = \mathrm{ka\_78} \cdot \mathrm{cPARP} \tag{156}$$

Table 199: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_78	CPARP degradation ka	0000356	$5.78704 \cdot 10^{-6}$	s^{-1}	☑

5.79 Reaction J79

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

Name Caspase-3 activation

SBO:0000170 stimulation

Reaction equation

$$\mathrm{pCasp3} \xrightarrow{\mathrm{Casp8}} \mathrm{Casp3} \tag{157}$$

Reactant

Table 200: Properties of each reactant.

Id	Name	SBO
pCasp3	pCasp3	

Modifier

Table 201: Properties of each modifier.

Id	Name	SBO
Casp8	Casp8	

Product

Table 202: Properties of each product.

Id	Name	SBO
Casp3	Casp3	

Kinetic Law

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

$$v_{79} = \mathrm{ka\_79} \cdot \mathrm{pCasp3} \cdot \mathrm{Casp8} \tag{158}$$

Table 203: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_79	Caspase-3 activation ka	0000363	0.016	$\mathrm{amol}^{-1} \cdot \mathrm{s}^{-1}$	☑

5.80 Reaction J80

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

Name Caspase-6 activation

SBO:0000170 stimulation

Reaction equation

$$\mathrm{pCasp6} \xrightarrow{\mathrm{Casp3}} \mathrm{Casp6} \tag{159}$$

Reactant

Table 204: Properties of each reactant.

Id	Name	SBO
pCasp6	pCasp6	

Modifier

Table 205: Properties of each modifier.

Id	Name	SBO
Casp3	Casp3	

Product

Table 206: Properties of each product.

Id	Name	SBO
Casp6	Casp6	

Kinetic Law

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

$$v_{80} = \mathrm{ka\_80} \cdot \mathrm{pCasp6} \cdot \mathrm{Casp3} \tag{160}$$

Table 207: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_80	Caspase-6 activation ka	0000363	0.009	$\mathrm{amol}^{-1} \cdot \mathrm{s}^{-1}$	☑

5.81 Reaction J81

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

Name Caspase-8 activation

SBO:0000170 stimulation

Reaction equation

$$\text{pCasp8} \xrightarrow{\text{Casp6}} \text{Casp8} \tag{161}$$

Reactant

Table 208: Properties of each reactant.

Id	Name	SBO
pCasp8	pCasp8	

Modifier

Table 209: Properties of each modifier.

Id	Name	SBO
Casp6	Casp6	

Product

Table 210: Properties of each product.

Id	Name	SBO
Casp8	Casp8	

Kinetic Law

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

$$v_{81} = \text{ka\_81} \cdot \text{pCasp8} \cdot \text{Casp6} \tag{162}$$

Table 211: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_81	Caspase-8 activation ka	0000363	0.002	$\text{amol}^{-1} \cdot \text{s}^{-1}$	☑

5.82 Reaction J82

This is a reversible reaction of two reactants forming one product.

Name XIAPC̃aspase-3 complex formation

SBO:0000526 protein complex formation

Reaction equation

$$\mathrm{XIAP} + \mathrm{Casp3} \rightleftharpoons \mathrm{XIAP\_Casp3} \tag{163}$$

Reactants

Table 212: Properties of each reactant.

Id	Name	SBO
XIAP	XIAP	
Casp3	Casp3	

Product

Table 213: Properties of each product.

Id	Name	SBO
XIAP_Casp3	XIAP:Casp3	

Kinetic Law

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

$$v_{82} = \mathrm{ka\_82} \cdot \mathrm{XIAP} \cdot \mathrm{Casp3} - \mathrm{kd\_82} \cdot \mathrm{XIAP\_Casp3} \tag{164}$$

Table 214: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_82	XIAPC̃aspase-3 complex formation ka	0000337	0.625	$\mathrm{amol}^{-1} \cdot \mathrm{s}^{-1}$	☑
kd_82	XIAPC̃aspase-3 complex formation kd	0000337	0.001	s^{-1}	☑

5.83 Reaction J83

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

Name XIAP degradation due to Caspase-3

SBO:0000179 degradation

Reaction equation

$$\mathrm{XIAP} \xrightarrow{\mathrm{Casp3}} \emptyset \tag{165}$$

Reactant

Table 215: Properties of each reactant.

