SBML Model Report

Model name: "Goldbeter2006_weightCycling"

May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 4 format. This model was created by Enuo He[1] at November 24th 2006 at 10:19 a. m. and last time modified at February 25th 2015 at 11:30 a. 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	3
events	0	constraints	0
reactions	6	function definitions	5
global parameters	0	unit definitions	2
rules	0	initial assignments	0

Model Notes

This model is according to the paper of *A model for the dynamics of human weight cycling* by A. Goldbeter 2006.The figure3 (A) and (B) have been reproduced by Copasi 4.0.19(development) and SBMLodeSolver.The writer of the paper did not specify any units for the metabolites, so the creator of the model did not define the units as well.Both Q and R are normalized to vary between 0 and 1.

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2 Unit Definitions

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

2.1 Unit `time`

Name weeks

Definition 604800 s

2.2 Unit `substance`

Name dimensionless

Definition dimensionless

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
body	body		3	1	litre	☑	

3.1 Compartment body

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

Name body

4 Species

This model contains three species. 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
P	P	body	dimensionless	⊟	⊟
Q	Q	body	dimensionless	⊟	⊟
R	R	body	dimensionless	⊟	⊟

5 Function definitions

This is an overview of five function definitions.

5.1 Function definition `function_4`

Arguments P, V3, R, k3

Mathematical Expression

$$\frac{P \cdot V3 \cdot (1 - R)}{k3 + (1 - R)} \tag{1}$$

5.2 Function definition `function_3`

Arguments V2, R, Q, K2

Mathematical Expression

$$\frac{V2 \cdot R \cdot Q}{K2 + Q} \tag{2}$$

5.3 Function definition `function_2`

Arguments V1, Q, K1

Mathematical Expression

$$\frac{V1 \cdot (1 - Q)}{K1 + (1 - Q)} \tag{3}$$

5.4 Function definition `function_1`

Arguments V, substrate, Km

Mathematical Expression

$$\frac{V \cdot substrate}{Km + substrate} \tag{4}$$

5.5 Function definition `function_0`

Arguments a, Q

Mathematical Expression

$$a \cdot Q \tag{5}$$

6 Reactions

This model contains six 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 4: Overview of all reactions

№	Id	Name	Reaction Equation	SBO
1	`reaction_0`	Increase of P	$\emptyset \xrightarrow{Q} P$	
2	`reaction_1`	Decrease of P	$P \longrightarrow \emptyset$	
3	`reaction_2`	Increase of Q	$\emptyset \longrightarrow Q$	
4	`reaction_3`	Decrease of Q	$Q \xrightarrow{R} \emptyset$	
5	`reaction_4`	Increase of R	$\emptyset \xrightarrow{P} R$	
6	`reaction_5`	Decrease of R	$R \longrightarrow \emptyset$	

6.1 Reaction `reaction_0`

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

Name Increase of P

Reaction equation

$$\emptyset \xrightarrow{\mathrm{Q}} \mathrm{P} \tag{6}$$

Modifier

Table 5: Properties of each modifier.

Id	Name	SBO
`Q`	Q	

Product

Table 6: Properties of each product.

Id	Name	SBO
`P`	P	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \mathrm{vol}\left(\mathrm{body}\right) \cdot \mathrm{function\_0}\left(\mathrm{a}, \mathrm{Q}\right) \tag{7}$$

$$\mathrm{function\_0}\left(\mathrm{a}, \mathrm{Q}\right) = \mathrm{a} \cdot \mathrm{Q} \tag{8}$$

$$\mathrm{function\_0}\left(\mathrm{a}, \mathrm{Q}\right) = \mathrm{a} \cdot \mathrm{Q} \tag{9}$$

Table 7: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
`a`			0.1		☑

6.2 Reaction reaction_1

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

Name Decrease of P

Reaction equation

$$\mathrm{P} \longrightarrow \emptyset \tag{10}$$

Reactant

Table 8: Properties of each reactant.

