SBML Model Report

Model name: “Webb2002 - Fas/FasL mediated tumor T-cell interaction”

May 17, 2018

1 General Overview

This is a document in SBML Level 2 Version 4 format. This model was created by the following four authors: Catherine Lloyd[1], Matthew Grant Roberts[2], Emma Fairbanks[3] and Rahuman Sheriff[4] at September seventh 2017 at 5:27 p. m. and last time modified at January 17th 2018 at 4:57 p. m. Table 1 gives an overview of the quantities of all components of this model.

Table 1: Number of components in this model, which are described in the following sections.

Element	Quantity	Element	Quantity
compartment types	0	compartments	3
species types	0	species	7
events	0	constraints	0
reactions	17	function definitions	12
global parameters	11	unit definitions	0
rules	0	initial assignments	0

Model Notes

Webb2002 - Fas/FasL mediated tumor T-cell interactionThis deterministic model ofimmunological surveillance involving tumour cellT-lymphocyteinteraction, cell surface expression of Fas/FasL, and theirsecreted soluble forms.

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This model is described in the article:Cells behaving badly: a theoretical model for the Fas/FasL system in tumour immunology.Webb SD, Sherratt JA, Fish RG.Math Biosci 2002 Sep-Oct; 179(2): 113-129

Abstract:

One proposed mechanism of tumour escape from immune surveillance is tumour up-regulation of the cell surface ligand FasL, which can lead to apoptosis of Fas receptor (Fas) positive lymphocytes. Based upon this 'counterattack', we have developed a mathematical model involving tumour cell-lymphocyte interaction, cell surface expression of Fas/FasL, and their secreted soluble forms. The model predicts that (a) the production of soluble forms of Fas and FasL will lead to the down-regulation of the immune response; (b) matrix metalloproteinase (MMP) inactivation should lead to increased membrane FasL and result in a higher rate of Fas-mediated apoptosis for lymphocytes than for tumour cells. Recent studies on cancer patients lend support for these predictions. The clinical implications are two-fold. Firstly, the use of broad spectrum MMP inhibitors as anti-angiogenic agents may be compromised by their adverse effect on tumour FasL up-regulation. Also, Fas/FasL interactions may have an impact on the outcome of numerous ongoing immunotherapeutic trials since the final common pathway of all these approaches is the transduction of death signals within the tumour cell.

This model is hosted on BioModels Database and identified by: BIOMD0000000661.

To cite BioModels Database, please use: Chelliah V et al. BioModels: ten-year anniversary. Nucl. Acids Res. 2015, 43(Database issue):D542-8.

2 Unit Definitions

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

2.1 Unit `substance`

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

Definition mol

2.2 Unit `volume`

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

Definition l

2.3 Unit `area`

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

Definition m^2

2.4 Unit `length`

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

Definition m

2.5 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
`compartment`	compartment		3	1	litre	☑	
`Tumour_cell`	Tumour cell		3	1	litre	☑	
`T_Lymphocyte_cell`	T-Lymphocyte cell		3	1	litre	☑	

3.1 Compartment `compartment`

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

Name compartment

3.2 Compartment `Tumour_cell`

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

Name Tumour cell

3.3 Compartment `T_Lymphocyte_cell`

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

Name T-Lymphocyte cell

4 Species

This model contains seven species. Section 8 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
`T`	T-cells (T)	`compartment`	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
`LT`	mFasL (LT)	`compartment`	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
`RT`	FasR (RT)	`T_Lymphocyte_cell`	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
`m`	Tumour cells (m)	`compartment`	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
`Lm`	mFasL (Lm)	`Tumour_cell`	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
`Rm`	FasR (Rm)	`Tumour_cell`	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
`SL`	sFasL (SL)	`compartment`	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟

5 Parameters

This model contains eleven global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		$8.38 \cdot 10^{-10}$		☑
k2	k2		0.006		☑
k3	k3		5.941		☑
k4	k4		0.350		☑
k5	k5		$2.52 \cdot 10^{-9}$		☑
k6	k6		2244.000		☑
k7	k7		0.350		☑
k8	k8		$1.92 \cdot 10^{10}$		☑
k9	k9		$8.73 \cdot 10^{9}$		☑
k10	k10		3110.000		☑
k11	k11		13.900		☑

6 Function definitions

This is an overview of twelve function definitions.