Id	Name	SBO
XIAP	XIAP	

Modifier

Table 216: Properties of each modifier.

Id	Name	SBO
Casp3	Casp3	

Kinetic Law

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

$$v_{83} = \mathrm{ka\_83} \cdot \mathrm{XIAP} \cdot \mathrm{Casp3} \tag{166}$$

Table 217: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_83	XIAP degradation due to Caspase-3 ka	0000356	1.875	$\mathrm{amol}^{-1} \cdot \mathrm{s}^{-1}$	☑

5.84 Reaction J84

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

Name XIAP˜Caspase-3 complex breakup

SBO:0000180 dissociation

Reaction equation

$$\text{XIAP\_Casp3} \longrightarrow \text{XIAP} \tag{167}$$

Reactant

Table 218: Properties of each reactant.

Id	Name	SBO
XIAP_Casp3	XIAP:Casp3	

Product

Table 219: Properties of each product.

Id	Name	SBO
XIAP	XIAP	

Kinetic Law

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

$$v_{84} = \text{ka\_84} \cdot \text{XIAP\_Casp3} \tag{168}$$

Table 220: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_84	XIAP˜Caspase-3 complex breakup ka	0000282	$5 \cdot 10^{-5}$	s^{-1}	☑

5.85 Reaction J85

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

Name negative feedback loop Caspase-3 on TNFR Complex1

SBO:0000169 inhibition

Reaction equation

$$\mathrm{RIP} \xrightarrow{\mathrm{Casp3}} \emptyset \tag{169}$$

Reactant

Table 221: Properties of each reactant.

Id	Name	SBO
RIP	RIP	

Modifier

Table 222: Properties of each modifier.

Id	Name	SBO
Casp3	Casp3	

Kinetic Law

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

$$v_{85} = \mathrm{ka\_85} \cdot \mathrm{RIP} \cdot \mathrm{Casp3} \tag{170}$$

Table 223: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_85	negative feedback loop Caspase-3 on TNFR Complex1 ka	0000261	0.156	$\mathrm{amol}^{-1} \cdot \mathrm{s}^{-1}$	☑

5.86 Reaction J86

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

Name FLIP degradation by Caspase-3

SBO:0000179 degradation

Reaction equation

$$\text{FLIP} \xrightarrow{\text{Casp3}} \emptyset \tag{171}$$

Reactant

Table 224: Properties of each reactant.

Id	Name	SBO
FLIP	FLIP	

Modifier

Table 225: Properties of each modifier.

Id	Name	SBO
Casp3	Casp3	

Kinetic Law

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

$$v_{86} = \text{ka\_86} \cdot \text{FLIP} \cdot \text{Casp3} \tag{172}$$

Table 226: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_86	FLIP degradation by Caspase-3 ka	0000356	0.156	$\text{amol}^{-1} \cdot \text{s}^{-1}$	☑

5.87 Reaction J87

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

Name PARP cleavage as Casp3 substrate

SBO:0000178 cleavage

Reaction equation

$$\text{PARP} \xrightarrow{\text{Casp3}} \text{cPARP} \tag{173}$$

Reactant

Table 227: Properties of each reactant.

Id	Name	SBO
PARP	PARP	

Modifier

Table 228: Properties of each modifier.

Id	Name	SBO
Casp3	Casp3	

Product

Table 229: Properties of each product.