Id	Name	SBO
P	P	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \mathrm{function\_1}\left(\mathrm{V}, \mathrm{P}, \mathrm{Km}\right) \tag{11}$$

$$\mathrm{function\_1}\left(\mathrm{V}, \mathrm{substrate}, \mathrm{Km}\right) = \frac{\mathrm{V} \cdot \mathrm{substrate}}{\mathrm{Km} + \mathrm{substrate}} \tag{12}$$

Table 9: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V			0.1		☑
Km			0.2		☑

6.3 Reaction reaction_2

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

Name Increase of Q

Reaction equation

$$\emptyset \longrightarrow \mathrm{Q} \tag{13}$$

Product

Table 10: Properties of each product.

Id	Name	SBO
Q	Q	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \text{function\_2}\,(\text{V1}, \text{Q}, \text{K1}) \tag{14}$$

$$\text{function\_2}\,(\text{V1}, \text{Q}, \text{K1}) = \frac{\text{V1} \cdot (1 - \text{Q})}{\text{K1} + (1 - \text{Q})} \tag{15}$$

Table 11: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V1			1.00		☑
K1			0.01		☑

6.4 Reaction reaction_3

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

Name Decrease of Q

Reaction equation

$$\text{Q} \xrightarrow{\text{R}} \emptyset \tag{16}$$

Reactant

Table 12: Properties of each reactant.

Id	Name	SBO
Q	Q	

Modifier

Table 13: Properties of each modifier.

Id	Name	SBO
R	R	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \text{function\_3}\left(\text{V2}, \text{R}, \text{Q}, \text{K2}\right) \tag{17}$$

$$\text{function\_3}\left(\text{V2}, \text{R}, \text{Q}, \text{K2}\right) = \frac{\text{V2} \cdot \text{R} \cdot \text{Q}}{\text{K2} + \text{Q}} \tag{18}$$

Table 14: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V2			1.50		☑
K2			0.01		☑

6.5 Reaction reaction_4

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

Name Increase of R

Reaction equation

$$\emptyset \xrightarrow{\text{P}} \text{R} \tag{19}$$

Modifier

Table 15: Properties of each modifier.

Id	Name	SBO
P	P	

Product

Table 16: Properties of each product.

Id	Name	SBO
R	R	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \text{function\_4}\,(\text{P}, \text{V3}, \text{R}, \text{k3}) \tag{20}$$

$$\text{function\_4}\,(\text{P}, \text{V3}, \text{R}, \text{k3}) = \frac{\text{P} \cdot \text{V3} \cdot (1 - \text{R})}{\text{k3} + (1 - \text{R})} \tag{21}$$

Table 17: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V3			6.00		☑
k3			0.01		☑

6.6 Reaction reaction_5

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

Name Decrease of R

Reaction equation

$$\text{R} \longrightarrow \emptyset \tag{22}$$

Reactant

Table 18: Properties of each reactant.

Id	Name	SBO
R	R	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \text{function\_1}\,(\text{V}, \text{R}, \text{Km}) \tag{23}$$

$$\text{function\_1}\left(\text{V}, \text{substrate}, \text{Km}\right) = \frac{\text{V} \cdot \text{substrate}}{\text{Km} + \text{substrate}} \tag{24}$$

Table 19: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
V			2.50		☑
Km			0.01		☑

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.

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.

7.1 Species P

Name P

Notes body weight

Initial concentration $0.43\ \text{dimensionless} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in reaction_1 and as a product in reaction_0 and as a modifier in reaction_4).

$$\frac{\text{d}}{\text{d}t}\text{P} = v_1 - v_2 \tag{25}$$

7.2 Species Q

Name Q

Notes dietary intake

Initial concentration $0.8\ \text{dimensionless} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in reaction_3 and as a product in reaction_2 and as a modifier in reaction_0).

$$\frac{\text{d}}{\text{d}t}\text{Q} = v_3 - v_4 \tag{26}$$

7.3 Species R

Name R

Notes degree of resolution measuring cognitive restraint

Initial concentration $0.55\ \text{dimensionless} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a reactant in reaction_5 and as a product in reaction_4 and as a modifier in reaction_3).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{R} = v_5 - v_6 \tag{27}$$

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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