

## SBML Model Report

**Model name: “Fernandez2006\_ModelIA”**



May 6, 2016

### 1 General Overview

This is a document in SBML Level 2 Version 1 format. This model was created by the following two authors: Nicolas Le Novre<sup>1</sup> and Lukas Endler<sup>2</sup> at March 28<sup>th</sup> 2006 at 3:55 p. m. and last time modified at April eighth 2016 at 3:37 p. m. Table 1 shows 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	64
events	21	constraints	0
reactions	120	function definitions	0
global parameters	7	unit definitions	0
rules	0	initial assignments	0

### Model Notes

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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<sup>2</sup>

### 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
Spine	Spine		3	$10^{-15}$	l	<input checked="" type="checkbox"/>	

### 3.1 Compartment *Spine*

This is a three dimensional compartment with a constant size of  $10^{-15}$  litre.

**Name** Spine

## 4 Species

This model contains 64 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 8 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
D	D	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
CDK5	CDK5	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D_CDK5	D_CDK5	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D75	D75	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
CK1	CK1	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D_CK1	D_CK1	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D137	D137	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
PKA	PKA	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D_PKA	D_PKA	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34	D34	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_CDK5	D34_CDK5	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_CK1	D34_CK1	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
PP2B	PP2B	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_PP2B	D34_PP2B	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_75	D34:75	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_137	D34:137	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D75CK1	D75_CK1	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D75_PKA	D75_PKA	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
PP2A	PP2A	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D75_PP2A	D75_PP2A	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
PP2AP	PP2AP	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>

Id	Name	Compartment	Derived Unit	Constant	Boundary Condi- tion
D75_PP2AP	D75_PP2AP	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D75_137	D75:137	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D137_CDK5	D137_CDK5	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D137_PKA	D137_PKA	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D137_PP2C	D137_PP2C	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
PP2C	PP2C	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_75_CK1	D34:75_CK1	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_137_CDK5	D34:137_CDK5	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_75_137	D34:75:137	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D75_137_PKA	D75:137_PKA	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_75_PP2B	D34:75_PP2B	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_137_PP2B	D34:137_PP2B	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_75_137_PP2B	D34:75:137_PP2B	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_75_PP2A	D34:75_PP2A	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D75_137_PP2A	D75:137_PP2A	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_75_134_PP2A	D34:75:137_PP2A	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_75_PP2AP	D34:75_PP2AP	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D75_137_PP2AP	D75:137_PP2AP	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_75_137_PP2AP	D34:75:137_PP2AP	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_137_PP2C	D34:137_PP2C	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D75_137_PP2C	D75:137_PP2C	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
PDE	PDE	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
PP2Binactive	PP2Binactive	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
D34_75_137_PP2C	D34:75:137_PP2C	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
CK1P	CK1P	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
CK1P_PP2B	CK1P_PP2B	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
PDE_PKA	PDE_PKA	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
PDEP	PDEP	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
PP2A_PKA	PP2A_PKA	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
Ca	Ca	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
PP2BinactiveCa2	PP2BinactiveCa2	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
R2C2	R2C2	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
cAMP	cAMP	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
cAMP_R2C2	cAMP_R2C2	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
cAMP2_R2C2	cAMP2_R2C2	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
cAMP3_R2C2	cAMP3_R2C2	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
cAMP4_R2C2	cAMP4_R2C2	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
cAMP4_R2C	cAMP4_R2C	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
cAMP4_R2	cAMP4_R2	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
cAMP_PDE	cAMP_PDE	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
AMP	AMP	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
cAMP_PDEP	cAMP_PDEP	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input type="checkbox"/>	<input type="checkbox"/>
Empty	Empty	Spine	$\text{mol} \cdot \text{l}^{-1}$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

## 5 Parameters

This model contains seven global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k57	ca_in		$2.5 \cdot 10^{-8}$		<input type="checkbox"/>
cAMP_delay	cAMP_delay		400.000		<input checked="" type="checkbox"/>
cAMP_Ca- _delay	cAMP_Ca.delay		50.000		<input checked="" type="checkbox"/>
kon_high	kon_high		$6.6 \cdot 10^{-6}$		<input checked="" type="checkbox"/>
spike- _duration	spike_duration		2.000		<input checked="" type="checkbox"/>
spike- _interval	spike_interval		2.000		<input checked="" type="checkbox"/>
kon_low	kon_low		$2.5 \cdot 10^{-8}$		<input checked="" type="checkbox"/>

## 6 Events

This is an overview of 21 events. Each event is initiated whenever its trigger condition switches from false to true. A delay function postpones the effects of an event to a later time point. At the time of execution, an event can assign values to species, parameters or compartments if these are not set to constant.

### 6.1 Event cAMP\_pulse

**Name** cAMP\_pulse

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} \quad (1)$$

**Assignment**

$$\text{cAMP} = 6.5999999999999995E - 6 \quad (2)$$

### 6.2 Event ca\_on1

**Name** ca\_on1

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} \quad (3)$$

**Assignment**

$$\text{k57} = \text{kon\_high} \quad (4)$$

### 6.3 Event `ca_on2`

**Name** `ca_on2`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + 1 \cdot (\text{spike\_duration} + \text{spike\_interval}) \quad (5)$$

**Assignment**

$$k57 = \text{kon\_high} \quad (6)$$

### 6.4 Event `ca_off1`

**Name** `ca_off`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + \text{spike\_duration} \quad (7)$$

**Assignment**

$$k57 = \text{kon\_low} \quad (8)$$

### 6.5 Event `Ca_on3`

**Name** `Ca_on3`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + 2 \cdot (\text{spike\_duration} + \text{spike\_interval}) \quad (9)$$

**Assignment**

$$k57 = \text{kon\_high} \quad (10)$$

### 6.6 Event `ca_on4`

**Name** `ca_on4`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + 3 \cdot (\text{spike\_duration} + \text{spike\_interval}) \quad (11)$$

**Assignment**

$$k57 = \text{kon\_high} \quad (12)$$

### 6.7 Event `ca_on5`

**Name** `ca_on5`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + 4 \cdot (\text{spike\_duration} + \text{spike\_interval}) \quad (13)$$

**Assignment**

$$k57 = \text{kon\_high} \quad (14)$$



### 6.8 Event `ca_on6`

**Name** `ca_on6`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + 5 \cdot (\text{spike\_duration} + \text{spike\_interval}) \quad (15)$$

**Assignment**

$$k57 = \text{kon\_high} \quad (16)$$

### 6.9 Event `ca_on7`

**Name** `ca_on7`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + 6 \cdot (\text{spike\_duration} + \text{spike\_interval}) \quad (17)$$

**Assignment**

$$k57 = \text{kon\_high} \quad (18)$$

### 6.10 Event `ca_on8`

**Name** `ca_on8`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + 7 \cdot (\text{spike\_duration} + \text{spike\_interval}) \quad (19)$$

**Assignment**

$$k57 = \text{kon\_high} \quad (20)$$

### 6.11 Event `ca_on9`

**Name** `ca_on9`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + 8 \cdot (\text{spike\_duration} + \text{spike\_interval}) \quad (21)$$

**Assignment**

$$k57 = \text{kon\_high} \quad (22)$$

### 6.12 Event `ca_on10`

**Name** `ca_on10`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + 9 \cdot (\text{spike\_duration} + \text{spike\_interval}) \quad (23)$$

**Assignment**

$$k57 = \text{kon\_high} \quad (24)$$

### 6.13 Event `ca_off2`

**Name** `ca_off2`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + \text{spike\_duration} + 1 \cdot (\text{spike\_interval} + \text{spike\_duration}) \quad (25)$$

**Assignment**

$$k57 = \text{kon\_low} \quad (26)$$

### 6.14 Event `ca_off3`

**Name** `ca_off3`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + \text{spike\_duration} + 2 \cdot (\text{spike\_interval} + \text{spike\_duration}) \quad (27)$$

**Assignment**

$$k57 = \text{kon\_low} \quad (28)$$

### 6.15 Event `ca_off4`

**Name** `ca_off4`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + \text{spike\_duration} + 3 \cdot (\text{spike\_interval} + \text{spike\_duration}) \quad (29)$$

**Assignment**

$$k57 = \text{kon\_low} \quad (30)$$

### 6.16 Event `ca_off5`

**Name** `ca_off5`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + \text{spike\_duration} + 4 \cdot (\text{spike\_interval} + \text{spike\_duration}) \quad (31)$$

**Assignment**

$$k57 = \text{kon\_low} \quad (32)$$

### 6.17 Event `ca_off6`

**Name** `ca_off6`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + \text{spike\_duration} + 5 \cdot (\text{spike\_interval} + \text{spike\_duration}) \quad (33)$$

**Assignment**

$$k57 = \text{kon\_low} \quad (34)$$

### 6.18 Event `ca_off7`

**Name** `ca_off7`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + \text{spike\_duration} + 6 \cdot (\text{spike\_interval} + \text{spike\_duration}) \quad (35)$$

**Assignment**

$$k57 = \text{kon\_low} \quad (36)$$

### 6.19 Event `ca_off8`

**Name** `ca_off8`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + \text{spike\_duration} + 7 \cdot (\text{spike\_interval} + \text{spike\_duration}) \quad (37)$$