6.1 Function definition Constant_flux__irreversible

Name Constant flux (irreversible)

Argument v

Mathematical Expression

$$v \tag{1}$$

6.2 Function definition Function_for_T_cell_degradation

Name Function for T-cell degradation

Arguments k1, [m], [T], [Lm], [RT]

Mathematical Expression

$$k1 \cdot [m] \cdot [T] \cdot [Lm] \cdot [RT] \tag{2}$$

6.3 Function definition Function_for_tumour_cell_degradation

Name Function for tumour cell degradation

Arguments k1, [m], [T], [LT], [Rm]

Mathematical Expression

$$\mathrm{k1} \cdot [\mathrm{m}] \cdot [\mathrm{T}] \cdot [\mathrm{LT}] \cdot [\mathrm{Rm}] \tag{3}$$

6.4 Function definition Function_for_LT_synthesis

Name Function for LT synthesis

Arguments k2, [T], [m]

Mathematical Expression

$$\mathrm{k2} \cdot [\mathrm{T}] \cdot [\mathrm{m}] \tag{4}$$

6.5 Function definition Function_for_RT_degradation__SL_modifier

Name Function for RT degradation (SL modifier)

Arguments k8, [RT], [SL]

Mathematical Expression

$$\mathrm{k8} \cdot [\mathrm{RT}] \cdot [\mathrm{SL}] \tag{5}$$

6.6 Function definition Function_for_Rm_degradation__SL_modifier

Name Function for Rm degradation (SL modifier)

Arguments k8, [Rm], [SL]

Mathematical Expression

$$\mathrm{k8} \cdot [\mathrm{Rm}] \cdot [\mathrm{SL}] \tag{6}$$

6.7 Function definition Function_for_LT_degradation

Name Function for LT degradation

Arguments K4, k3, [LT]

Mathematical Expression

$$(\mathrm{K4} + \mathrm{k3}) \cdot [\mathrm{LT}] \tag{7}$$

6.8 Function definition Function_for_Lm_degradation

Name Function for Lm degradation

Arguments k3, k4, [Lm]

Mathematical Expression

$$(\mathrm{k3} + \mathrm{k4}) \cdot [\mathrm{Lm}] \tag{8}$$

6.9 Function definition Function_for_LT_degradation__m__T_and_Rm_modifiers

Name Function for LT degradation (m, T and Rm modifiers)

Arguments k5, [m], [T], [LT], [Rm]

Mathematical Expression

$$\mathrm{k5} \cdot [\mathrm{m}] \cdot [\mathrm{T}] \cdot [\mathrm{LT}] \cdot [\mathrm{Rm}] \tag{9}$$

6.10 Function definition Function_for_Lm_degradation__m__T_and_RT_modifiers

Name Function for Lm degradation (m, T and RT modifiers)

Arguments k5, [m], [T], [Lm], [RT]

Mathematical Expression

$$\mathrm{k5} \cdot [\mathrm{m}] \cdot [\mathrm{T}] \cdot [\mathrm{Lm}] \cdot [\mathrm{RT}] \tag{10}$$

6.11 Function definition Function_for_SL_synthesis

Name Function for SL synthesis

Arguments k3, [Lm], [m], [LT], [T]

Mathematical Expression

$$\mathrm{k3} \cdot ([\mathrm{Lm}] \cdot [\mathrm{m}] + [\mathrm{LT}] \cdot [\mathrm{T}]) \tag{11}$$

6.12 Function definition Function_for_SL_degradation__Rm__m__RT__T_and_SL_modifiers

Name Function for SL degradation (Rm, m, RT, T and SL modifiers)

Arguments k9, [Rm], [m], [RT], [T], [SL]

Mathematical Expression

$$\mathrm{k9} \cdot ([\mathrm{Rm}] \cdot [\mathrm{m}] + [\mathrm{RT}] \cdot [\mathrm{T}]) \cdot [\mathrm{SL}] \tag{12}$$

7 Reactions

This model contains 17 reactions. All reactions are listed in the following table and are subsequently described in detail. If a reaction is affected by a modifier, the identifier of this species is written above the reaction arrow.

