SBML Model Report

Model name: "Wodarz2003 - Cytotoxic T lymphocyte cross-priming"

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: Catherine Lloyd[1] and Matthew Grant Roberts[2] at June 25$^{\text{th}}$ 2010 at 1:46 p.m. and last time modified at March nineth 2018 at 11:42 a.m. Table 1 gives an overview of the quantities of all components of this model.

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

Element	Quantity	Element	Quantity
compartment types	0	compartments	1
species types	0	species	0
events	0	constraints	0
reactions	0	function definitions	0
global parameters	17	unit definitions	1
rules	5	initial assignments	0

Model Notes

This a model from the article:
A dynamical perspective of CTL cross-priming and regulation: implications forcancer immunology.
Wodarz D, Jansen VA. Immunol Lett 2003 May 1;86(3):213-27 12706524 ,

[1]University of Auckland, c.lloyd@auckland.ac.nz
[2]EMBL-EBI, mroberts@embl.ac.uk

Abstract:
Cytotoxic T lymphocytes (CTL) responses are required to fight many diseases suchas viral infections and tumors. At the same time, they can cause disease wheninduced inappropriately. Which factors regulate CTL and decide whether theyshould remain silent or react is open to debate. The phenomenon calledcross-priming has received attention in this respect. That is, CTL expansionoccurs if antigen is recognized on the surface of professional antigenpresenting cells (APCs). This is in contrast to direct presentation whereantigen is seen on the surface of the target cells (e.g. infected cells or tumorcells). Here we introduce a mathematical model, which takes the phenomenon ofcross-priming into account. We propose a new mechanism of regulation which isimplicit in the dynamics of the CTL: According to the model, the ability of aCTL response to become established depends on the ratio of cross-presentation todirect presentation of the antigen. If this ratio is relatively high, CTLresponses are likely to become established. If this ratio is relatively low,tolerance is the likely outcome. The behavior of the model includes a parameterregion where the outcome depends on the initial conditions. We discuss ourresults with respect to the idea of self/non-self discrimination and the dangersignal hypothesis. We apply the model to study the role of CTL in cancerinitiation, cancer evolution/progression, and therapeutic vaccination againstcancers.

This model was taken from the CellML repository and automatically converted to SBML.
The original model was: **Wodarz D, Jansen VA. (2003) - version=1.0**
The original CellML model was created by:
Catherine Lloyd
c.lloyd@auckland.ac.nz
The University of Auckland

2 Unit Definitions

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

2.1 Unit `time`

Name time

Definition 86400 s

2.2 Unit `substance`

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

Definition mol

2.3 Unit `volume`

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

Definition l

2.4 Unit `area`

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

Definition m^2

2.5 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`	COMpartment		3	1	litre	☑	

3.1 Compartment `COMpartment`

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

Name COMpartment

4 Parameters

This model contains 17 global parameters.

Table 3: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
T	T		0.1		☐
k	k		10.0		☑
r	r		1.0		☑
d	d		0.1		☑
gamma	gamma		1.0		☑
A	A		2.0		☐
lambda	lambda		1.0		☑
delta_1	delta_1		0.1		☑
A_star	A_star		2.0		☐
delta_2	delta_2		1.5		☑
C	C		0.3		☐
eta	eta		2.0		☑
epsilon	epsilon		1.0		☑
q	q		0.5		☑
mu	mu		0.1		☑
R	R		12.0		☐
alpha	alpha		0.5		☑

5 Rules

This is an overview of five rules.

5.1 Rule R

Rule R is an assignment rule for parameter R:

$$R = \frac{C \cdot A\_star}{q \cdot T} \tag{1}$$

5.2 Rule T

Rule T is a rate rule for parameter T:

$$\frac{d}{dt}T = r \cdot T \cdot \left(1 - \frac{T}{k}\right) - d \cdot T - gamma \cdot T \cdot C \tag{2}$$

5.3 Rule `A`

Rule `A` is a rate rule for parameter `A`:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{A} = \mathrm{lambda} - \mathrm{delta\_1} \cdot \mathrm{A} - \mathrm{alpha} \cdot \mathrm{A} \cdot \mathrm{T} \tag{3}$$

5.4 Rule `A_star`

Rule `A_star` is a rate rule for parameter `A_star`:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{A\_star} = \mathrm{alpha} \cdot \mathrm{A} \cdot \mathrm{T} - \mathrm{delta\_2} \cdot \mathrm{A\_star} \tag{4}$$

5.5 Rule `C`

Rule `C` is a rate rule for parameter `C`:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{C} = \frac{\mathrm{eta} \cdot \mathrm{A\_star} \cdot \mathrm{C}}{\mathrm{epsilon} \cdot \mathrm{C} + 1} - \mathrm{q} \cdot \mathrm{T} \cdot \mathrm{C} - \mathrm{mu} \cdot \mathrm{C} \tag{5}$$

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