SBML Model Report

Model name: "Wodarz2007 - Basic Model of Cytomegalovirus Infection"

May 17, 2018

1 General Overview

This is a document in SBML Level 2 Version 4 format. This model was created by the following two authors: Matthew Grant Roberts[1] and Catherine Lloyd[2] at June 25$^{\text{th}}$ 2010 at 1:41 p. m. and last time modified at March nineth 2018 at 4:21 p. 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	1
species types	0	species	0
events	0	constraints	0
reactions	0	function definitions	0
global parameters	16	unit definitions	3
rules	6	initial assignments	0

Model Notes

This a model from the article:
Dynamics of killer T cell inflation in viral infections.
Wodarz D, Sierro S, Klenerman P. J R Soc Interface 2007 Jun 22;4(14):533-43 17251133 ,
Abstract:

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Upon acute viral infection, a typical cytotoxic T lymphocyte (CTL) response ischaracterized by a phase of expansion and contraction after which it settles ata relatively stable memory level. Recently, experimental data from mice infectedwith murine cytomegalovirus (MCMV) showed different and unusual dynamics. Afteracute infection had resolved, some antigen specific CTL started to expand overtime despite the fact that no replicative virus was detectable. This phenomenonhas been termed as „CTL memory inflation„. In order to examine the dynamics ofthis system further, we developed a mathematical model analysing the impact ofinnate and adaptive immune responses. According to this model, a potentiallyimportant contributor to CTL inflation is competition between the specific CTLresponse and an innate natural killer (NK) cell response. Inflation occurs mostreadily if the NK cell response is more efficient than the CTL at reducing virusload during acute infection, but thereafter maintains a chronic virus load whichis sufficient to induce CTL proliferation. The model further suggests thatweaker NK cell mediated protection can correlate with more pronounced CTLinflation dynamics over time. We present experimental data from mice infectedwith MCMV which are consistent with the theoretical predictions. This modelprovides valuable information and may help to explain the inflation of CMVspecific CD8+T cells seen in humans as they age.

This model was taken from the CellML repository and automatically converted to SBML.
The original model was: **Wodarz D, Sierro S, Klenerman P. (2007) - version=1.0**
The original CellML model was created by:
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To cite BioModels Database, please use: Li C, Donizelli M, Rodriguez N, Dharuri H, Endler L, Chelliah V, Li L, He E, Henry A, Stefan MI, Snoep JL, Hucka M, Le Novre N, Laibe C (2010) BioModels Database: An enhanced, curated and annotated resource for published quantitative kinetic models. BMC Syst Biol., 4:92.

2 Unit Definitions

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

2.1 Unit `time`

Name time

Definition 3600 s

2.2 Unit `unit_0`

Name 1

Definition dimensionless^0

2.3 Unit `unit_1`

Name 1/(0.277778*ms)

Definition $(0.277778\ \text{ms})^{-1}$

2.4 Unit `substance`

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

Definition mol

2.5 Unit `volume`

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

Definition l

2.6 Unit `area`

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

Definition m^2

2.7 Unit `length`

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

Definition m

3 Compartment

This model contains one compartment.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
COMpartment	Mouse		3	1	litre	☑	

3.1 Compartment COMpartment

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

Name Mouse

4 Parameters

This model contains 16 global parameters.

Table 3: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
x	x		1.000	dimensionless^0	☐
y0	y0		0.000	dimensionless^0	☐
y1	y1		0.000	dimensionless^0	☐
L	L		0.000	dimensionless^0	☐
v	v		1.000	dimensionless^0	☐
R0	R0		15.909	dimensionless^0	☐
a0	a0		0.100	$(0.277778\ \text{ms})^{-1}$	☑
a1	a1		0.200	$(0.277778\ \text{ms})^{-1}$	☑
k	k		1.000	$(0.277778\ \text{ms})^{-1}$	☑
u	u		1.000	$(0.277778\ \text{ms})^{-1}$	☑
lambda	lambda		10.000	$(0.277778\ \text{ms})^{-1}$	☑
d	d		0.100	$(0.277778\ \text{ms})^{-1}$	☑
beta	beta		0.100	$(0.277778\ \text{ms})^{-1}$	☑
gamma	gamma		0.500	$(0.277778\ \text{ms})^{-1}$	☑
phi	phi		0.100	$(0.277778\ \text{ms})^{-1}$	☑
eta	eta		0.010	$(0.277778\ \text{ms})^{-1}$	☑

5 Rules

This is an overview of six rules.

5.1 Rule R0

Rule R0 is an assignment rule for parameter R0:

$$\mathrm{R0} = \frac{\mathrm{lambda} \cdot \mathrm{eta}}{\mathrm{d} \cdot \mathrm{a1} \cdot (\mathrm{a0} + \mathrm{eta})} \cdot \left(\mathrm{beta} + \frac{\mathrm{gamma} \cdot \mathrm{phi}}{\mathrm{phi} + \mathrm{d}}\right) \tag{1}$$

Derived unit dimensionless

5.2 Rule x

Rule x is a rate rule for parameter x:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x} = \mathrm{lambda} - (\mathrm{d} \cdot \mathrm{x} + \mathrm{beta} \cdot \mathrm{x} \cdot \mathrm{v} + \mathrm{gamma} \cdot \mathrm{x} \cdot \mathrm{v}) \tag{2}$$

Derived unit $(0.277778\ \mathrm{ms})^{-1}$

5.3 Rule y0

Rule y0 is a rate rule for parameter y0:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{y0} = \mathrm{beta} \cdot \mathrm{x} \cdot \mathrm{v} - (\mathrm{a0} \cdot \mathrm{y0} + \mathrm{eta} \cdot \mathrm{y0}) + \mathrm{phi} \cdot \mathrm{L} \tag{3}$$

Derived unit $(0.277778\ \mathrm{ms})^{-1}$

5.4 Rule y1

Rule y1 is a rate rule for parameter y1:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{y1} = \mathrm{eta} \cdot \mathrm{y0} - \mathrm{a1} \cdot \mathrm{y1} \tag{4}$$

Derived unit $(0.277778\ \mathrm{ms})^{-1}$

5.5 Rule L

Rule L is a rate rule for parameter L:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{L} = \mathrm{gamma} \cdot \mathrm{x} \cdot \mathrm{v} - (\mathrm{phi} \cdot \mathrm{L} + \mathrm{d} \cdot \mathrm{L}) \tag{5}$$

Derived unit $(0.277778\ \mathrm{ms})^{-1}$

5.6 Rule v

Rule v is a rate rule for parameter v:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{v} = \mathrm{k} \cdot \mathrm{y1} - \mathrm{u} \cdot \mathrm{v} \tag{6}$$

Derived unit $(0.277778\ \mathrm{ms})^{-1}$

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.

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