**Assignment**

$$k57 = \text{kon\_low} \quad (38)$$

### 6.20 Event `ca_off9`

**Name** `ca_off9`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + \text{spike\_duration} + 8 \cdot (\text{spike\_interval} + \text{spike\_duration}) \quad (39)$$

**Assignment**

$$k57 = \text{kon\_low} \quad (40)$$

## 6.21 Event `ca_off10`

**Name** `ca_off10`

**Trigger condition**

$$\text{time} \geq \text{cAMP\_delay} + \text{cAMP\_Ca\_delay} + \text{spike\_duration} + 9 \cdot (\text{spike\_interval} + \text{spike\_duration}) \quad (41)$$

**Assignment**

$$k57 = \text{kon\_low} \quad (42)$$

## 7 Reactions

This model contains 120 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 5: Overview of all reactions

Nº	Id	Name	Reaction Equation	SBO
1	von1	D_CDK5_binding	$D + CDK5 \longrightarrow D\_CDK5$	
2	voff1	D_CDK5_unbinding	$D\_CDK5 \longrightarrow D + CDK5$	
3	vcat1	DPhospho_by_CDK5_on_75	$D\_CDK5 \longrightarrow D75 + CDK5$	
4	von2	DCDK1_binding	$D + CK1 \longrightarrow D\_CK1$	
5	voff2	D_CDK1_unbinding	$D\_CK1 \longrightarrow D + CK1$	
6	vcat2	D_Phospho_by_CK1_on_137	$D\_CK1 \longrightarrow D137 + CK1$	
7	von3	D_PKA_binding	$D + PKA \longrightarrow D\_PKA$	
8	voff3	D_PKA_unbinding	$D\_PKA \longrightarrow D + PKA$	
9	vcat3	D_Phospho_by_PKA_on_34	$D\_PKA \longrightarrow D34 + PKA$	
10	von4	D34_CDK5_binding	$D34 + CDK5 \longrightarrow D34\_CDK5$	
11	von5	D34_CK1_binding	$D34 + CK1 \longrightarrow D34\_CK1$	
12	von6	D34_PP2B_binding	$D34 + PP2B \longrightarrow D34\_PP2B$	
13	voff4	D34_CDK5_unbinding	$D34\_CDK5 \longrightarrow D34 + CDK5$	
14	vcat4	D34_Phospho_by_CDK5_on_75	$D34\_CDK5 \longrightarrow D34\_75 + CDK5$	
15	voff5	D34_CK1_unbinding	$D34\_CK1 \longrightarrow D34 + CK1$	
16	vcat5	D34_Phospho_by_CK1_on_137	$D34\_CK1 \longrightarrow D34\_137 + CK1$	
17	vcat6	D34_Dephospho_by_PP2B	$D34\_PP2B \longrightarrow D + PP2B$	
18	voff6	D34_PP2B_unbinding	$D34\_PP2B \longrightarrow D34 + PP2B$	
19	von7	D75_CK1_binding	$D75 + CK1 \longrightarrow D75CK1$	
20	von8	D75_PKA_binding	$D75 + PKA \longrightarrow D75\_PKA$	
21	von9	D75_PP2A_binding	$D75 + PP2A \longrightarrow D75\_PP2A$	
22	von10	D75_PP2AP_binding	$D75 + PP2AP \longrightarrow D75\_PP2AP$	
23	voff7	D75_CK1_unbinding	$D75CK1 \longrightarrow D75 + CK1$	

Nº	Id	Name	Reaction Equation	SBO
24	vcat7	D75_Phospho_by_CK1_on_137	$D75CK1 \longrightarrow CK1 + D75\_137$	
25	vcat8	D75_Phospho_by_PKA_on_34	$D75\_PKA \longrightarrow D34\_75 + PKA$	
26	voff8	D75_PKA_unbinding	$D75\_PKA \longrightarrow D75 + PKA$	
27	vcat9	D75_dephospho_by_PP2A	$D75\_PP2A \longrightarrow D + PP2A$	
28	voff9	D75_PP2A_unbinding	$D75\_PP2A \longrightarrow D75 + PP2A$	
29	vcat10	D75_dephospho_by_PP2AP	$D75\_PP2AP \longrightarrow D + PP2AP$	
30	voff10	D75_PP2AP_unbinding	$D75\_PP2AP \longrightarrow D75 + PP2AP$	
31	von11	D137_CDK5_binding	$D137 + CDK5 \longrightarrow D137\_CDK5$	
32	von12	D137_PKA_binding	$D137 + PKA \longrightarrow D137\_PKA$	
33	von13	D137_PP2C_binding	$D137 + PP2C \longrightarrow D137\_PP2C$	
34	voff11	D137_CDK5_unbinding	$D137\_CDK5 \longrightarrow D137 + CDK5$	
35	vcat11	D137_Phospho_by_CDK5_on_75	$D137\_CDK5 \longrightarrow D75\_137 + CDK5$	
36	voff12	D137_PKA_unbinding	$D137\_PKA \longrightarrow D137 + PKA$	
37	vcat12	D137_phospho_by_PKA_on_34	$D137\_PKA \longrightarrow D34\_137 + PKA$	
38	vcat13	D137_dephospho_by_PP2C	$D137\_PP2C \longrightarrow D + PP2C$	
39	voff13	D137_PP2C_unbinding	$D137\_PP2C \longrightarrow D137 + PP2C$	
40	von14	D34:75_CK1_binding	$D34\_75 + CK1 \longrightarrow D34\_75\_CK1$	
41	von18	D34:137_CDK5_binding	$D34\_137 + CDK5 \longrightarrow D34\_137\_CDK5$	
42	voff18	D34:137_CDK5_unbinding	$D34\_137\_CDK5 \longrightarrow D34\_137 + CDK5$	
43	voff14	D34:75_CK1_unbinding	$D34\_75\_CK1 \longrightarrow D34\_75 + CK1$	
44	vcat14	D34:75_phospho_by_CK1_on_137	$D34\_75\_CK1 \longrightarrow D34\_75\_137 + CK1$	
45	vcat18	D34:137_phospho_by_CDK5_on_75	$D34\_137\_CDK5 \longrightarrow D34\_75\_137 + CDK5$	
46	von21	D75:137_PKA_binding	$D75\_137 + PKA \longrightarrow D75\_137\_PKA$	
47	vcat21	D75:137_phospho_by_PKA_on_34	$D75\_137\_PKA \longrightarrow D34\_75\_137 + PKA$	
48	voff21	D75:137_PKA_unbinding	$D75\_137\_PKA \longrightarrow D75\_137 + PKA$	
49	von17	D34:75_PP2B_binding	$D34\_75 + PP2B \longrightarrow D34\_75\_PP2B$	
50	voff17	D34:75_PP2B_unbinding	$D34\_75\_PP2B \longrightarrow D34\_75 + PP2B$	
51	vcat17	D34:75_dephospho_by_PP2B_on_34	$D34\_75\_PP2B \longrightarrow D75 + PP2B$	
52	von19	D34:137_PP2B_binding	$D34\_137 + PP2B \longrightarrow D34\_137\_PP2B$	

Nº	Id	Name	Reaction Equation	SBO
53	vcat19	D34:137_dephospho.by_PP2B_on_34	$D34\_137\_PP2B \longrightarrow D137 + PP2B$	
54	voff19	D34:137_PP2B_unbinding	$D34\_137\_PP2B \longrightarrow D34\_137 + PP2B$	
55	von27	D34:75:137_PP2B_binding	$D34\_75\_137 + PP2B \longrightarrow D34\_75\_137\_PP2B$	
56	voff27	D34:75:137_PP2B_unbinding	$D34\_75\_137\_PP2B \longrightarrow D34\_75\_137 + PP2B$	
57	vcat27	D34:75:137_dephospho.by_PP2B_on_34	$D34\_75\_137\_PP2B \longrightarrow D75\_137 + PP2B$	
58	von15	D34:75_PP2A_binding	$D34\_75 + PP2A \longrightarrow D34\_75\_PP2A$	
59	vcat15	D34:75_dephospho.by_PP2A_on_75	$D34\_75\_PP2A \longrightarrow D34 + PP2A$	
60	voff15	D34:75_PP2A_unbinding	$D34\_75\_PP2A \longrightarrow D34\_75 + PP2A$	
61	von22	D75:137_PP2A_binding	$D75\_137 + PP2A \longrightarrow D75\_137\_PP2A$	
62	vcat22	D75:137_dephospho.by_PP2A_on_75	$D75\_137\_PP2A \longrightarrow D137 + PP2A$	
63	voff22	D75:137_PP2A_unbinding	$D75\_137\_PP2A \longrightarrow D75\_137 + PP2A$	
64	von25	D34:75:137_PP2A_binding	$D34\_75\_137 + PP2A \longrightarrow D34\_75\_134\_PP2A$	
65	vcat25	D34:75:137_dephospho.by_PP2A_on_75	$D34\_75\_134\_PP2A \longrightarrow D34\_137 + PP2A$	
66	voff25	D34:75:137_PP2A_unbinding	$D34\_75\_134\_PP2A \longrightarrow D34\_75\_137 + PP2A$	
67	von16	D34:75_PP2AP_binding	$D34\_75 + PP2AP \longrightarrow D34\_75\_PP2AP$	
68	vcat16	D34:75_dephospho.by_PP2AP_on_75	$D34\_75\_PP2AP \longrightarrow D34 + PP2AP$	
69	voff16	D34:75_PP2AP_unbinding	$D34\_75\_PP2AP \longrightarrow D34\_75 + PP2AP$	
70	von23	D75:137_PP2AP_binding	$D75\_137 + PP2AP \longrightarrow D75\_137\_PP2AP$	
71	vcat23	D75:137_dephospho.by_PP2AP_on_75	$D75\_137\_PP2AP \longrightarrow D137 + PP2AP$	
72	voff23	D75:137_PP2AP_unbinding	$D75\_137\_PP2AP \longrightarrow D75\_137 + PP2AP$	
73	vcat26	D34:75:137_dephospho.by_PP2AP_on_75	$D34\_75\_137\_PP2AP \longrightarrow D34\_137 + PP2AP$	
74	von26	D34:75:137_PP2AP_binding	$D34\_75\_137 + PP2AP \longrightarrow D34\_75\_137\_PP2AP$	
75	voff26	D34:75:137_PP2AP_unbinding	$D34\_75\_137\_PP2AP \longrightarrow D34\_75\_137 + PP2AP$	
76	von20	D34:137_PP2C_binding	$D34\_137 + PP2C \longrightarrow D34\_137\_PP2C$	
77	vcat20	D34:137_dephospho.by_PP2C_on_137	$D34\_137\_PP2C \longrightarrow D34 + PP2C$	
78	voff20	D34:137_PP2C_unbinding	$D34\_137\_PP2C \longrightarrow D34\_137 + PP2C$	
79	von24	D75:137_PP2C_binding	$D75\_137 + PP2C \longrightarrow D75\_137\_PP2C$	
80	vcat24	D75:137_dephospho.by_PP2C_137	$D75\_137\_PP2C \longrightarrow D75 + PP2C$	
81	voff24	D75:137_PP2C_unbinding	$D75\_137\_PP2C \longrightarrow D75\_137 + PP2C$	