Table 5: Overview of all reactions

№	Id	Name	Reaction Equation	SBO
1	T_cell_degradation	T-cell degradation	$\mathrm{T} \xrightarrow{\mathrm{m,\ Lm,\ RT}} \emptyset$	
2	Tumour_cell_degradation	Tumour cell degradation	$\mathrm{m} \xrightarrow{\mathrm{T,\ LT,\ Rm}} \emptyset$	
3	SL_degradation	SL degradation	$\mathrm{SL} \longrightarrow \emptyset$	
4	Lm_synthesis	Lm synthesis	$\emptyset \longrightarrow \mathrm{Lm}$	
5	RT_synthesis	RT synthesis	$\emptyset \longrightarrow \mathrm{RT}$	
6	Rm_synthesis	Rm synthesis	$\emptyset \longrightarrow \mathrm{Rm}$	
7	RT_degradation	RT degradation	$\mathrm{RT} \longrightarrow \emptyset$	
8	Rm_degradation	Rm degradation	$\mathrm{Rm} \longrightarrow \emptyset$	
9	LT_synthesis	LT synthesis	$\emptyset \xrightarrow{\mathrm{T,\ m}} \mathrm{LT}$	
10	RT_degradation__SL_modifier	RT degradation (SL modifier)	$\mathrm{RT} \xrightarrow{\mathrm{SL}} \emptyset$	
11	Rm_degradation__SL_modifier	Rm degradation (SL modifier)	$\mathrm{Rm} \xrightarrow{\mathrm{SL}} \emptyset$	
12	LT_degradation	LT degradation	$\mathrm{LT} \longrightarrow \emptyset$	
13	Lm_degradation	Lm degradation	$\mathrm{Lm} \longrightarrow \emptyset$	
14	LT_degradation__m__T_and_Rm_modifiers	LT degradation (m, T and Rm modifiers)	$\mathrm{LT} \xrightarrow{\mathrm{m,\ T,\ Rm}} \emptyset$	

№	Id	Name	Reaction Equation	SBO
15	Lm_degradation__m__T_and_RT_modifiers	Lm degradation (m, T and RT modifiers)	$\mathrm{Lm} \xrightarrow{\mathrm{m,\ T,\ RT}} \emptyset$	
16	SL_synthesis	SL formation	$\emptyset \xrightarrow{\mathrm{Lm,\ m,\ LT,\ T}} \mathrm{SL}$	
17	SL_degradation__Rm__m__RT__T_and_SL_modifiers	SL degradation (Rm, m, RT, T and SL modifiers)	$\mathrm{SL} \xrightarrow{\mathrm{Rm,\ m,\ RT,\ T}} \emptyset$	

7.1 Reaction T_cell_degradation

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

Name T-cell degradation

Notes `1 is version of urn:miriam:unknown:IDOMAL:0000393`

Reaction equation

$$\mathrm{T} \xrightarrow{\mathrm{m,\ Lm,\ RT}} \emptyset \tag{13}$$

Reactant

Table 6: Properties of each reactant.

Id	Name	SBO
T	T-cells (T)	

Modifiers

Table 7: Properties of each modifier.