Id	Name	SBO
cPARP	cPARP	

Kinetic Law

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

$$v_{87} = \text{ka\_87} \cdot \text{Casp3} \cdot \text{PARP} \tag{174}$$

Table 230: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_87	PARP cleavage as Casp3 substrate ka	0000356	0.188	$\text{amol}^{-1} \cdot \text{s}^{-1}$	☑

5.88 Reaction J88

This is a reversible reaction of two reactants forming one product.

Name BARC̃aspase-8 complex formation

SBO:0000526 protein complex formation

Reaction equation

$$\mathrm{BAR} + \mathrm{Casp8} \rightleftharpoons \mathrm{BAR\_Casp8} \tag{175}$$

Reactants

Table 231: Properties of each reactant.

Id	Name	SBO
BAR	BAR	
Casp8	Casp8	

Product

Table 232: Properties of each product.

Id	Name	SBO
BAR_Casp8	BAR:Casp8	

Kinetic Law

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

$$v_{88} = \mathrm{ka\_88} \cdot \mathrm{BAR} \cdot \mathrm{Casp8} - \mathrm{kd\_88} \cdot \mathrm{BAR\_Casp8} \tag{176}$$

Table 233: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
ka_88	BARC̃aspase-8 complex formation ka	0000337	0.521	$\mathrm{amol}^{-1} \cdot \mathrm{s}^{-1}$	☑
kd_88	BARC̃aspase-8 complex formation kd	0000337	0.001	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 TNFR_E

Name TNFR_E

SBO:0000252 polypeptide chain

Initial amount 0.0050 $Unknownunita_mole$

This species takes part in three reactions (as a reactant in J3, J18 and as a product in J1).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNFR\_E} = v_1 - v_3 - v_{18} \tag{177}$$

6.2 Species TNF_E

Name TNF_E

SBO:0000252 polypeptide chain

Initial amount 0.2688 $Unknownunita_mole$

This species takes part in one reaction (as a reactant in J18).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNF\_E} = -v_{18} \tag{178}$$

6.3 Species TNF_TNFR_E

Name TNF:TNFR_E

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in three reactions (as a reactant in J8, J19 and as a product in J18).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNF\_TNFR\_E} = v_{18} - v_8 - v_{19} \tag{179}$$

6.4 Species TNFR

Name TNFR

SBO:0000252 polypeptide chain

Initial amount $2.8 \cdot 10^{-4}\ Unknownunita_mole$

This species takes part in two reactions (as a reactant in J1 and as a product in J2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNFR} = v_2 - v_1 \tag{180}$$

6.5 Species RIP

Name RIP

SBO:0000252 polypeptide chain

Initial amount $0.20256\ Unknownunita_mole$

This species takes part in five reactions (as a reactant in J20, J33, J85 and as a product in J4, J22).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{RIP} = v_4 + v_{22} - v_{20} - v_{33} - v_{85} \tag{181}$$

6.6 Species TRADD

Name TRADD

SBO:0000252 polypeptide chain

Initial amount $0.29344\ Unknownunita_mole$

This species takes part in two reactions (as a reactant in J19 and as a product in J5).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TRADD} = v_5 - v_{19} \tag{182}$$

6.7 Species TRAF2

Name TRAF2

SBO:0000252 polypeptide chain

Initial amount $0.33056\ Unknownunita_mole$

This species takes part in five reactions (as a reactant in J20, J33 and as a product in J6, J22, J53).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TRAF2} = v_6 + v_{22} + v_{53} - v_{20} - v_{33} \tag{183}$$

6.8 Species FADD

Name FADD

SBO:0000252 polypeptide chain

Initial amount 0.30944 $Unknownunita_mole$

This species takes part in two reactions (as a reactant in J23 and as a product in J7).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{FADD} = v_7 - 2v_{23} \tag{184}$$

6.9 Species TNF_TNFR_TRADD

Name TNF:TNFR:TRADD

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in four reactions (as a reactant in J9, J20 and as a product in J19, J53).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNF\_TNFR\_TRADD} = v_{19} + v_{53} - v_9 - v_{20} \tag{185}$$