Nº	Id	Name	Reaction Equation	SBO
82	von28	D34:75:137_PP2C_binding	$D34\_75\_137 + PP2C \longrightarrow D34\_75\_137\_PP2C$	
83	vcat28	D34:75:137_dephospho_by_PP2C_on_137	$D34\_75\_137\_PP2C \longrightarrow D34\_75 + PP2C$	
84	voff28	D34:75:137_PP2C_unbinding	$D34\_75\_137\_PP2C \longrightarrow D34\_75\_137 + PP2C$	
85	von29	CK1P_PP2B_binding	$CK1P + PP2B \longrightarrow CK1P\_PP2B$	
86	voff29	CK1P_PP2B_unbinding	$CK1P\_PP2B \longrightarrow CK1P + PP2B$	
87	vcat29	CK1P_dephospho_by_PP2B	$CK1P\_PP2B \longrightarrow CK1 + PP2B$	
88	vcat30	CK1_phosphorylation	$CK1 \longrightarrow CK1P$	
89	von31	PDE_PKA_binding	$PDE + PKA \longrightarrow PDE\_PKA$	
90	vcat31	PDE_phospho_by_PKA	$PDE\_PKA \longrightarrow PDEP + PKA$	
91	voff31	PDE_PKA_unbinding	$PDE\_PKA \longrightarrow PDE + PKA$	
92	vcat32	PDEP_dephospho	$PDEP \longrightarrow PDE$	
93	von33	PP2A_PKA_binding	$PP2A + PKA \longrightarrow PP2A\_PKA$	
94	voff33	PP2A_PKA_unbinding	$PP2A\_PKA \longrightarrow PP2A + PKA$	
95	vcat33	PP2A_phospho_by_PKA	$PP2A\_PKA \longrightarrow PP2AP + PKA$	
96	vcat34	PP2AP_dephospho	$PP2AP \longrightarrow PP2A$	
97	von35	PP2Binactive_Ca_binding	$PP2Binactive + 2\ Ca \longrightarrow PP2BinactiveCa2$	
98	von36	PP2B_activation	$PP2BinactiveCa2 + 2\ Ca \longrightarrow PP2B$	
99	voff35	PP2BinactiveCa2_Ca_unbinding	$PP2BinactiveCa2 \longrightarrow PP2Binactive + 2\ Ca$	
100	voff36	PP2B_inactivation	$PP2B \longrightarrow PP2BinactiveCa2 + 2\ Ca$	
101	von37	R2C2_cAMP_binding	$R2C2 + cAMP \longrightarrow cAMP\_R2C2$	
102	von38	cAMP_R2C2_binding_by_cAMP	$cAMP\_R2C2 + cAMP \longrightarrow cAMP2\_R2C2$	
103	von39	cAMP2_R2C2_binding_by_cAMP	$cAMP2\_R2C2 + cAMP \longrightarrow cAMP3\_R2C2$	
104	von40	cAMP3_R2C2_binding_by_cAMP	$cAMP3\_R2C2 + cAMP \longrightarrow cAMP4\_R2C2$	
105	voff37	cAMP_R2C2_unbinding	$cAMP\_R2C2 \longrightarrow R2C2 + cAMP$	
106	voff38	cAMP2_R2C2_unbinding	$cAMP2\_R2C2 \longrightarrow cAMP\_R2C2 + cAMP$	
107	voff39	cAMP3_R2C2_unbinding	$cAMP3\_R2C2 \longrightarrow cAMP2\_R2C2 + cAMP$	
108	voff40	cAMP4_R2C2_unbinding	$cAMP4\_R2C2 \longrightarrow cAMP3\_R2C2 + cAMP$	
109	von41	cAMP4_R2C_PKA_binding	$cAMP4\_R2C + PKA \longrightarrow cAMP4\_R2C2$	
110	voff41	cAMP4_R2C2_PKA_unbinding	$cAMP4\_R2C2 \longrightarrow cAMP4\_R2C + PKA$	



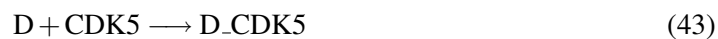
Nº	Id	Name	Reaction Equation	SBO
111	von42	cAMP4_R2_PKA_binding	$\text{cAMP4\_R2} + \text{PKA} \longrightarrow \text{cAMP4\_R2C}$	
112	von43	cAMP4_R2C_PKA_unbinding	$\text{cAMP4\_R2C} \longrightarrow \text{cAMP4\_R2} + \text{PKA}$	
113	von44	cAMP_PDE_binding	$\text{cAMP} + \text{PDE} \longrightarrow \text{cAMP\_PDE}$	
114	voff44	cAMP_PDE_unbinding	$\text{cAMP\_PDE} \longrightarrow \text{cAMP} + \text{PDE}$	
115	vc44	cAMP_PDE_degradation	$\text{cAMP\_PDE} \longrightarrow \text{AMP} + \text{PDE}$	
116	von45	cAMP_PDEP_binding	$\text{cAMP} + \text{PDEP} \longrightarrow \text{cAMP\_PDEP}$	
117	voff45	cAMP_PDEP_unbinding	$\text{cAMP\_PDEP} \longrightarrow \text{cAMP} + \text{PDEP}$	
118	vc45	cAMP_PDEP_degradation	$\text{cAMP\_PDEP} \longrightarrow \text{AMP} + \text{PDEP}$	
119	v57	Ca_in	$\text{Empty} \longrightarrow \text{Ca}$	
120	v58	Ca_destroy	$\text{Ca} \longrightarrow \text{Empty}$	

### 7.1 Reaction von1

This is an irreversible reaction of two reactants forming one product.

**Name** D\_CDK5\_binding

#### Reaction equation



#### Reactants

Table 6: Properties of each reactant.

Id	Name	SBO
D	D	
CDK5	CDK5	

#### Product

Table 7: Properties of each product.

Id	Name	SBO
D_CDK5	D_CDK5	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_1 = \text{vol}(\text{Spine}) \cdot \text{kon1} \cdot [D] \cdot [CDK5] \quad (44)$$

Table 8: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon1	kon1		5600000.0		<input checked="" type="checkbox"/>

### 7.2 Reaction voff1

This is an irreversible reaction of one reactant forming two products.

**Name** D\_CDK5\_unbinding

### Reaction equation



### Reactant

Table 9: Properties of each reactant.

Id	Name	SBO
D_CDK5	D_CDK5	

### Products

Table 10: Properties of each product.

Id	Name	SBO
D	D	
CDK5	CDK5	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_2 = \text{vol}(\text{Spine}) \cdot [\text{D\_CDK5}] \cdot \text{koff1} \quad (46)$$

Table 11: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff1	koff1		12.0		<input checked="" type="checkbox"/>

## 7.3 Reaction `vcat1`

This is an irreversible reaction of one reactant forming two products.

**Name** DPhospho\_by\_CDK5\_on\_75

### Reaction equation



### Reactant

Table 12: Properties of each reactant.

Id	Name	SBO
D_CDK5	D_CDK5	

## Products

Table 13: Properties of each product.