Id	Name	SBO
m	Tumour cells (m)	
Lm	mFasL (Lm)	
RT	FasR (RT)	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \mathrm{Function\_for\_T\_cell\_degradation}\left(\mathrm{k1}, [\mathrm{m}], [\mathrm{T}], [\mathrm{Lm}], [\mathrm{RT}]\right) \tag{14}$$

$$\mathrm{Function\_for\_T\_cell\_degradation}\left(\mathrm{k1}, [\mathrm{m}], [\mathrm{T}], [\mathrm{Lm}], [\mathrm{RT}]\right) = \mathrm{k1} \cdot [\mathrm{m}] \cdot [\mathrm{T}] \cdot [\mathrm{Lm}] \cdot [\mathrm{RT}] \tag{15}$$

7.2 Reaction Tumour_cell_degradation

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

Name Tumour cell degradation

Reaction equation

$$\mathrm{m} \xrightarrow{\mathrm{T,\ LT,\ Rm}} \emptyset \tag{16}$$

Reactant

Table 8: Properties of each reactant.

Id	Name	SBO
m	Tumour cells (m)	

Modifiers

Table 9: Properties of each modifier.

Id	Name	SBO
T	T-cells (T)	
LT	mFasL (LT)	
Rm	FasR (Rm)	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \mathrm{Function\_for\_tumour\_cell\_degradation}\left(\mathrm{k1}, [\mathrm{m}], [\mathrm{T}], [\mathrm{LT}], [\mathrm{Rm}]\right) \tag{17}$$

$$\mathrm{Function\_for\_tumour\_cell\_degradation}\left(\mathrm{k1}, [\mathrm{m}], [\mathrm{T}], [\mathrm{LT}], [\mathrm{Rm}]\right) = \mathrm{k1} \cdot [\mathrm{m}] \cdot [\mathrm{T}] \cdot [\mathrm{LT}] \cdot [\mathrm{Rm}] \tag{18}$$

7.3 Reaction SL_degradation

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

Name SL degradation

Reaction equation

$$\mathrm{SL} \longrightarrow \emptyset \tag{19}$$

Reactant

Table 10: Properties of each reactant.

Id	Name	SBO
SL	sFasL (SL)	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \text{vol}\left(\text{compartment}\right) \cdot \text{k11} \cdot [\text{SL}] \tag{20}$$

7.4 Reaction Lm_synthesis

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

Name Lm synthesis

Reaction equation

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

Product

Table 11: Properties of each product.

Id	Name	SBO
Lm	mFasL (Lm)	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \text{vol}\left(\text{Tumour\_cell}\right) \cdot \text{Constant\_flux\_\_irreversible}\left(\text{k10}\right) \tag{22}$$

$$\text{Constant\_flux\_\_irreversible}\left(\text{v}\right) = \text{v} \tag{23}$$

$$\text{Constant\_flux\_\_irreversible}\left(\text{v}\right) = \text{v} \tag{24}$$

7.5 Reaction RT_synthesis

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

Name RT synthesis

Reaction equation

$$\emptyset \longrightarrow \mathrm{RT} \tag{25}$$

Product

Table 12: Properties of each product.

Id	Name	SBO
RT	FasR (RT)	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \mathrm{vol}\left(\mathrm{T\_Lymphocyte\_cell}\right) \cdot \mathrm{Constant\_flux\_\_irreversible}\left(\mathrm{k6}\right) \tag{26}$$

$$\mathrm{Constant\_flux\_\_irreversible}\left(\mathrm{v}\right) = \mathrm{v} \tag{27}$$

$$\mathrm{Constant\_flux\_\_irreversible}\left(\mathrm{v}\right) = \mathrm{v} \tag{28}$$

7.6 Reaction Rm_synthesis

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

Name Rm synthesis

Reaction equation

$$\emptyset \longrightarrow \mathrm{Rm} \tag{29}$$

Product

Table 13: Properties of each product.

Id	Name	SBO
Rm	FasR (Rm)	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \mathrm{vol}\left(\mathrm{Tumour\_cell}\right) \cdot \mathrm{Constant\_flux\_\_irreversible}\left(\mathrm{k6}\right) \tag{30}$$

$$\mathrm{Constant\_flux\_\_irreversible}\left(\mathrm{v}\right) = \mathrm{v} \tag{31}$$

$$\mathrm{Constant\_flux\_\_irreversible}\left(\mathrm{v}\right) = \mathrm{v} \tag{32}$$

7.7 Reaction RT_degradation

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

Name RT degradation

Reaction equation

$$\mathrm{RT} \longrightarrow \emptyset \tag{33}$$

Reactant

Table 14: Properties of each reactant.