6.10 Species TNFRC1

Name TNFRC1

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in five reactions (as a reactant in J10, J21, J53 and as a product in J20 and as a modifier in J51).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNFRC1} = v_{20} - v_{10} - v_{21} - v_{53} \tag{186}$$

6.11 Species TNFRCint1

Name TNFRCint1

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in two reactions (as a reactant in J22 and as a product in J21).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNFRCint1} = v_{21} - v_{22} \tag{187}$$

6.12 Species TNFRCint2

Name TNFRCint2

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in two reactions (as a reactant in J23 and as a product in J22).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNFRCint2} = v_{22} - v_{23} \tag{188}$$

6.13 Species TNFRCint3

Name TNFRCint3

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in two reactions (as a reactant in J24 and as a product in J23).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNFRCint3} = v_{23} - v_{24} \tag{189}$$

6.14 Species TNFRC2

Name TNFRC2

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in six reactions (as a reactant in J11, J25, J27 and as a product in J24, J29, J32).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNFRC2} = v_{24} + v_{29} + v_{32} - v_{11} - v_{25} - v_{27} \tag{190}$$

6.15 Species FLIP

Name FLIP

SBO:0000252 polypeptide chain

Initial amount 0.0320472 $Unknownunita_mole$

This species takes part in six reactions (as a reactant in J25, J26, J30, J86 and as a product in J37, J67).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{FLIP} = v_{37} + v_{67} - v_{25} - v_{26} - v_{30} - v_{86} \tag{191}$$

6.16 Species TNFRC2_FLIP

Name TNFRC2:FLIP

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in four reactions (as a reactant in J12, J26, J31 and as a product in J25).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNFRC2\_FLIP} = v_{25} - v_{12} - v_{26} - v_{31} \tag{192}$$

6.17 Species TNFRC2_pCasp8

Name TNFRC2:pCasp8

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in four reactions (as a reactant in J14, J28, J30 and as a product in J27).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNFRC2\_pCasp8} = v_{27} - v_{14} - v_{28} - v_{30} \tag{193}$$

6.18 Species TNFRC2_FLIP_FLIP

Name TNFRC2:FLIP:FLIP

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in two reactions (as a reactant in J13 and as a product in J26).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNFRC2\_FLIP\_FLIP} = v_{26} - v_{13} \tag{194}$$

6.19 Species TNFRC2_pCasp8_pCasp8

Name TNFRC2:pCasp8:pCasp8

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in three reactions (as a reactant in J15, J29 and as a product in J28).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNFRC2\_pCasp8\_pCasp8} = v_{28} - v_{15} - v_{29} \tag{195}$$

6.20 Species TNFRC2_FLIP_pCasp8

Name TNFRC2:FLIP:pCasp8

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in five reactions (as a reactant in J16, J32, J33 and as a product in J30, J31).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNFRC2\_FLIP\_pCasp8} = v_{30} + v_{31} - v_{16} - v_{32} - v_{33} \tag{196}$$

6.21 Species TNFRC2_FLIP_pCasp8_RIP_TRAF2

Name TNFRC2:FLIP:pCasp8:RIP:TRAF2

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in three reactions (as a reactant in J17 and as a product in J33 and as a modifier in J34).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TNFRC2\_FLIP\_pCasp8\_RIP\_TRAF2} = v_{33} - v_{17} \tag{197}$$

6.22 Species IKK

Name IKK

SBO:0000252 polypeptide chain

Initial amount 0.64 $Unknownunita_mole$

This species takes part in four reactions (as a reactant in J34, J51 and as a product in J35, J52).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IKK} = v_{35} + v_{52} - v_{34} - v_{51} \tag{198}$$

6.23 Species IKKa

Name IKKa

SBO:0000252 polypeptide chain

Initial amount 0 $Unknownunita_mole$

This species takes part in five reactions (as a reactant in J40, J52 and as a product in J34, J51 and as a modifier in J55).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IKKa} = v_{34} + v_{51} - v_{40} - v_{52} \tag{199}$$

