

SBML Model Report

Model name: “Mayya2005_STATmodule”



May 5, 2016

1 General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by Harish Dharuri¹ at September 26th 2007 at 2:22 a.m. and last time modified at May 27th 2014 at 10:17 p.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	3
species types	0	species	9
events	0	constraints	0
reactions	7	function definitions	0
global parameters	0	unit definitions	9
rules	1	initial assignments	0

Model Notes

The model reproduces Fig 2B of the paper. Model successfully reproduced using MathSBML.

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¹California Institute of Technology, hdharuri@cds.caltech.edu

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2 Unit Definitions

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

2.1 Unit `substance`

Definition μmol

2.2 Unit `volume`

Definition l

2.3 Unit `area`

Definition μm^2

2.4 Unit `molecules`

Definition item

2.5 Unit `um2`

Definition μm^2

2.6 Unit `s_1`

Definition s^{-1}

2.7 Unit `uM_1_s_1`

Definition $\mu\text{mol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$

2.8 Unit `uM_um_s_1`

Definition $\mu\text{mol} \cdot \text{l}^{-1} \cdot \mu\text{m}^{-2} \cdot \text{s}^{-1}$

2.9 Unit `uM`

Definition $\mu\text{mol} \cdot \text{l}^{-1}$

2.10 Unit `length`

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

Definition `m`

2.11 Unit `time`

Notes Second is the predefined SBML unit for `time`.

Definition `s`

3 Compartments

This model contains three compartments.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial	Size	Unit	Constant	Outside
			Dimensions				
<code>nuc</code>	<code>nuc</code>		3	1		<input checked="" type="checkbox"/>	
<code>sol</code>	<code>sol</code>		3	14.625		<input checked="" type="checkbox"/>	
<code>nm</code>	<code>nm</code>		2	1	μm^2	<input checked="" type="checkbox"/>	

3.1 Compartment `nuc`

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

Name `nuc`

3.2 Compartment `sol`

This is a three dimensional compartment with a constant size of 14.625 litre.

Name `sol`

3.3 Compartment `nm`

This is a two dimensional compartment with a constant size of one μm^2 .

Name `nm`

4 Species

This model contains nine species. The boundary condition of one of these species is set to `true` so that this 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
stat_sol	stat_sol	sol	$\mu\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
Pstat_sol	Pstat_sol	sol	$\mu\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
statKinase_sol	statKinase_sol	sol	$\mu\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PstatDimer_sol	PstatDimer_sol	sol	$\mu\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
PstatDimer_nuc	PstatDimer_nuc	nuc	$\mu\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
stat_nuc	stat_nuc	nuc	$\mu\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
Pstat_nuc	Pstat_nuc	nuc	$\mu\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
statPhosphatase-nuc	statPhosphatase_nuc	nuc	$\mu\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
species_test	species_test	sol	$\mu\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>

5 Rule

This is an overview of one rule.

5.1 Rule `statKinase_sol`

Rule `statKinase_sol` is an assignment rule for species `statKinase_sol`:

$$\begin{aligned} &\text{statKinase_sol} \\ &= \begin{cases} 0.01 \cdot \sin(0.001571 \cdot (-500 + t)) & \text{if } (t > 500) \wedge (t < 2502.54614894971) \\ 0 & \text{otherwise} \end{cases} \quad (1) \end{aligned}$$

