SBML Model Report

Model name: "Waugh2006 - Diabetic Wound Healing - Macrophage Dynamics"

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 25th 2010 at 12:01 a. m. and last time modified at March first 2018 at 12:48 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	4
events	0	constraints	0
reactions	0	function definitions	0
global parameters	11	unit definitions	9
rules	4	initial assignments	0

Model Notes

This a model from the article:
Macrophage dynamics in diabetic wound dealing.
Waugh HV, Sherratt JA. Bull Math Biol 2006 Jan;68(1):197-207 16794927 ,
Abstract:

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Wound healing in diabetes is a complex process, characterised by a chronicinflammation phase. The exact mechanism by which this occurs is not fullyunderstood, and whilst several treatments for healing diabetic wounds exist,very little research has been conducted towards the causes of the extendedinflammation phase. We describe a mathematical model which offers a possible-explanation for diabetic wound healing in terms of the distribution ofmacrophage phenotypes being altered in the diabetic patient compared to normalwound repair. As a consequence of this, we put forward a suggestion fortreatment based on rectifying the macrophage phenotype imbalance.

This model was taken from the CellML repository and automatically converted to SBML.
The original model was: **Waugh HV, Sherratt JA. (2006) - version=1.0**
The original CellML model was created by:
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2 Unit Definitions

This is an overview of 13 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 unit_0

Name 8.64e-11*m6̂/(g*s)

Definition $\left(8.64 \cdot 10^{-11}\ \mathrm{m}\right)^{6} \cdot \mathrm{g}^{-3} \cdot \mathrm{s}^{-1}$

2.3 Unit `unit_1`

Name 0.0864*mm/(g*s)

Definition $(0.0864\ \mathrm{mm})^{3} \cdot \mathrm{g}^{-2} \cdot \mathrm{s}^{-1}$

2.4 Unit `unit_2`

Name 1/(11.5741*Mg*s)

Definition $(11.5741\ \mathrm{Mg})^{-1} \cdot \mathrm{s}^{-1}$

2.5 Unit `unit_3`

Name 1/(0.0115741*m*s)

Definition $(0.0115741\ \mathrm{m})^{-3} \cdot \mathrm{s}^{-1}$

2.6 Unit `unit_4`

Name 1

Definition $\mathrm{dimensionless}^{0}$

2.7 Unit `unit_5`

Name 1/(0.0115741*ms)

Definition $(0.0115741\ \mathrm{ms})^{-1}$

2.8 Unit `unit_6`

Name 0.001*m

Definition $(0.0010\ \mathrm{m})^{3}$

2.9 Unit `unit_7`

Name 0.0864*g/s

Definition $\left(0.0864\ 10^{-6}\ \mathrm{dimensionless}\right)^{0} \cdot 0.0864\ \mathrm{g} \cdot \mathrm{s}^{-1}$

2.10 Unit `substance`

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

Definition mol

2.11 Unit `volume`

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

Definition l

2.12 Unit `area`

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

Definition m^2

2.13 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`	Wound		3	1	litre	☑	

3.1 Compartment `COMpartment`

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

Name Wound

4 Species

This model contains four species. The boundary condition of four of these species is set to `true` so that these species' amount cannot be changed by any reaction. Section 7 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
`K_T`	K_T	`COMpartment`	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
`phi_I`	phi_I	`COMpartment`	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
`phi_R`	phi_R	`COMpartment`	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	☐	☑
`T`	T	`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
tau1	tau1		−2.470	$\left(8.64 \cdot 10^{-11}\ \mathrm{m}\right)^{6} \cdot \mathrm{g}^{-3} \cdot \mathrm{s}^{-1}$	☑
tau2	tau2		21.940	$(0.0864\ \mathrm{mm})^{3} \cdot \mathrm{g}^{-2} \cdot \mathrm{s}^{-1}$	☑
tau3	tau3		6.410	$(11.5741\ \mathrm{Mg})^{-1} \cdot \mathrm{s}^{-1}$	☑
tau4	tau4		1.750	$(0.0115741\ \mathrm{m})^{-3} \cdot \mathrm{s}^{-1}$	☑
alpha	alpha		0.800	$\mathrm{dimensionless}^{0}$	☑
k1	k1		0.050	$\mathrm{dimensionless}^{0}$	☑
k2	k2		0.693	$(0.0115741\ \mathrm{ms})^{-1}$	☑
k3	k3		0.002	$(0.0010\ \mathrm{m})^{3}$	☑
k4	k4		0.070	$\left(0.0864\ 10^{-6}\ \mathrm{dimensionless}\right)^{0} \cdot 0.0864\ \mathrm{g} \cdot \mathrm{s}^{-1}$	☑
d1	d1		0.200	$(0.0115741\ \mathrm{ms})^{-1}$	☑
d2	d2		9.100	$(0.0115741\ \mathrm{ms})^{-1}$	☑

6 Rules

This is an overview of four rules.

6.1 Rule K_T

Rule K_T is an assignment rule for species K_T:

$$\mathrm{K\_T} = \mathrm{tau1} \cdot [\mathrm{T}]^{3} + \mathrm{tau2} \cdot [\mathrm{T}]^{2} + \mathrm{tau3} \cdot [\mathrm{T}] + \mathrm{tau4} \tag{1}$$

Derived unit $\left(8.64 \cdot 10^{-11}\ \mathrm{m}\right)^{6} \cdot \mathrm{g}^{-3} \cdot \mathrm{s}^{-1} \cdot \mathrm{mol}^{3} \cdot \mathrm{l}^{-3}$

6.2 Rule phi_I

Rule phi_I is a rate rule for species phi_I:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{phi\_I} = \mathrm{alpha} \cdot [\mathrm{K\_T}] + \mathrm{k1} \cdot \mathrm{k2} \cdot [\mathrm{phi\_I}] \cdot (1 - \mathrm{k3} \cdot ([\mathrm{phi\_I}] + [\mathrm{phi\_R}])) - \mathrm{d1} \cdot [\mathrm{phi\_I}] \tag{2}$$

6.3 Rule phi_R

Rule phi_R is a rate rule for species phi_R:

$$\frac{d}{dt}\text{phi\_R} = (1 - \text{alpha}) \cdot [\text{K\_T}] + \text{k1} \cdot \text{k2} \cdot [\text{phi\_R}] \cdot (1 - \text{k3} \cdot ([\text{phi\_I}] + [\text{phi\_R}])) - \text{d1} \cdot [\text{phi\_R}] \quad (3)$$

6.4 Rule T

Rule T is a rate rule for species T:

$$\frac{d}{dt}\text{T} = \text{k4} \cdot [\text{phi\_I}] - \text{d2} \cdot [\text{T}] \quad (4)$$

Derived unit $0.0864\ \text{g} \cdot \text{s}^{-1} \cdot \text{mol} \cdot \text{l}^{-1}$

7 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.

7.1 Species K_T

Name K_T

Initial concentration $296.53\ \text{mol} \cdot \text{l}^{-1}$

Involved in rule K_T

One rule determines the species' quantity.

7.2 Species phi_I

Name phi_I

Initial concentration $200\ \text{mol} \cdot \text{l}^{-1}$

Involved in rule phi_I

One rule determines the species' quantity.

7.3 Species phi_R

Name phi_R

Initial concentration $200\ \text{mol} \cdot \text{l}^{-1}$

Involved in rule phi_R

One rule determines the species' quantity.

7.4 Species T

Name T

Initial concentration $6\,\mathrm{mol}\cdot\mathrm{l}^{-1}$

Involved in rule T

One rule determines the species' quantity.

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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