6.24 Species A20

Name A20

SBO:0000252 polypeptide chain

Initial amount 0.104434 $Unknownunita_mole$

This species takes part in three reactions (as a product in J39, J63 and as a modifier in J53).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{A20} = v_{39} + v_{63} \tag{200}$$

6.25 Species NFkB

Name NFkB

SBO:0000252 polypeptide chain

Initial amount $1.15365 \cdot 10^{-4}$ $Unknownunita_mole$

This species takes part in four reactions (as a reactant in J54, J56 and as a product in J36, J55).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{NFkB} = v_{36} + v_{55} - v_{54} - v_{56} \tag{201}$$

6.26 Species IkBa

Name IkBa

SBO:0000252 polypeptide chain

Initial amount 0.00101518 $Unknownunita_mole$

This species takes part in four reactions (as a reactant in J44, J54, J59 and as a product in J58).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IkBa} = v_{58} - v_{44} - v_{54} - v_{59} \tag{202}$$

6.27 Species IkBa_NFkB

Name IkBa:NFkB

SBO:0000297 protein complex

Initial amount 0.0151032 $Unknownunita_mole$

This species takes part in four reactions (as a reactant in J41, J55 and as a product in J54, J61).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IkBa\_NFkB} = v_{54} + v_{61} - v_{41} - v_{55} \tag{203}$$

6.28 Species PIkBa

Name PIkBa

SBO:0000252 polypeptide chain

Initial amount $0\ Unknownunita_mole$

This species takes part in two reactions (as a reactant in J47 and as a product in J55).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{PIkBa} = v_{55} - v_{47} \tag{204}$$

6.29 Species NFkB_N

Name NFkB_N

SBO:0000252 polypeptide chain

Initial amount $6.91431 \cdot 10^{-4}\ Unknownunita_mole$

This species takes part in seven reactions (as a reactant in J42, J60 and as a product in J56 and as a modifier in J57, J62, J64, J66).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{NFkB\_N} = v_{56} - v_{42} - v_{60} \tag{205}$$

6.30 Species IkBa_N

Name IkBa_N

SBO:0000252 polypeptide chain

Initial amount $0.0013839\ Unknownunita_mole$

This species takes part in three reactions (as a reactant in J45, J60 and as a product in J59).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IkBa\_N} = v_{59} - v_{45} - v_{60} \tag{206}$$

6.31 Species IkBa_NFkB_N

Name IkBa:NFkB_N

SBO:0000297 protein complex

Initial amount $9.00189 \cdot 10^{-5}\ Unknownunita_mole$

This species takes part in three reactions (as a reactant in J46, J61 and as a product in J60).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IkBa\_NFkB\_N} = v_{60} - v_{46} - v_{61} \tag{207}$$

6.32 Species A20_mRNA

Name A20_mRNA

SBO:0000278 messenger RNA

Initial amount $5.56657 \cdot 10^{-5}\ Unknownunita_mole$

This species takes part in three reactions (as a reactant in J48 and as a product in J62 and as a modifier in J63).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{A20\_mRNA} = v_{62} - v_{48} \tag{208}$$

6.33 Species IkBa_mRNA

Name IkBa_mRNA

SBO:0000278 messenger RNA

Initial amount $5.31517 \cdot 10^{-5}\ Unknownunita_mole$

This species takes part in three reactions (as a reactant in J43 and as a product in J57 and as a modifier in J58).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IkBa\_mRNA} = v_{57} - v_{43} \tag{209}$$

6.34 Species XIAP_mRNA

Name XIAP_mRNA

SBO:0000278 messenger RNA

Initial amount $2.19646 \cdot 10^{-4}\ Unknownunita_mole$

This species takes part in three reactions (as a reactant in J49 and as a product in J64 and as a modifier in J65).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{XIAP\_mRNA} = v_{64} - v_{49} \tag{210}$$