Id	Name	SBO
RT	FasR (RT)	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \mathrm{vol}\left(\mathrm{T\_Lymphocyte\_cell}\right) \cdot \mathrm{k7} \cdot [\mathrm{RT}] \tag{34}$$

7.8 Reaction Rm_degradation

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

Name Rm degradation

Reaction equation

$$\mathrm{Rm} \longrightarrow \emptyset \tag{35}$$

Reactant

Table 15: Properties of each reactant.

Id	Name	SBO
Rm	FasR (Rm)	

Kinetic Law

Derived unit contains undeclared units

$$v_8 = \mathrm{vol}\left(\mathrm{Tumour\_cell}\right) \cdot \mathrm{k7} \cdot [\mathrm{Rm}] \tag{36}$$

7.9 Reaction LT_synthesis

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

Name LT synthesis

Reaction equation

$$\emptyset \xrightarrow{\mathrm{T},\ \mathrm{m}} \mathrm{LT} \tag{37}$$

Modifiers

Table 16: Properties of each modifier.

Id	Name	SBO
T	T-cells (T)	
m	Tumour cells (m)	

Product

Table 17: Properties of each product.

Id	Name	SBO
LT	mFasL (LT)	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \mathrm{vol}\,(\mathrm{compartment}) \cdot \mathrm{Function\_for\_LT\_synthesis}\,(\mathrm{k2}, [\mathrm{T}], [\mathrm{m}]) \tag{38}$$

$$\mathrm{Function\_for\_LT\_synthesis}\,(\mathrm{k2}, [\mathrm{T}], [\mathrm{m}]) = \mathrm{k2} \cdot [\mathrm{T}] \cdot [\mathrm{m}] \tag{39}$$

$$\mathrm{Function\_for\_LT\_synthesis}\,(\mathrm{k2}, [\mathrm{T}], [\mathrm{m}]) = \mathrm{k2} \cdot [\mathrm{T}] \cdot [\mathrm{m}] \tag{40}$$

7.10 Reaction `RT_degradation__SL_modifier`

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

Name RT degradation (SL modifier)

Reaction equation

$$\mathrm{RT} \xrightarrow{\mathrm{SL}} \emptyset \tag{41}$$

Reactant

Table 18: Properties of each reactant.

Id	Name	SBO
`RT`	FasR (RT)	

Modifier

Table 19: Properties of each modifier.

Id	Name	SBO
`SL`	sFasL (SL)	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \mathrm{Function\_for\_RT\_degradation\_\_SL\_modifier}\,(\mathrm{k8}, [\mathrm{RT}], [\mathrm{SL}]) \tag{42}$$

$$\mathrm{Function\_for\_RT\_degradation\_\_SL\_modifier}\,(\mathrm{k8}, [\mathrm{RT}], [\mathrm{SL}]) = \mathrm{k8} \cdot [\mathrm{RT}] \cdot [\mathrm{SL}] \tag{43}$$

7.11 Reaction `Rm_degradation__SL_modifier`

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

Name Rm degradation (SL modifier)

Reaction equation

$$\mathrm{Rm} \xrightarrow{\mathrm{SL}} \emptyset \tag{44}$$

Reactant

Table 20: Properties of each reactant.

Id	Name	SBO
Rm	FasR (Rm)	

Modifier

Table 21: Properties of each modifier.