Id	Name	SBO
D75	D75	
CDK5	CDK5	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_3 = \text{vol}(\text{Spine}) \cdot [\text{D\_CDK5}] \cdot \text{kcat1} \quad (48)$$

Table 14: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat1	kcat1		3.0		<input checked="" type="checkbox"/>

## 7.4 Reaction von2

This is an irreversible reaction of two reactants forming one product.

**Name** DCDK1\_binding

## Reaction equation



## Reactants

Table 15: Properties of each reactant.

Id	Name	SBO
D	D	
CK1	CK1	

## Product

Table 16: Properties of each product.

Id	Name	SBO
D_CK1	D_CK1	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_4 = \text{vol}(\text{Spine}) \cdot [\text{D}] \cdot [\text{CK1}] \cdot \text{kon2} \quad (50)$$

Table 17: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon2	kon2		4400000.0		<input checked="" type="checkbox"/>

## 7.5 Reaction `voff2`

This is an irreversible reaction of one reactant forming two products.

**Name** D.CDK1\_unbinding

### Reaction equation



## Reactant

Table 18: Properties of each reactant.

Id	Name	SBO
D_CK1	D_CK1	

## Products

Table 19: Properties of each product.

Id	Name	SBO
D	D	

Id	Name	SBO
CK1	CK1	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_5 = \text{vol}(\text{Spine}) \cdot \text{koff2} \cdot [\text{D\_CK1}] \quad (52)$$

Table 20: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff2	koff2		12.0		<input checked="" type="checkbox"/>

## 7.6 Reaction `vcat2`

This is an irreversible reaction of one reactant forming two products.

**Name** D\_Phospho\_by\_CK1\_on\_137

## Reaction equation



## Reactant

Table 21: Properties of each reactant.

Id	Name	SBO
D_CK1	D_CK1	

## Products

Table 22: Properties of each product.

Id	Name	SBO
D137	D137	
CK1	CK1	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_6 = \text{vol}(\text{Spine}) \cdot \text{kcat2} \cdot [\text{D\_CK1}] \quad (54)$$

Table 23: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat2	kcat2		3.0		<input checked="" type="checkbox"/>

## 7.7 Reaction von3

This is an irreversible reaction of two reactants forming one product.

**Name** D\_PKA\_binding

### Reaction equation



### Reactants

Table 24: Properties of each reactant.

Id	Name	SBO
D	D	
PKA	PKA	

### Product

Table 25: Properties of each product.

Id	Name	SBO
D_PKA	D_PKA	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_7 = \text{vol}(\text{Spine}) \cdot [\text{D}] \cdot [\text{PKA}] \cdot \text{kon3} \quad (56)$$

Table 26: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon3	kon3		5600000.0		<input checked="" type="checkbox"/>

## 7.8 Reaction voff3

This is an irreversible reaction of one reactant forming two products.

**Name** D\_PKA\_unbinding

### Reaction equation



### Reactant

Table 27: Properties of each reactant.

Id	Name	SBO
D_PKA	D_PKA	

### Products

Table 28: Properties of each product.

Id	Name	SBO
D	D	
PKA	PKA	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_8 = \text{vol}(\text{Spine}) \cdot [\text{D\_PKA}] \cdot \text{koff3} \quad (58)$$

Table 29: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff3	koff3		10.8		<input checked="" type="checkbox"/>



## 7.9 Reaction vcat3

This is an irreversible reaction of one reactant forming two products.

**Name** D\_Phospho\_by\_PKA\_on\_34

### Reaction equation



### Reactant

Table 30: Properties of each reactant.

Id	Name	SBO
D_PKA	D_PKA	

### Products

Table 31: Properties of each product.

Id	Name	SBO
D34	D34	
PKA	PKA	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_9 = \text{vol}(\text{Spine}) \cdot [\text{D\_PKA}] \cdot \text{kcat3} \quad (60)$$

Table 32: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat3	kcat3		2.7		<input checked="" type="checkbox"/>

## 7.10 Reaction von4

This is an irreversible reaction of two reactants forming one product.

**Name** D34\_CDK5\_binding

### Reaction equation



### Reactants

Table 33: Properties of each reactant.

Id	Name	SBO
D34	D34	
CDK5	CDK5	

### Product

Table 34: Properties of each product.

Id	Name	SBO
D34_CDK5	D34_CDK5	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{10} = \text{vol}(\text{Spine}) \cdot [\text{D34}] \cdot [\text{CDK5}] \cdot \text{kon4} \quad (62)$$

Table 35: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon4	kon4		5600000.0		<input checked="" type="checkbox"/>

### 7.11 Reaction von5

This is an irreversible reaction of two reactants forming one product.

**Name** D34\_CK1\_binding

### Reaction equation



### Reactants

Table 36: Properties of each reactant.

Id	Name	SBO
D34	D34	
CK1	CK1	

## Product

Table 37: Properties of each product.

Id	Name	SBO
D34_CK1	D34_CK1	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{11} = \text{vol}(\text{Spine}) \cdot [\text{D34}] \cdot [\text{CK1}] \cdot \text{kon5} \quad (64)$$

Table 38: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon5	kon5		4400000.0		<input checked="" type="checkbox"/>

## 7.12 Reaction von6

This is an irreversible reaction of two reactants forming one product.

**Name** D34\_PP2B\_binding

## Reaction equation



## Reactants

Table 39: Properties of each reactant.

Id	Name	SBO
D34	D34	
PP2B	PP2B	

## Product

Table 40: Properties of each product.

Id	Name	SBO
D34_PP2B	D34_PP2B	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{12} = \text{vol}(\text{Spine}) \cdot [\text{D34}] \cdot [\text{PP2B}] \cdot \text{kon6} \quad (66)$$

Table 41: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon6	kon6		$10^7$		<input checked="" type="checkbox"/>

### 7.13 Reaction `voff4`

This is an irreversible reaction of one reactant forming two products.

**Name** D34.CDK5\_unbinding

#### Reaction equation



## Reactant

Table 42: Properties of each reactant.

Id	Name	SBO
D34_CDK5	D34_CDK5	

## Products

Table 43: Properties of each product.

Id	Name	SBO
D34	D34	

Id	Name	SBO
CDK5	CDK5	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{13} = \text{vol}(\text{Spine}) \cdot [\text{D34\_CDK5}] \cdot \text{koff4} \quad (68)$$

Table 44: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff4	koff4		12.0		<input checked="" type="checkbox"/>

### 7.14 Reaction `vcat4`

This is an irreversible reaction of one reactant forming two products.

**Name** D34.Phospho.by\_CDK5.on\_75

### Reaction equation



### Reactant

Table 45: Properties of each reactant.

Id	Name	SBO
D34_CDK5	D34_CDK5	

### Products

Table 46: Properties of each product.

Id	Name	SBO
D34_75	D34:75	
CDK5	CDK5	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{14} = \text{vol}(\text{Spine}) \cdot [\text{D34\_CDK5}] \cdot \text{kcat4} \quad (70)$$

Table 47: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat4	kcat4		3.0		<input checked="" type="checkbox"/>

## 7.15 Reaction voff5

This is an irreversible reaction of one reactant forming two products.

**Name** D34\_CK1\_unbinding

### Reaction equation



## Reactant

Table 48: Properties of each reactant.

Id	Name	SBO
D34_CK1	D34_CK1	

## Products

Table 49: Properties of each product.

Id	Name	SBO
D34	D34	
CK1	CK1	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{15} = \text{vol}(\text{Spine}) \cdot [\text{D34\_CK1}] \cdot \text{koff5} \quad (72)$$

Table 50: Properties of each parameter.

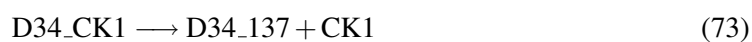
Id	Name	SBO	Value	Unit	Constant
koff5	koff5		12.0		<input checked="" type="checkbox"/>

### 7.16 Reaction vcat5

This is an irreversible reaction of one reactant forming two products.

**Name** D34\_Phospho\_by\_CK1\_on\_137

#### Reaction equation



#### Reactant

Table 51: Properties of each reactant.

Id	Name	SBO
D34_CK1	D34_CK1	

#### Products

Table 52: Properties of each product.

Id	Name	SBO
D34_137	D34:137	
CK1	CK1	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{16} = \text{vol}(\text{Spine}) \cdot [\text{D34\_CK1}] \cdot \text{kcat5} \quad (74)$$

Table 53: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat5	kcat5		3.0		<input checked="" type="checkbox"/>

### 7.17 Reaction `vcat6`

This is an irreversible reaction of one reactant forming two products.

**Name** D34.Dephospho.by\_PP2B

#### Reaction equation



#### Reactant

Table 54: Properties of each reactant.

Id	Name	SBO
D34_PP2B	D34_PP2B	

#### Products

Table 55: Properties of each product.

Id	Name	SBO
D	D	
PP2B	PP2B	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{17} = \text{vol}(\text{Spine}) \cdot [\text{D34\_PP2B}] \cdot \text{kcat6} \quad (76)$$

Table 56: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat6	kcat6		4.0		<input checked="" type="checkbox"/>

### 7.18 Reaction `voff6`

This is an irreversible reaction of one reactant forming two products.

**Name** D34\_PP2B\_unbinding



### Reaction equation



### Reactant

Table 57: Properties of each reactant.

Id	Name	SBO
D34_PP2B	D34_PP2B	

### Products

Table 58: Properties of each product.