6 Reactions

This model contains seven 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

Nº	Id	Name	Reaction Equation	SBO
1	PstatDimerisation	PstatDimerisation	$2 \text{ Pstat_sol} \xrightleftharpoons{\text{statPhosphatase_nuc}} \text{PstatDimer_sol}$	
2	statDephosphorylation	statDephosphorylation	$\text{Pstat_nuc} \xrightleftharpoons{\text{statKinase_sol}} \text{stat_nuc}$	
3	statPhosphorylation	statPhosphorylation	$\text{stat_sol} \xrightleftharpoons{\text{statKinase_sol}} \text{Pstat_sol} + \text{species_test}$	
4	PstatDimerisationNuc	PstatDimerisationNuc	$2 \text{ Pstat_nuc} \xrightleftharpoons{\text{statPhosphatase_nuc}} \text{PstatDimer_nuc}$	
5	PstatDimer_-import	PstatDimer_import	$\text{PstatDimer_sol} \xrightleftharpoons{\text{statPhosphatase_nuc}} \text{PstatDimer_nuc}$	
6	stat_export	stat_export	$\text{stat_sol} \xrightleftharpoons{\text{statPhosphatase_nuc}} \text{stat_nuc}$	
7	stat_import	stat_import	$\text{stat_sol} \xrightleftharpoons{\text{statPhosphatase_nuc}} \text{stat_nuc}$	

6.1 Reaction PstatDimerisation

This is a reversible reaction of one reactant forming one product.

Name PstatDimerisation

Reaction equation



Reactant

Table 5: Properties of each reactant.

Id	Name	SBO
Pstat_sol	Pstat_sol	

Product

Table 6: Properties of each product.

Id	Name	SBO
PstatDimer_sol	PstatDimer_sol	

Kinetic Law

Derived unit $10^{-6} \text{ mol} \cdot \text{s}^{-1}$

$$v_1 = (\text{Kf_PstatDimerisation} \cdot [\text{Pstat_sol}]^2 + ((\text{Kr_PstatDimerisation} \cdot [\text{PstatDimer_sol}]))) \cdot \text{vol}(\text{sol}) \quad (3)$$

Table 7: Properties of each parameter.

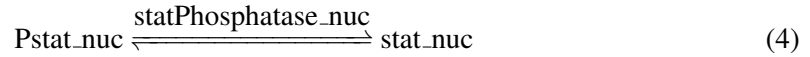
Id	Name	SBO	Value	Unit	Constant
Kf-			0.60	$\mu\text{mol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
_PstatDimerisation					
Kr-			0.03	s^{-1}	<input checked="" type="checkbox"/>
_PstatDimerisation					

6.2 Reaction statDephosphorylation

This is a reversible reaction of one reactant forming one product influenced by one modifier.

Name statDephosphorylation

Reaction equation



Reactant

Table 8: Properties of each reactant.

Id	Name	SBO
Pstat_nuc	Pstat_nuc	

Modifier

Table 9: Properties of each modifier.

Id	Name	SBO
statPhosphatase_nuc	statPhosphatase_nuc	

Product

Table 10: Properties of each product.

Id	Name	SBO
stat_nuc	stat_nuc	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = K_{\text{cat_dephos}} \cdot [\text{statPhosphatase_nuc}] \cdot [\text{Pstat_nuc}] \cdot \frac{1}{K_{\text{m_dephos}} + [\text{Pstat_nuc}]} \cdot \text{vol}(\text{nuc}) \quad (5)$$

Table 11: Properties of each parameter.

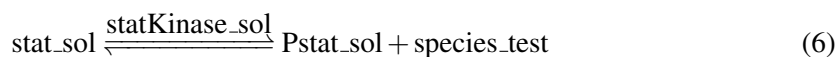
Id	Name	SBO	Value	Unit	Constant
Kcat_dephos			1.0	s ⁻¹	<input checked="" type="checkbox"/>
Km_dephos			2.0	μmol · l ⁻¹	<input checked="" type="checkbox"/>

6.3 Reaction `statPhosphorylation`

This is a reversible reaction of one reactant forming two products influenced by one modifier.

Name `statPhosphorylation`

Reaction equation



Reactant

Table 12: Properties of each reactant.

Id	Name	SBO
<code>stat_sol</code>	<code>stat_sol</code>	

Modifier

Table 13: Properties of each modifier.

Id	Name	SBO
<code>statKinase_sol</code>	<code>statKinase_sol</code>	

Products

Table 14: Properties of each product.

Id	Name	SBO
<code>Pstat_sol</code>	<code>Pstat_sol</code>	
<code>species_test</code>	<code>species_test</code>	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = K_{cat_phos} \cdot [statKinase_sol] \cdot [stat_sol] \cdot \frac{1}{K_{m_phos} + [stat_sol]} \cdot vol(sol) \quad (7)$$

Table 15: Properties of each parameter.