6.35 Species FLIP_mRNA

Name FLIP_mRNA

SBO:0000278 messenger RNA

Initial amount $1.39056 \cdot 10^{-4}\ Unknownunita_mole$

This species takes part in three reactions (as a reactant in J50 and as a product in J66 and as a modifier in J67).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{FLIP\_mRNA} = v_{66} - v_{50} \tag{211}$$

6.36 Species BAR

Name BAR

SBO:0000252 polypeptide chain

Initial amount 0.28789 $Unknownunita_mole$

This species takes part in two reactions (as a reactant in J88 and as a product in J75).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{BAR} = v_{75} - v_{88} \tag{212}$$

6.37 Species XIAP

Name XIAP

SBO:0000252 polypeptide chain

Initial amount 7.83371 $Unknownunita_mole$

This species takes part in five reactions (as a reactant in J82, J83 and as a product in J38, J65, J84).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{XIAP} = v_{38} + v_{65} + v_{84} - v_{82} - v_{83} \tag{213}$$

6.38 Species pCasp8

Name pCasp8

SBO:0000252 polypeptide chain

Initial amount 3.2 $Unknownunita_mole$

This species takes part in five reactions (as a reactant in J27, J28, J31, J81 and as a product in J68).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pCasp8} = v_{68} - v_{27} - v_{28} - v_{31} - v_{81} \tag{214}$$

6.39 Species pCasp3

Name pCasp3

SBO:0000252 polypeptide chain

Initial amount 0.8 $Unknownunita_mole$

This species takes part in two reactions (as a reactant in J79 and as a product in J69).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pCasp3} = v_{69} - v_{79} \tag{215}$$

6.40 Species pCasp6

Name pCasp6

SBO:0000252 polypeptide chain

Initial amount 0.064 $Unknownunita_mole$

This species takes part in two reactions (as a reactant in J80 and as a product in J70).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{pCasp6} = v_{70} - v_{80} \tag{216}$$

6.41 Species Casp8

Name Casp8

SBO:0000252 polypeptide chain

Initial amount 0 $Unknownunita_mole$

This species takes part in six reactions (as a reactant in J71, J88 and as a product in J29, J32, J81 and as a modifier in J79).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Casp8} = v_{29} + v_{32} + v_{81} - v_{71} - v_{88} \tag{217}$$

6.42 Species Casp3

Name Casp3

SBO:0000252 polypeptide chain

Initial amount 0 $Unknownunita_mole$

This species takes part in eight reactions (as a reactant in J72, J82 and as a product in J79 and as a modifier in J80, J83, J85, J86, J87).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Casp3} = v_{79} - v_{72} - v_{82} \tag{218}$$

6.43 Species Casp6

Name Casp6

SBO:0000252 polypeptide chain

Initial amount 0 $Unknownunita_mole$

This species takes part in three reactions (as a reactant in J73 and as a product in J80 and as a modifier in J81).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Casp6} = v_{80} - v_{73} \tag{219}$$

6.44 Species BAR_Casp8

Name BAR:Casp8

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in two reactions (as a reactant in J76 and as a product in J88).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{BAR\_Casp8} = v_{88} - v_{76} \tag{220}$$

6.45 Species XIAP_Casp3

Name XIAP:Casp3

SBO:0000297 protein complex

Initial amount 0 $Unknownunita_mole$

This species takes part in three reactions (as a reactant in J74, J84 and as a product in J82).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{XIAP\_Casp3} = v_{82} - v_{74} - v_{84} \tag{221}$$

6.46 Species PARP

Name PARP

SBO:0000252 polypeptide chain

Initial amount 1.66667 $Unknownunita_mole$

This species takes part in two reactions (as a reactant in J77, J87).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{PARP} = -v_{77} - v_{87} \tag{222}$$