Id	Name	SBO
SL	sFasL (SL)	

Kinetic Law

Derived unit contains undeclared units

$$v_{11} = \mathrm{Function\_for\_Rm\_degradation\_\_SL\_modifier}\left(\mathrm{k8}, [\mathrm{Rm}], [\mathrm{SL}]\right) \tag{45}$$

$$\mathrm{Function\_for\_Rm\_degradation\_\_SL\_modifier}\left(\mathrm{k8}, [\mathrm{Rm}], [\mathrm{SL}]\right) = \mathrm{k8} \cdot [\mathrm{Rm}] \cdot [\mathrm{SL}] \tag{46}$$

7.12 Reaction LT_degradation

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

Name LT degradation

Reaction equation

$$\mathrm{LT} \longrightarrow \emptyset \tag{47}$$

Reactant

Table 22: Properties of each reactant.

Id	Name	SBO
LT	mFasL (LT)	

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = \mathrm{vol}\left(\mathrm{compartment}\right) \cdot \mathrm{Function\_for\_LT\_degradation}\left(\mathrm{k4}, \mathrm{k3}, [\mathrm{LT}]\right) \tag{48}$$

$$\mathrm{Function\_for\_LT\_degradation}\left(\mathrm{K4}, \mathrm{k3}, [\mathrm{LT}]\right) = \left(\mathrm{K4} + \mathrm{k3}\right) \cdot [\mathrm{LT}] \tag{49}$$

$$\mathrm{Function\_for\_LT\_degradation}\left(\mathrm{K4}, \mathrm{k3}, [\mathrm{LT}]\right) = \left(\mathrm{K4} + \mathrm{k3}\right) \cdot [\mathrm{LT}] \tag{50}$$

7.13 Reaction `Lm_degradation`

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

Name Lm degradation

Reaction equation

$$\mathrm{Lm} \longrightarrow \emptyset \tag{51}$$

Reactant

Table 23: Properties of each reactant.

Id	Name	SBO
Lm	mFasL (Lm)	

Kinetic Law

Derived unit contains undeclared units

$$v_{13} = \mathrm{vol}\left(\mathrm{Tumour\_cell}\right) \cdot \mathrm{Function\_for\_Lm\_degradation}\left(\mathrm{k3}, \mathrm{k4}, [\mathrm{Lm}]\right) \tag{52}$$

$$\mathrm{Function\_for\_Lm\_degradation}\left(\mathrm{k3}, \mathrm{k4}, [\mathrm{Lm}]\right) = \left(\mathrm{k3} + \mathrm{k4}\right) \cdot [\mathrm{Lm}] \tag{53}$$

$$\mathrm{Function\_for\_Lm\_degradation}\left(\mathrm{k3}, \mathrm{k4}, [\mathrm{Lm}]\right) = \left(\mathrm{k3} + \mathrm{k4}\right) \cdot [\mathrm{Lm}] \tag{54}$$

7.14 Reaction LT_degradation__m__T_and_Rm_modifiers

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

Name LT degradation (m, T and Rm modifiers)

Notes NCIT_C20139

Reaction equation

$$\mathrm{LT} \xrightarrow{\mathrm{m},\ \mathrm{T},\ \mathrm{Rm}} \emptyset \tag{55}$$

Reactant

Table 24: Properties of each reactant.

Id	Name	SBO
LT	mFasL (LT)	

Modifiers

Table 25: Properties of each modifier.

Id	Name	SBO
m	Tumour cells (m)	
T	T-cells (T)	
Rm	FasR (Rm)	

Kinetic Law

Derived unit contains undeclared units

$$v_{14} = \mathrm{Function\_for\_LT\_degradation\_\_m\_\_T\_and\_Rm\_modifiers}\left(\mathrm{k5}, [\mathrm{m}], [\mathrm{T}], [\mathrm{LT}], [\mathrm{Rm}]\right) \tag{56}$$

$$\begin{aligned}&\mathrm{Function\_for\_LT\_degradation\_\_m\_\_T\_and\_Rm\_modifiers}\left(\mathrm{k5}, [\mathrm{m}], [\mathrm{T}], [\mathrm{LT}], [\mathrm{Rm}]\right)\\ &\quad = \mathrm{k5} \cdot [\mathrm{m}] \cdot [\mathrm{T}] \cdot [\mathrm{LT}] \cdot [\mathrm{Rm}]\end{aligned} \tag{57}$$

7.15 Reaction Lm_degradation__m__T_and_RT_modifiers

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

Name Lm degradation (m, T and RT modifiers)

Reaction equation

$$\mathrm{Lm} \xrightarrow{\mathrm{m},\ \mathrm{T},\ \mathrm{RT}} \emptyset \tag{58}$$

Reactant

Table 26: Properties of each reactant.