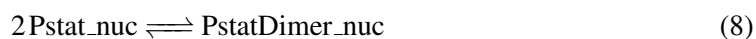
Id	Name	SBO	Value	Unit	Constant
Kcat_phos			1.0	s ⁻¹	<input checked="" type="checkbox"/>
Km_phos			4.0	μmol · l ⁻¹	<input checked="" type="checkbox"/>

6.4 Reaction PstatDimerisationNuc

This is a reversible reaction of one reactant forming one product.

Name PstatDimerisationNuc

Reaction equation



Reactant

Table 16: Properties of each reactant.

Id	Name	SBO
Pstat_nuc	Pstat_nuc	

Product

Table 17: Properties of each product.

Id	Name	SBO
PstatDimer_nuc	PstatDimer_nuc	

Kinetic Law

Derived unit 10⁻⁶ mol · s⁻¹

$$v_4 = (K_{f_PstatDimerisation} \cdot [Pstat_nuc]^2 + ((K_{r_PstatDimerisation} \cdot [PstatDimer_nuc]))) \cdot vol(nuc) \quad (9)$$

Table 18: Properties of each parameter.

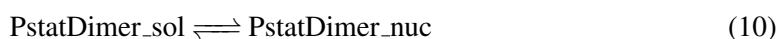
Id	Name	SBO	Value	Unit	Constant
Kf-			0.60	$\mu\text{mol}^{-1} \cdot \text{l} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
_PstatDimerisation					
Kr-			0.03	s^{-1}	<input checked="" type="checkbox"/>
_PstatDimerisation					

6.5 Reaction PstatDimer__import

This is a reversible reaction of one reactant forming one product.

Name PstatDimer_ import

Reaction equation



Reactant

Table 19: Properties of each reactant.

Id	Name	SBO
PstatDimer_sol	PstatDimer_sol	

Product

Table 20: Properties of each product.

Id	Name	SBO
PstatDimer_nuc	PstatDimer_nuc	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \text{PstatDimer_impMax} \cdot [\text{PstatDimer_sol}] \cdot \frac{1}{\text{Kpsd_imp} + [\text{PstatDimer_sol}]} \cdot \text{area}(\text{nm}) \quad (11)$$

Table 21: Properties of each parameter.

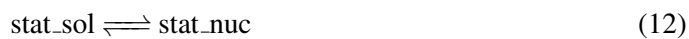
Id	Name	SBO	Value	Unit	Constant
PstatDimer-			0.045	$\mu\text{mol} \cdot \text{l}^{-1} \cdot \mu\text{m}^{-2} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
_impMax					
Kpsd_imp			0.300	$\mu\text{mol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>

6.6 Reaction `stat_export`

This is a reversible reaction of one reactant forming one product.

Name `stat_export`

Reaction equation



Reactant

Table 22: Properties of each reactant.

Id	Name	SBO
<code>stat_sol</code>	<code>stat_sol</code>	

Product

Table 23: Properties of each product.

Id	Name	SBO
<code>stat_nuc</code>	<code>stat_nuc</code>	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \text{vol}(\text{nuc}) \cdot \text{stat_expMax} \cdot [\text{stat_nuc}] \cdot \frac{1}{\text{Ks_exp} + [\text{stat_nuc}]} \cdot \text{area}(\text{nm}) \quad (13)$$

Table 24: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
stat_expMax			-0.06	$\mu\text{mol} \cdot \text{l}^{-1} \cdot \mu\text{m}^{-2} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
Ks_exp			0.60	$\mu\text{mol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>

6.7 Reaction `stat_import`

This is a reversible reaction of one reactant forming one product.

Name `stat_import`

Reaction equation



Reactant

Table 25: Properties of each reactant.

Id	Name	SBO
stat_sol	stat_sol	

Product

Table 26: Properties of each product.