Id	Name	SBO
D34	D34	
PP2B	PP2B	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{18} = \text{vol}(\text{Spine}) \cdot [\text{D34\_PP2B}] \cdot \text{koff6} \quad (78)$$

Table 59: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff6	koff6		16.0		<input checked="" type="checkbox"/>

### 7.19 Reaction von7

This is an irreversible reaction of two reactants forming one product.

**Name** D75\_CK1\_binding

### Reaction equation



### Reactants

Table 60: Properties of each reactant.

Id	Name	SBO
D75	D75	
CK1	CK1	

## Product

Table 61: Properties of each product.

Id	Name	SBO
D75CK1	D75_CK1	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{19} = \text{vol}(\text{Spine}) \cdot [\text{D75}] \cdot [\text{CK1}] \cdot \text{kon7} \quad (80)$$

Table 62: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon7	kon7		4400000.0		<input checked="" type="checkbox"/>

## 7.20 Reaction von8

This is an irreversible reaction of two reactants forming one product.

**Name** D75\_PKA\_binding

## Reaction equation



## Reactants

Table 63: Properties of each reactant.

Id	Name	SBO
D75	D75	
PKA	PKA	

## Product

Table 64: Properties of each product.

Id	Name	SBO
D75_PKA	D75_PKA	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{20} = \text{vol}(\text{Spine}) \cdot [\text{D75}] \cdot [\text{PKA}] \cdot \text{kon8} \quad (82)$$

Table 65: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon8	kon8		5600000.0		<input checked="" type="checkbox"/>

## 7.21 Reaction von9

This is an irreversible reaction of two reactants forming one product.

**Name** D75\_PP2A.binding

## Reaction equation



## Reactants

Table 66: Properties of each reactant.

Id	Name	SBO
D75	D75	
PP2A	PP2A	

## Product

Table 67: Properties of each product.

Id	Name	SBO
D75_PP2A	D75_PP2A	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{21} = \text{vol}(\text{Spine}) \cdot [\text{D75}] \cdot [\text{PP2A}] \cdot \text{kon9} \quad (84)$$

Table 68: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon9	kon9		3800000.0		<input checked="" type="checkbox"/>

### 7.22 Reaction von10

This is an irreversible reaction of two reactants forming one product.

**Name** D75\_PP2AP.binding

### Reaction equation



### Reactants

Table 69: Properties of each reactant.

Id	Name	SBO
D75	D75	
PP2AP	PP2AP	

### Product

Table 70: Properties of each product.

Id	Name	SBO
D75_PP2AP	D75_PP2AP	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{22} = \text{vol}(\text{Spine}) \cdot [\text{D75}] \cdot [\text{PP2AP}] \cdot \text{kon10} \quad (86)$$

Table 71: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon10	kon10		$1.7 \cdot 10^7$		<input checked="" type="checkbox"/>

## 7.23 Reaction voff7

This is an irreversible reaction of one reactant forming two products.

**Name** D75\_CK1\_unbinding

### Reaction equation



## Reactant

Table 72: Properties of each reactant.

Id	Name	SBO
D75CK1	D75_CK1	

## Products

Table 73: Properties of each product.

Id	Name	SBO
D75	D75	
CK1	CK1	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{23} = \text{vol}(\text{Spine}) \cdot [\text{D75CK1}] \cdot \text{koff7} \quad (88)$$

Table 74: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff7	koff7		12.0		<input checked="" type="checkbox"/>

## 7.24 Reaction vcat7

This is an irreversible reaction of one reactant forming two products.

**Name** D75\_Phospho\_by\_CK1\_on\_137

### Reaction equation



### Reactant

Table 75: Properties of each reactant.

Id	Name	SBO
D75CK1	D75_CK1	

### Products

Table 76: Properties of each product.

Id	Name	SBO
CK1	CK1	
D75_137	D75:137	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{24} = \text{vol}(\text{Spine}) \cdot [\text{D75CK1}] \cdot \text{kcat7} \quad (90)$$

Table 77: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat7	kcat7		3.0		<input checked="" type="checkbox"/>

### 7.25 Reaction `vcat8`

This is an irreversible reaction of one reactant forming two products.

**Name** D75.Phospho.by\_PKA.on\_34

#### Reaction equation



#### Reactant

Table 78: Properties of each reactant.

Id	Name	SBO
D75_PKA	D75_PKA	

#### Products

Table 79: Properties of each product.

Id	Name	SBO
D34_75	D34:75	
PKA	PKA	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{25} = \text{vol}(\text{Spine}) \cdot [\text{D75\_PKA}] \cdot \text{kcat8} \quad (92)$$

Table 80: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat8	kcat8		0.0		<input checked="" type="checkbox"/>

### 7.26 Reaction `voff8`

This is an irreversible reaction of one reactant forming two products.

**Name** D75\_PKA\_unbinding

### Reaction equation



### Reactant

Table 81: Properties of each reactant.

Id	Name	SBO
D75_PKA	D75_PKA	

### Products

Table 82: Properties of each product.

Id	Name	SBO
D75	D75	
PKA	PKA	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{26} = \text{vol}(\text{Spine}) \cdot [\text{D75\_PKA}] \cdot \text{koff8} \quad (94)$$

Table 83: Properties of each parameter.

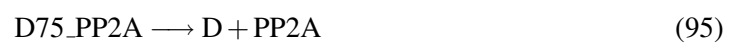
Id	Name	SBO	Value	Unit	Constant
koff8	koff8		10.8		<input checked="" type="checkbox"/>

### 7.27 Reaction vcat9

This is an irreversible reaction of one reactant forming two products.

**Name** D75\_dephospho\_by\_PP2A

### Reaction equation



### Reactant



Table 84: Properties of each reactant.

Id	Name	SBO
D75_PP2A	D75_PP2A	

## Products

Table 85: Properties of each product.

Id	Name	SBO
D PP2A	D PP2A	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{27} = \text{vol}(\text{Spine}) \cdot [\text{D75\_PP2A}] \cdot \text{kcat9} \quad (96)$$

Table 86: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat9	kcat9		10.0		<input checked="" type="checkbox"/>

## 7.28 Reaction voff9

This is an irreversible reaction of one reactant forming two products.

**Name** D75\_PP2A\_unbinding

## Reaction equation



## Reactant

Table 87: Properties of each reactant.

Id	Name	SBO
D75_PP2A	D75_PP2A	

## Products

Table 88: Properties of each product.

Id	Name	SBO
D75	D75	
PP2A	PP2A	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{28} = \text{vol}(\text{Spine}) \cdot [\text{D75\_PP2A}] \cdot \text{koff9} \quad (98)$$

Table 89: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff9	koff9		24.0		<input checked="" type="checkbox"/>

## 7.29 Reaction vcat10

This is an irreversible reaction of one reactant forming two products.

**Name** D75\_dephospho\_by\_PP2AP

## Reaction equation



## Reactant

Table 90: Properties of each reactant.

Id	Name	SBO
D75_PP2AP	D75_PP2AP	

## Products

Table 91: Properties of each product.

Id	Name	SBO
D	D	
PP2AP	PP2AP	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{29} = \text{vol}(\text{Spine}) \cdot [\text{D75\_PP2AP}] \cdot \text{kcat10} \quad (100)$$

Table 92: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat10	kcat10		24.0		<input checked="" type="checkbox"/>

### 7.30 Reaction `voff10`

This is an irreversible reaction of one reactant forming two products.

**Name** D75\_PP2AP\_unbinding

### Reaction equation



### Reactant

Table 93: Properties of each reactant.

Id	Name	SBO
D75_PP2AP	D75_PP2AP	

### Products

Table 94: Properties of each product.

Id	Name	SBO
D75	D75	
PP2AP	PP2AP	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{30} = \text{vol}(\text{Spine}) \cdot [\text{D75\_PP2AP}] \cdot \text{koff10} \quad (102)$$

Table 95: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff10	koff10		40.0		<input checked="" type="checkbox"/>

## 7.31 Reaction von11

This is an irreversible reaction of two reactants forming one product.

**Name** D137\_CDK5\_binding

## Reaction equation



## Reactants

Table 96: Properties of each reactant.

Id	Name	SBO
D137	D137	
CDK5	CDK5	

## Product

Table 97: Properties of each product.

Id	Name	SBO
D137_CDK5	D137_CDK5	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{31} = \text{vol}(\text{Spine}) \cdot [\text{D137}] \cdot [\text{CDK5}] \cdot \text{kon11} \quad (104)$$

Table 98: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon11	kon11		5600000.0		<input checked="" type="checkbox"/>

### 7.32 Reaction von12

This is an irreversible reaction of two reactants forming one product.

**Name** D137\_PKA\_binding

#### Reaction equation



#### Reactants

Table 99: Properties of each reactant.

Id	Name	SBO
D137	D137	
PKA	PKA	

#### Product

Table 100: Properties of each product.

Id	Name	SBO
D137_PKA	D137_PKA	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{32} = \text{vol}(\text{Spine}) \cdot [\text{D137}] \cdot [\text{PKA}] \cdot \text{kon12} \quad (106)$$

Table 101: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon12	kon12		5600000.0		<input checked="" type="checkbox"/>

### 7.33 Reaction von13

This is an irreversible reaction of two reactants forming one product.