Id	Name	SBO
Lm	mFasL (Lm)	

Modifiers

Table 27: Properties of each modifier.

Id	Name	SBO
m	Tumour cells (m)	
T	T-cells (T)	
RT	FasR (RT)	

Kinetic Law

Derived unit contains undeclared units

$$v_{15} = \mathrm{Function\_for\_Lm\_degradation\_\_m\_\_T\_and\_RT\_modifiers}\left(\mathrm{k5}, [\mathrm{m}], [\mathrm{T}], [\mathrm{Lm}], [\mathrm{RT}]\right) \tag{59}$$

$$\begin{aligned}&\mathrm{Function\_for\_Lm\_degradation\_\_m\_\_T\_and\_RT\_modifiers}\left(\mathrm{k5}, [\mathrm{m}], [\mathrm{T}], [\mathrm{Lm}], [\mathrm{RT}]\right)\\ &\quad = \mathrm{k5} \cdot [\mathrm{m}] \cdot [\mathrm{T}] \cdot [\mathrm{Lm}] \cdot [\mathrm{RT}]\end{aligned} \tag{60}$$

7.16 Reaction `SL_synthesis`

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

Name SL formation

Notes `1 has property Systems Biology Ontology SBO:0000178`

Reaction equation

$$\emptyset \xrightarrow{\mathrm{Lm},\ \mathrm{m},\ \mathrm{LT},\ \mathrm{T}} \mathrm{SL} \tag{61}$$

Modifiers

Table 28: Properties of each modifier.

Id	Name	SBO
Lm	mFasL (Lm)	
m	Tumour cells (m)	
LT	mFasL (LT)	
T	T-cells (T)	

Product

Table 29: Properties of each product.

Id	Name	SBO
SL	sFasL (SL)	

Kinetic Law

Derived unit contains undeclared units

$$v_{16} = \text{Function\_for\_SL\_synthesis}\left(\text{k3}, [\text{Lm}], [\text{m}], [\text{LT}], [\text{T}]\right) \tag{62}$$

$$\text{Function\_for\_SL\_synthesis}\left(\text{k3}, [\text{Lm}], [\text{m}], [\text{LT}], [\text{T}]\right) = \text{k3} \cdot \left([\text{Lm}] \cdot [\text{m}] + [\text{LT}] \cdot [\text{T}]\right) \tag{63}$$

7.17 Reaction SL_degradation__Rm__m__RT__T_and_SL_modifiers

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

Name SL degradation (Rm, m, RT, T and SL modifiers)

Notes `1 is version of NCIt NCIT_C20139`

Reaction equation

$$\text{SL} \xrightarrow{\text{Rm, m, RT, T}} \emptyset \tag{64}$$

Reactant

Table 30: Properties of each reactant.

Id	Name	SBO
SL	sFasL (SL)	

Modifiers

Table 31: Properties of each modifier.

Id	Name	SBO
Rm	FasR (Rm)	
m	Tumour cells (m)	
RT	FasR (RT)	
T	T-cells (T)	

Kinetic Law

Derived unit contains undeclared units

$$v_{17} = \text{Function\_for\_SL\_degradation\_\_Rm\_\_m\_\_RT\_\_T\_and\_SL\_modifiers}\left(\text{k9}, [\text{Rm}], [\text{m}], [\text{RT}], [\text{T}], [\text{SL}]\right) \tag{65}$$

$$\text{Function\_for\_SL\_degradation\_\_Rm\_\_m\_\_RT\_\_T\_and\_SL\_modifiers}\left(\text{k9}, [\text{Rm}], [\text{m}], [\text{RT}], [\text{T}], [\text{SL}]\right) = \text{k9} \cdot \left([\text{Rm}] \cdot [\text{m}] + [\text{RT}] \cdot [\text{T}]\right) \cdot [\text{SL}] \tag{66}$$

8 Derived Rate Equations

When interpreted as an ordinary differential equation framework, this model implies the following set of equations for the rates of change of each species.

