SBML Model Report

Model name: "Lenbury2001_InsulinKineticsModel_A"

August 8, 2012

1 General Overview

This is a document in SBML Level 2 Version 4 format. 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	16	unit definitions	0
rules	3	initial assignments	0

Model Notes

This a model from the article:
Modeling insulin kinetics: responses to a single oral glucose administration or ambulatory-fed conditions.
Lenbury Y, Ruktamatakul S, Amornsamarnkul S. Biosystems. 2001 Jan;59(1):15-25.11226623,
Abstract:
This paper presents a nonlinear mathematical model of the glucose-insulin feedback system, which has been extended to incorporate the beta-cells' function on maintaining and regulating plasma insulin level in man. Initially, a gastrointestinal absorption term for glucose is utilized

to effect the glucose absorption by the intestine and the subsequent release of glucose into the bloodstream, taking place at a given initial rate and falling off exponentially with time. An analysis of the model is carried out by the singular perturbation technique in order to derive boundary conditions on the system parameters which identify, in particular, the existence of limit cycles in our model system consistent with the oscillatory patterns often observed in clinical data. We then utilize a sinusoidal term to incorporate the temporal absorption of glucose in order to study the responses in the patients under ambulatory-fed conditions. A numerical investigation is carried out in this case to construct a bifurcation diagram to identify the ranges of parametric values for which chaotic behavior can be expected, leading to interesting biological interpretations.

This model was taken from the CellML repository and automatically converted to SBML.
The original model was: **lenbury_ruktamatakul_amornsamarnkul_2001_A**
The original CellML model was created by:
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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 Compartment

This model contains one compartment.

Table 2: Properties of all compartments.

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

3.1 Compartment COMpartment

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

4 Parameters

This model contains 16 global parameters.

Table 3: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
time_environment	time		0.00		☑
x	x		4.00		⊟
r_1	r_1		0.20		☑
r_2	r_2		0.10		☑
c_1	c_1		0.10		☑
y	y		0.00		⊟
r_3	r_3		0.10		☑
r_4	r_4		0.10		☑
c_2	c_2		0.10		☑
z	z		1.00		⊟
r_5	r_5		0.10		☑
r_6	r_6		0.10		☑
r_7	r_7		0.05		☑
z_hat	z_hat		2.00		☑
y_hat	y_hat		1.24		☑
epsilon	epsilon		0.10		☑

5 Rules

This is an overview of three rules.

5.1 Rule x

Rule x is a rate rule for parameter x:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{x} = \mathrm{z} \cdot (\mathrm{r\_1} \cdot \mathrm{y} + \mathrm{r\_2} \cdot \mathrm{x} + \mathrm{c\_1}) \tag{1}$$

5.2 Rule y

Rule y is a rate rule for parameter y:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{y} = \mathrm{epsilon} \cdot \left(\frac{\mathrm{r\_3}}{\mathrm{z}} - \mathrm{r\_4} \cdot \mathrm{x} + \mathrm{c\_2}\right) \tag{2}$$

5.3 Rule z

Rule z is a rate rule for parameter z:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{z} = \mathrm{r\_5} \cdot (\mathrm{y} - \mathrm{y\_hat}) \cdot (\mathrm{z\_hat} - \mathrm{z}) + \mathrm{r\_6} \cdot \mathrm{z} \cdot (\mathrm{z\_hat} - \mathrm{z}) - \mathrm{r\_7} \cdot \mathrm{z} \tag{3}$$

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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