**Name** D137\_PP2C\_binding

#### Reaction equation



#### Reactants

Table 102: Properties of each reactant.

Id	Name	SBO
D137	D137	
PP2C	PP2C	

#### Product

Table 103: Properties of each product.

Id	Name	SBO
D137_PP2C	D137_PP2C	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{33} = \text{vol}(\text{Spine}) \cdot [\text{D137}] \cdot [\text{PP2C}] \cdot \text{kon13} \quad (108)$$

Table 104: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon13	kon13		7500000.0		<input checked="" type="checkbox"/>

### 7.34 Reaction voff11

This is an irreversible reaction of one reactant forming two products.

**Name** D137\_CDK5\_unbinding

### Reaction equation



### Reactant

Table 105: Properties of each reactant.

Id	Name	SBO
D137_CDK5	D137_CDK5	

### Products

Table 106: Properties of each product.

Id	Name	SBO
D137	D137	
CDK5	CDK5	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{34} = \text{vol}(\text{Spine}) \cdot [\text{D137\_CDK5}] \cdot \text{koff11} \quad (110)$$

Table 107: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff11	koff11		12.0		<input checked="" type="checkbox"/>

### 7.35 Reaction `vcat11`

This is an irreversible reaction of one reactant forming two products.

**Name** D137\_Phospho\_by\_CDK5\_on\_75

### Reaction equation



### Reactant

Table 108: Properties of each reactant.

Id	Name	SBO
D137_CDK5	D137_CDK5	

## Products

Table 109: Properties of each product.

Id	Name	SBO
D75_137 CDK5	D75:137 CDK5	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{35} = \text{vol}(\text{Spine}) \cdot [\text{D137\_CDK5}] \cdot \text{kcat11} \quad (112)$$

Table 110: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat11	kcat11		3.0		<input checked="" type="checkbox"/>

### 7.36 Reaction voff12

This is an irreversible reaction of one reactant forming two products.

**Name** D137\_PKA\_unbinding

## Reaction equation



## Reactant

Table 111: Properties of each reactant.

Id	Name	SBO
D137_PKA	D137_PKA	



## Products

Table 112: Properties of each product.

Id	Name	SBO
D137	D137	
PKA	PKA	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{36} = \text{vol}(\text{Spine}) \cdot [\text{D137\_PKA}] \cdot \text{koff12} \quad (114)$$

Table 113: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff12	koff12		10.8		<input checked="" type="checkbox"/>

## 7.37 Reaction `vcat12`

This is an irreversible reaction of one reactant forming two products.

**Name** D137\_phospho\_by\_PKA\_on\_34

## Reaction equation



## Reactant

Table 114: Properties of each reactant.

Id	Name	SBO
D137_PKA	D137_PKA	

## Products

Table 115: Properties of each product.

Id	Name	SBO
D34_137	D34:137	
PKA	PKA	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{37} = \text{vol}(\text{Spine}) \cdot [\text{D137\_PKA}] \cdot \text{kcat12} \quad (116)$$

Table 116: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat12	kcat12		2.7		<input checked="" type="checkbox"/>

### 7.38 Reaction `vcat13`

This is an irreversible reaction of one reactant forming two products.

**Name** D137\_dephospho\_by\_PP2C

### Reaction equation



### Reactant

Table 117: Properties of each reactant.

Id	Name	SBO
D137_PP2C	D137_PP2C	

### Products

Table 118: Properties of each product.

Id	Name	SBO
D	D	
PP2C	PP2C	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{38} = \text{vol}(\text{Spine}) \cdot [\text{D137\_PP2C}] \cdot \text{kcat13} \quad (118)$$

Table 119: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat13	kcat13		3.0		<input checked="" type="checkbox"/>

## 7.39 Reaction voff13

This is an irreversible reaction of one reactant forming two products.

**Name** D137\_PP2C\_unbinding

## Reaction equation



## Reactant

Table 120: Properties of each reactant.

Id	Name	SBO
D137_PP2C	D137_PP2C	

## Products

Table 121: Properties of each product.

Id	Name	SBO
D137	D137	
PP2C	PP2C	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{39} = \text{vol}(\text{Spine}) \cdot [\text{D137\_PP2C}] \cdot \text{koff13} \quad (120)$$

Table 122: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff13	koff13		12.0		<input checked="" type="checkbox"/>

## 7.40 Reaction von14

This is an irreversible reaction of two reactants forming one product.

**Name** D34:75\_CK1\_binding

### Reaction equation



### Reactants

Table 123: Properties of each reactant.

Id	Name	SBO
D34_75	D34:75	
CK1	CK1	

### Product

Table 124: Properties of each product.

Id	Name	SBO
D34_75_CK1	D34:75_CK1	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{40} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75}] \cdot [\text{CK1}] \cdot \text{kon14} \quad (122)$$

Table 125: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon14	kon14		4400000.0		<input checked="" type="checkbox"/>

### 7.41 Reaction von18

This is an irreversible reaction of two reactants forming one product.

**Name** D34:137\_CDK5\_binding

#### Reaction equation



#### Reactants

Table 126: Properties of each reactant.

Id	Name	SBO
D34_137	D34:137	
CDK5	CDK5	

#### Product

Table 127: Properties of each product.

Id	Name	SBO
D34_137_CDK5	D34:137_CDK5	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{41} = \text{vol}(\text{Spine}) \cdot [\text{D34\_137}] \cdot [\text{CDK5}] \cdot \text{kon18} \quad (124)$$

Table 128: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon18	kon18		5600000.0		<input checked="" type="checkbox"/>

### 7.42 Reaction voff18

This is an irreversible reaction of one reactant forming two products.

**Name** D34:137\_CDK5\_unbinding

### Reaction equation



### Reactant

Table 129: Properties of each reactant.

Id	Name	SBO
D34_137_CDK5	D34:137_CDK5	

### Products

Table 130: Properties of each product.

Id	Name	SBO
D34_137 CDK5	D34:137 CDK5	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{42} = \text{vol}(\text{Spine}) \cdot [\text{D34\_137\_CDK5}] \cdot \text{koff18} \quad (126)$$

Table 131: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff18	koff18		12.0		<input checked="" type="checkbox"/>

### 7.43 Reaction voff14

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75\_CK1\_unbinding

### Reaction equation



### Reactant

Table 132: Properties of each reactant.

Id	Name	SBO
D34_75_CK1	D34:75_CK1	

## Products

Table 133: Properties of each product.

Id	Name	SBO
D34_75_CK1	D34:75_CK1	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{43} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_CK1}] \cdot \text{koff14} \quad (128)$$

Table 134: Properties of each parameter.

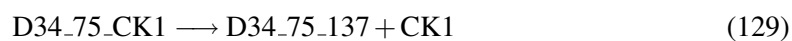
Id	Name	SBO	Value	Unit	Constant
koff14	koff14		12.0		<input checked="" type="checkbox"/>

### 7.44 Reaction `vcat14`

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75\_phospho\_by\_CK1\_on\_137

## Reaction equation



## Reactant

Table 135: Properties of each reactant.

Id	Name	SBO
D34_75_CK1	D34:75_CK1	

## Products

Table 136: Properties of each product.

Id	Name	SBO
D34_75_137	D34:75:137	
CK1	CK1	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{44} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_CK1}] \cdot \text{kcat14} \quad (130)$$

Table 137: Properties of each parameter.

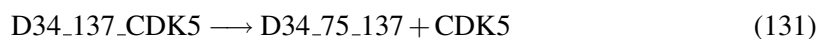
Id	Name	SBO	Value	Unit	Constant
kcat14	kcat14		3.0		<input checked="" type="checkbox"/>

### 7.45 Reaction `vcat18`

This is an irreversible reaction of one reactant forming two products.

**Name** D34:137\_phospho\_by\_CDK5\_on\_75

#### Reaction equation



## Reactant

Table 138: Properties of each reactant.

Id	Name	SBO
D34_137_CDK5	D34:137_CDK5	

## Products



Table 139: Properties of each product.

Id	Name	SBO
D34_75_137	D34:75:137	
CDK5	CDK5	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{45} = \text{vol}(\text{Spine}) \cdot [\text{D34\_137\_CDK5}] \cdot \text{kcat18} \quad (132)$$

Table 140: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat18	kcat18		3.0		<input checked="" type="checkbox"/>

### 7.46 Reaction von21

This is an irreversible reaction of two reactants forming one product.

**Name** D75:137\_PKA\_binding

### Reaction equation



### Reactants

Table 141: Properties of each reactant.

Id	Name	SBO
D75_137	D75:137	
PKA	PKA	

### Product

Table 142: Properties of each product.

Id	Name	SBO
D75_137_PKA	D75:137_PKA	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{46} = \text{vol}(\text{Spine}) \cdot [\text{D75\_137}] \cdot [\text{PKA}] \cdot \text{kon21} \quad (134)$$

Table 143: Properties of each parameter.

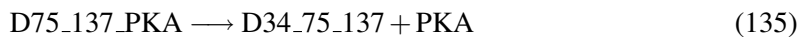
Id	Name	SBO	Value	Unit	Constant
kon21	kon21		5600000.0		<input checked="" type="checkbox"/>

## 7.47 Reaction $v_{\text{cat21}}$

This is an irreversible reaction of one reactant forming two products.