Id	Name	SBO
stat_nuc	stat_nuc	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \text{vol}(\text{nuc}) \cdot \text{stat_impMax} \cdot [\text{stat_sol}] \cdot \frac{1}{\text{Ks_imp} + [\text{stat_sol}]} \cdot \text{area}(\text{nm}) \quad (15)$$

Table 27: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
stat_impMax			0.003	$\mu\text{mol} \cdot \text{l}^{-1} \cdot \mu\text{m}^{-2} \cdot \text{s}^{-1}$	<input checked="" type="checkbox"/>
Ks_imp			3.000	$\mu\text{mol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>

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 `stat_sol`

Name `stat_sol`

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

This species takes part in three reactions (as a reactant in `statPhosphorylation`, `stat_export`, `stat_import`).

$$\frac{d}{dt}\text{stat_sol} = -v_3 - v_6 - v_7 \quad (16)$$

7.2 Species `Pstat_sol`

Name `Pstat_sol`

Initial concentration $0 \mu\text{mol} \cdot \text{l}^{-1}$

This species takes part in two reactions (as a reactant in `PstatDimerisation` and as a product in `statPhosphorylation`).

$$\frac{d}{dt}\text{Pstat_sol} = v_3 - 2v_1 \quad (17)$$

7.3 Species `statKinase_sol`

Name `statKinase_sol`

Involved in rule `statKinase_sol`

This species takes part in one reaction (as a modifier in `statPhosphorylation`). Not this but one rule determines the species' quantity because this species is on the boundary of the reaction system.

7.4 Species `PstatDimer_sol`

Name `PstatDimer_sol`

Initial concentration $0 \mu\text{mol} \cdot \text{l}^{-1}$

This species takes part in two reactions (as a reactant in `PstatDimer__import` and as a product in `PstatDimerisation`).

$$\frac{d}{dt} \text{PstatDimer_sol} = v_1 - v_5 \quad (18)$$

7.5 Species `PstatDimer_nuc`

Name `PstatDimer_nuc`

Initial concentration $0 \mu\text{mol} \cdot \text{l}^{-1}$

This species takes part in two reactions (as a product in `PstatDimerisationNuc`, `PstatDimer__import`).

$$\frac{d}{dt} \text{PstatDimer_nuc} = v_4 + v_5 \quad (19)$$

7.6 Species `stat_nuc`

Name `stat_nuc`

Initial concentration $0 \mu\text{mol} \cdot \text{l}^{-1}$

This species takes part in three reactions (as a product in `statDephosphorylation`, `stat__export`, `stat_import`).

$$\frac{d}{dt} \text{stat_nuc} = v_2 + v_6 + v_7 \quad (20)$$

7.7 Species `Pstat_nuc`

Name `Pstat_nuc`

Initial concentration $0 \mu\text{mol} \cdot \text{l}^{-1}$

This species takes part in two reactions (as a reactant in `statDephosphorylation`, `PstatDimerisationNuc`).

$$\frac{d}{dt} \text{Pstat_nuc} = -v_2 - 2v_4 \quad (21)$$

7.8 Species `statPhosphatase_nuc`

Name `statPhosphatase_nuc`

Initial concentration $0.05 \mu\text{mol} \cdot \text{l}^{-1}$

This species takes part in one reaction (as a modifier in `statDephosphorylation`).

$$\frac{d}{dt} \text{statPhosphatase_nuc} = 0 \quad (22)$$

7.9 Species `species_test`

Name `species_test`

Initial concentration $0 \mu\text{mol} \cdot \text{l}^{-1}$

This species takes part in one reaction (as a product in `statPhosphorylation`).

$$\frac{d}{dt} \text{species_test} = v_3 \quad (23)$$

SBML2^{LaTeX} 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.

^aCenter for Bioinformatics Tübingen (ZBIT), Germany

^bCalifornia Institute of Technology, Beckman Institute BNMC, Pasadena, United States

^cEuropean Bioinformatics Institute, Wellcome Trust Genome Campus, Hinxton, United Kingdom

^dEML Research gGmbH, Heidelberg, Germany