Identifiers for kinetic laws highlighted in gray cannot be verified to evaluate to units of SBML `substance` per `time`. As a result, some SBML interpreters may not be able to verify the consistency of the units on quantities in the model. Please check if

- parameters without an unit definition are involved or
- volume correction is necessary because the `hasOnlySubstanceUnits` flag may be set to `false` and `spacialDimensions`> 0 for certain species.

8.1 Species T

Name T-cells (T)

Initial concentration $500.000000000001 \text{ mol} \cdot \text{l}^{-1}$

This species takes part in seven reactions (as a reactant in T_cell_degradation and as a modifier in Tumour_cell_degradation, LT_synthesis, LT_degradation__m__T_and_Rm_modifiers, Lm_degradation__m__T_and_RT_modifiers, SL_synthesis, SL_degradation__Rm__m__RT__T_and_SL_modifiers).

$$\frac{d}{dt}\text{T} = -v_1 \tag{67}$$

8.2 Species LT

Name mFasL (LT)

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

This species takes part in five reactions (as a reactant in LT_degradation, LT_degradation__m__T_and_Rm_modifiers and as a product in LT_synthesis and as a modifier in Tumour_cell_degradation, SL_synthesis).

$$\frac{d}{dt}\text{LT} = v_9 - v_{12} - v_{14} \tag{68}$$

8.3 Species RT

Name FasR (RT)

Initial concentration $10000.0000000001 \text{ mol} \cdot \text{l}^{-1}$

This species takes part in six reactions (as a reactant in RT_degradation, RT_degradation__SL_modifier and as a product in RT_synthesis and as a modifier in T_cell_degradation, Lm_degradation__m__T_and_RT_modifiers, SL_degradation__Rm__m__RT__T_and_SL_modifiers).

$$\frac{d}{dt}\text{RT} = v_5 - v_7 - v_{10} \tag{69}$$

8.4 Species m

Name Tumour cells (m)

Initial concentration $500.000000000001 \text{ mol} \cdot \text{l}^{-1}$

This species takes part in seven reactions (as a reactant in Tumour_cell_degradation and as a modifier in T_cell_degradation, LT_synthesis, LT_degradation__m__T_and_Rm_modifiers, Lm_degradation__m__T_and_RT_modifiers, SL_synthesis, SL_degradation__Rm__m__RT__T_and_SL_modifiers).

$$\frac{d}{dt}\text{m} = -v_2 \tag{70}$$

8.5 Species Lm

Name mFasL (Lm)

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

This species takes part in five reactions (as a reactant in Lm_degradation, Lm_degradation__m__T_and_RT_modifiers and as a product in Lm_synthesis and as a modifier in T_cell_degradation, SL_synthesis).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Lm} = v_4 - v_{13} - v_{15} \tag{71}$$

8.6 Species Rm

Name FasR (Rm)

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

This species takes part in six reactions (as a reactant in Rm_degradation, Rm_degradation__SL_modifier and as a product in Rm_synthesis and as a modifier in Tumour_cell_degradation, LT_degradation__m__T_and_Rm_modifiers, SL_degradation__Rm__m__RT__T_and_SL_modifiers).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Rm} = v_6 - v_8 - v_{11} \tag{72}$$

8.7 Species SL

Name sFasL (SL)

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

This species takes part in five reactions (as a reactant in SL_degradation, SL_degradation__Rm__m__RT__T_and_SL_modifiers and as a product in SL_synthesis and as a modifier in RT_degradation__SL_modifier, Rm_degradation__SL_modifier).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{SL} = v_{16} - v_3 - v_{17} \tag{73}$$

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