**Name** D75:137\_phospho\_by\_PKA\_on\_34

### Reaction equation



### Reactant

Table 144: Properties of each reactant.

Id	Name	SBO
D75\_137\_PKA	D75:137_PKA	

### Products

Table 145: Properties of each product.

Id	Name	SBO
D34\_75\_137	D34:75:137	
PKA	PKA	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{47} = \text{vol}(\text{Spine}) \cdot [\text{D75\_137\_PKA}] \cdot \text{kcat21} \quad (136)$$

Table 146: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat21	kcat21		0.0		<input checked="" type="checkbox"/>

### 7.48 Reaction voff21

This is an irreversible reaction of one reactant forming two products.

**Name** D75:137\_PKA\_unbinding

#### Reaction equation



#### Reactant

Table 147: Properties of each reactant.

Id	Name	SBO
D75_137_PKA	D75:137_PKA	

#### Products

Table 148: Properties of each product.

Id	Name	SBO
D75_137 PKA	D75:137 PKA	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{48} = \text{vol}(\text{Spine}) \cdot [\text{D75\_137\_PKA}] \cdot \text{koff21} \quad (138)$$

Table 149: Properties of each parameter.

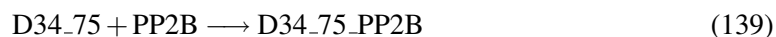
Id	Name	SBO	Value	Unit	Constant
koff21	koff21		10.8		<input checked="" type="checkbox"/>

### 7.49 Reaction von17

This is an irreversible reaction of two reactants forming one product.

**Name** D34:75\_PP2B\_binding

#### Reaction equation



#### Reactants

Table 150: Properties of each reactant.

Id	Name	SBO
D34_75	D34:75	
PP2B	PP2B	

#### Product

Table 151: Properties of each product.

Id	Name	SBO
D34_75_PP2B	D34:75_PP2B	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{49} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75}] \cdot [\text{PP2B}] \cdot \text{kon17} \quad (140)$$

Table 152: Properties of each parameter.

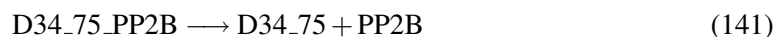
Id	Name	SBO	Value	Unit	Constant
kon17	kon17		$10^7$		<input checked="" type="checkbox"/>

### 7.50 Reaction voff17

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75\_PP2B\_unbinding

### Reaction equation



### Reactant

Table 153: Properties of each reactant.

Id	Name	SBO
D34_75_PP2B	D34:75_PP2B	

### Products

Table 154: Properties of each product.

Id	Name	SBO
D34_75	D34:75	
PP2B	PP2B	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{50} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_PP2B}] \cdot \text{koff17} \quad (142)$$

Table 155: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff17	koff17		1600.0		<input checked="" type="checkbox"/>

### 7.51 Reaction `vcat17`

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75\_dephopsho\_by\_PP2B\_on\_34

### Reaction equation



### Reactant

Table 156: Properties of each reactant.

Id	Name	SBO
D34_75_PP2B	D34:75_PP2B	

## Products

Table 157: Properties of each product.

Id	Name	SBO
D75	D75	
PP2B	PP2B	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{51} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_PP2B}] \cdot \text{kcat17} \quad (144)$$

Table 158: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat17	kcat17		4.0		<input checked="" type="checkbox"/>

## 7.52 Reaction von19

This is an irreversible reaction of two reactants forming one product.

**Name** D34:137\_PP2B\_binding

## Reaction equation



## Reactants

Table 159: Properties of each reactant.

Id	Name	SBO
D34_137	D34:137	
PP2B	PP2B	

## Product

Table 160: Properties of each product.

Id	Name	SBO
D34_137_PP2B	D34:137_PP2B	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{52} = \text{vol}(\text{Spine}) \cdot [\text{D34}_\cdot 137] \cdot [\text{PP2B}] \cdot \text{kon19} \quad (146)$$

Table 161: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon19	kon19		75000.0		<input checked="" type="checkbox"/>

## 7.53 Reaction `vcat19`

This is an irreversible reaction of one reactant forming two products.

**Name** D34:137\_dephospho\_by\_PP2B\_on\_34

## Reaction equation



## Reactant

Table 162: Properties of each reactant.

Id	Name	SBO
D34_137_PP2B	D34:137_PP2B	

## Products

Table 163: Properties of each product.

Id	Name	SBO
D137	D137	

Id	Name	SBO
PP2B	PP2B	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{53} = \text{vol}(\text{Spine}) \cdot [\text{D34\_137\_PP2B}] \cdot \text{kcat19} \quad (148)$$

Table 164: Properties of each parameter.

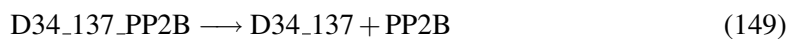
Id	Name	SBO	Value	Unit	Constant
kcat19	kcat19		0.03		<input checked="" type="checkbox"/>

## 7.54 Reaction voff19

This is an irreversible reaction of one reactant forming two products.

**Name** D34:137\_PP2B\_unbinding

## Reaction equation



## Reactant

Table 165: Properties of each reactant.

Id	Name	SBO
D34_137_PP2B	D34:137_PP2B	

## Products

Table 166: Properties of each product.

Id	Name	SBO
D34_137	D34:137	
PP2B	PP2B	



## Kinetic Law

**Derived unit** contains undeclared units

$$v_{54} = \text{vol}(\text{Spine}) \cdot [\text{D34\_137\_PP2B}] \cdot \text{koff19} \quad (150)$$

Table 167: Properties of each parameter.

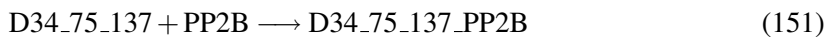
Id	Name	SBO	Value	Unit	Constant
koff19	koff19		0.12		<input checked="" type="checkbox"/>

## 7.55 Reaction von27

This is an irreversible reaction of two reactants forming one product.

**Name** D34:75:137\_PP2B\_binding

## Reaction equation



## Reactants

Table 168: Properties of each reactant.

Id	Name	SBO
D34_75_137	D34:75:137	
PP2B	PP2B	

## Product

Table 169: Properties of each product.

Id	Name	SBO
D34_75_137_PP2B	D34:75:137_PP2B	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{55} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_137}] \cdot [\text{PP2B}] \cdot \text{kon27} \quad (152)$$

Table 170: Properties of each parameter.

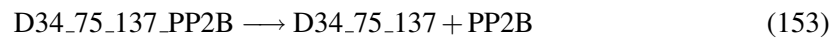
Id	Name	SBO	Value	Unit	Constant
kon27	kon27		75000.0		<input checked="" type="checkbox"/>

### 7.56 Reaction voff27

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75:137\_PP2B\_unbinding

#### Reaction equation



#### Reactant

Table 171: Properties of each reactant.

Id	Name	SBO
D34_75_137_PP2B	D34:75:137_PP2B	

#### Products

Table 172: Properties of each product.

Id	Name	SBO
D34_75_137 PP2B	D34:75:137 PP2B	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{56} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_137\_PP2B}] \cdot \text{koff27} \quad (154)$$

Table 173: Properties of each parameter.

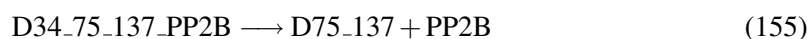
Id	Name	SBO	Value	Unit	Constant
koff27	koff27		120.0		<input checked="" type="checkbox"/>

### 7.57 Reaction vcat27

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75:137\_dephospho\_by\_PP2B\_on\_34

#### Reaction equation



#### Reactant

Table 174: Properties of each reactant.

Id	Name	SBO
D34_75_137_PP2B	D34:75:137_PP2B	

#### Products

Table 175: Properties of each product.

Id	Name	SBO
D75_137	D75:137	
PP2B	PP2B	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{57} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_137\_PP2B}] \cdot \text{kcat27} \quad (156)$$

Table 176: Properties of each parameter.

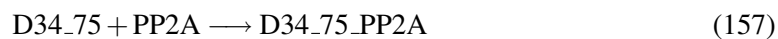
Id	Name	SBO	Value	Unit	Constant
kcat27	kcat27		0.03		<input checked="" type="checkbox"/>

### 7.58 Reaction von15

This is an irreversible reaction of two reactants forming one product.

**Name** D34:75\_PP2A\_binding

### Reaction equation



### Reactants

Table 177: Properties of each reactant.

Id	Name	SBO
D34_75	D34:75	
PP2A	PP2A	

### Product

Table 178: Properties of each product.

Id	Name	SBO
D34_75_PP2A	D34:75_PP2A	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{58} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75}] \cdot [\text{PP2A}] \cdot \text{kon15} \quad (158)$$

Table 179: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon15	kon15		3800000.0		<input checked="" type="checkbox"/>

### 7.59 Reaction vcat15

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75\_dephospho\_by\_PP2A\_on\_75

### Reaction equation



### Reactant

Table 180: Properties of each reactant.

Id	Name	SBO
D34_75_PP2A	D34:75_PP2A	

## Products

Table 181: Properties of each product.

Id	Name	SBO
D34 PP2A	D34 PP2A	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{59} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_PP2A}] \cdot \text{kcat15} \quad (160)$$

Table 182: Properties of each parameter.