6.47 Species cPARP

Name cPARP

SBO:0000252 polypeptide chain

Initial amount 0 $Unknownunita_mole$

This species takes part in two reactions (as a reactant in J78 and as a product in J87).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{cPARP} = v_{87} - v_{78} \tag{223}$$

A Glossary of Systems Biology Ontology Terms

SBO:0000009 kinetic constant: Numerical parameter that quantifies the velocity of a chemical reaction

SBO:0000169 inhibition: Negative modulation of the execution of a process

SBO:0000170 stimulation: Positive modulation of the execution of a process

SBO:0000178 cleavage: Rupture of a covalent bond resulting in the conversion of one physical entity into several physical entities

SBO:0000179 degradation: Complete disappearance of a physical entity

SBO:0000180 dissociation: Transformation of a non-covalent complex that results in the formation of several independent biochemical entitie

SBO:0000183 transcription: Process through which a DNA sequence is copied to produce a complementary RNA

SBO:0000184 translation: Process in which a polypeptide chain is produced from a messenger RNA

SBO:0000185 transport reaction: Movement of a physical entity without modification of the structure of the entity

SBO:0000252 polypeptide chain: Naturally occurring macromolecule formed by the repetition of amino-acid residues linked by peptidic bonds. A polypeptide chain is synthesized by the ribosome. CHEBI:1654

SBO:0000261 inhibitory constant: Dissociation constant of a compound from a target of which it inhibits the function.

SBO:0000278 messenger RNA: A messenger RNA is a ribonucleic acid synthesized during the transcription of a gene, and that carries the information to encode one or several proteins

SBO:0000282 dissociation constant: Equilibrium constant that measures the propensity of a larger object to separate (dissociate) reversibly into smaller components, as when a complex falls apart into its component molecules, or when a salt splits up into its component ions. The dissociation constant is usually denoted Kd and is the inverse of the affinity constant.

SBO:0000290 physical compartment: Specific location of space, that can be bounded or not. A physical compartment can have 1, 2 or 3 dimensions

SBO:0000297 protein complex: Macromolecular complex containing one or more polypeptide chains possibly associated with simple chemicals. CHEBI:3608

SBO:0000337 association constant: Equilibrium constant that measures the propensity of two objects to assemble (associate) reversibly into a larger component. The association constant is usually denoted Ka and is the inverse of the dissociation constant.

SBO:0000349 inactivation rate constant: Kinetic constant describing the rate of an irreversible enzyme inactivation by decay of the active enzyme into its inactive form

SBO:0000356 decay constant: Kinetic constant characterising a mono-exponential decay. It is the inverse of the mean lifetime of the continuant being decayed. Its unit is"per tim".

SBO:0000357 biological effect of a perturbation: Biochemical networks can be affected by external influences. Those influences can be well-defined physical perturbations, such as a light pulse, or a change in temperature but also more complex of not well defined phenomena, for instance a biological process, an experimental setup, or a mutation

SBO:0000363 activation constant: Dissociation constant of a potentiator (activator) from a target (e.g. an enzyme) of which it activates the function

SBO:0000393 production: Generation of a material or conceptual entity.

SBO:0000395 encapsulating process: An aggregation of interactions and entities into a single process

SBO:0000526 protein complex formation: The process by which two or more proteins interact non-covalently to form a protein complex (SBO:0000297)

SBML2LaTeX was developed by Andreas Dräger[a], Hannes Planatscher[a], Dieudonné M Wouamba[a], Adrian Schröder[a], Michael Hucka[b], Lukas Endler[c], Martin Golebiewski[d] and Andreas Zell[a]. Please see http://www.ra.cs.uni-tuebingen.de/software/SBML2LaTeX for more information.

[a]Center for Bioinformatics Tübingen (ZBIT), Germany
[b]California Institute of Technology, Beckman Institute BNMC, Pasadena, United States
[c]European Bioinformatics Institute, Wellcome Trust Genome Campus, Hinxton, United Kingdom
[d]EML Research gGmbH, Heidelberg, Germany