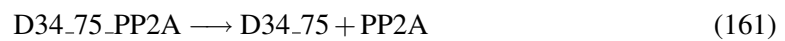
Id	Name	SBO	Value	Unit	Constant
kcat15	kcat15		10.0		<input checked="" type="checkbox"/>

### 7.60 Reaction voff15

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75\_PP2A\_unbinding

### Reaction equation



## Reactant

Table 183: Properties of each reactant.

Id	Name	SBO
D34_75_PP2A	D34:75_PP2A	

## Products

Table 184: Properties of each product.

Id	Name	SBO
D34_75	D34:75	
PP2A	PP2A	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{60} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_PP2A}] \cdot \text{koff15} \quad (162)$$

Table 185: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff15	koff15		24.0		<input checked="" type="checkbox"/>

## 7.61 Reaction von22

This is an irreversible reaction of two reactants forming one product.

**Name** D75:137\_PP2A.binding

## Reaction equation



## Reactants

Table 186: Properties of each reactant.

Id	Name	SBO
D75_137	D75:137	
PP2A	PP2A	

## Product

Table 187: Properties of each product.

Id	Name	SBO
D75_137_PP2A	D75:137_PP2A	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{61} = \text{vol}(\text{Spine}) \cdot [\text{D75\_137}] \cdot [\text{PP2A}] \cdot \text{kon22} \quad (164)$$

Table 188: Properties of each parameter.

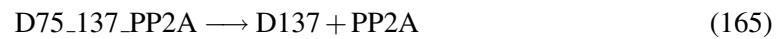
Id	Name	SBO	Value	Unit	Constant
kon22	kon22		3800000.0		<input checked="" type="checkbox"/>

### 7.62 Reaction `vcat22`

This is an irreversible reaction of one reactant forming two products.

**Name** D75:137\_dephospho\_by\_PP2A\_on\_75

### Reaction equation



### Reactant

Table 189: Properties of each reactant.

Id	Name	SBO
D75_137_PP2A	D75:137_PP2A	

### Products

Table 190: Properties of each product.

Id	Name	SBO
D137	D137	
PP2A	PP2A	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{62} = \text{vol}(\text{Spine}) \cdot [\text{D75\_137\_PP2A}] \cdot \text{kcat22} \quad (166)$$

Table 191: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat22	kcat22		10.0		<input checked="" type="checkbox"/>

## 7.63 Reaction voff22

This is an irreversible reaction of one reactant forming two products.

**Name** D75:137\_PP2A\_unbinding

### Reaction equation



### Reactant

Table 192: Properties of each reactant.

Id	Name	SBO
D75_137_PP2A	D75:137_PP2A	

### Products

Table 193: Properties of each product.

Id	Name	SBO
D75_137	D75:137	
PP2A	PP2A	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{63} = \text{vol}(\text{Spine}) \cdot [\text{D75\_137\_PP2A}] \cdot \text{koff22} \quad (168)$$



Table 194: Properties of each parameter.

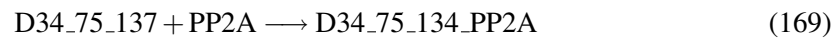
Id	Name	SBO	Value	Unit	Constant
koff22	koff22		24.0		<input checked="" type="checkbox"/>

## 7.64 Reaction von25

This is an irreversible reaction of two reactants forming one product.

**Name** D34:75:137\_PP2A\_binding

### Reaction equation



### Reactants

Table 195: Properties of each reactant.

Id	Name	SBO
D34_75_137	D34:75:137	
PP2A	PP2A	

### Product

Table 196: Properties of each product.

Id	Name	SBO
D34_75_134_PP2A	D34:75:137_PP2A	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{64} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_137}] \cdot [\text{PP2A}] \cdot \text{kon25} \quad (170)$$

Table 197: Properties of each parameter.

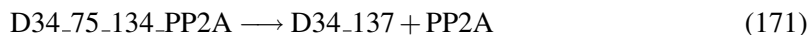
Id	Name	SBO	Value	Unit	Constant
kon25	kon25		3800000.0		<input checked="" type="checkbox"/>

### 7.65 Reaction $v_{cat25}$

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75:137\_dephospho\_by\_PP2A\_on\_75

#### Reaction equation



#### Reactant

Table 198: Properties of each reactant.

Id	Name	SBO
D34_75_134_PP2A	D34:75:137_PP2A	

#### Products

Table 199: Properties of each product.

Id	Name	SBO
D34_137	D34:137	
PP2A	PP2A	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{65} = \text{vol}(\text{Spine}) \cdot [D34\_75\_134\_PP2A] \cdot kcat25 \quad (172)$$

Table 200: Properties of each parameter.

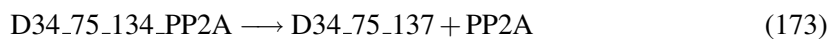
Id	Name	SBO	Value	Unit	Constant
kcat25	kcat25		10.0		<input checked="" type="checkbox"/>

### 7.66 Reaction $v_{off25}$

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75:137\_PP2A\_unbinding

### Reaction equation



### Reactant

Table 201: Properties of each reactant.

Id	Name	SBO
D34_75_134_PP2A	D34:75:137_PP2A	

### Products

Table 202: Properties of each product.

Id	Name	SBO
D34_75_137 PP2A	D34:75:137 PP2A	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{66} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_134\_PP2A}] \cdot \text{koff25} \quad (174)$$

Table 203: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff25	koff25		24.0		<input checked="" type="checkbox"/>

### 7.67 Reaction von16

This is an irreversible reaction of two reactants forming one product.

**Name** D34:75\_PP2AP\_binding

### Reaction equation



### Reactants

Table 204: Properties of each reactant.

Id	Name	SBO
D34_75	D34:75	
PP2AP	PP2AP	

## Product

Table 205: Properties of each product.

Id	Name	SBO
D34_75_PP2AP	D34:75_PP2AP	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{67} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75}] \cdot [\text{PP2AP}] \cdot \text{kon16} \quad (176)$$

Table 206: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon16	kon16		$1.7 \cdot 10^7$		<input checked="" type="checkbox"/>

## 7.68 Reaction vcat16

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75\_dephospho\_by\_PP2AP\_on\_75

## Reaction equation



## Reactant

Table 207: Properties of each reactant.

Id	Name	SBO
D34_75_PP2AP	D34:75_PP2AP	

## Products

Table 208: Properties of each product.

Id	Name	SBO
D34	D34	
PP2AP	PP2AP	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{68} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_PP2AP}] \cdot \text{kcat16} \quad (178)$$

Table 209: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat16	kcat16		24.0		<input checked="" type="checkbox"/>

### 7.69 Reaction `voff16`

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75\_PP2AP\_unbinding

#### Reaction equation



## Reactant

Table 210: Properties of each reactant.

Id	Name	SBO
D34_75_PP2AP	D34:75_PP2AP	

## Products

Table 211: Properties of each product.

Id	Name	SBO
D34_75	D34:75	
PP2AP	PP2AP	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{69} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_PP2AP}] \cdot \text{koff16} \quad (180)$$

Table 212: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff16	koff16		40.0		<input checked="" type="checkbox"/>

### 7.70 Reaction von23

This is an irreversible reaction of two reactants forming one product.

**Name** D75:137\_PP2AP\_binding

### Reaction equation



### Reactants

Table 213: Properties of each reactant.

Id	Name	SBO
D75_137	D75:137	
PP2AP	PP2AP	

### Product

Table 214: Properties of each product.

Id	Name	SBO
D75_137_PP2AP	D75:137_PP2AP	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{70} = \text{vol}(\text{Spine}) \cdot [\text{D75\_137}] \cdot [\text{PP2AP}] \cdot \text{kon23} \quad (182)$$

Table 215: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon23	kon23		$1.7 \cdot 10^7$		<input checked="" type="checkbox"/>

## 7.71 Reaction $v_{\text{cat23}}$

This is an irreversible reaction of one reactant forming two products.

**Name** D75:137\_dephospho\_by\_PP2AP\_on\_75

## Reaction equation



## Reactant

Table 216: Properties of each reactant.

Id	Name	SBO
D75_137_PP2AP	D75:137_PP2AP	

## Products

Table 217: Properties of each product.

Id	Name	SBO
D137	D137	
PP2AP	PP2AP	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{71} = \text{vol}(\text{Spine}) \cdot [\text{D75\_137\_PP2AP}] \cdot \text{kcat23} \quad (184)$$

Table 218: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat23	kcat23		24.0		<input checked="" type="checkbox"/>

## 7.72 Reaction voff23

This is an irreversible reaction of one reactant forming two products.

**Name** D75:137\_PP2AP\_unbinding

### Reaction equation



### Reactant

Table 219: Properties of each reactant.

Id	Name	SBO
D75_137_PP2AP	D75:137_PP2AP	

### Products

Table 220: Properties of each product.

Id	Name	SBO
D75_137 PP2AP	D75:137 PP2AP	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{72} = \text{vol}(\text{Spine}) \cdot [\text{D75\_137\_PP2AP}] \cdot \text{koff23} \quad (186)$$

Table 221: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff23	koff23		40.0		<input checked="" type="checkbox"/>

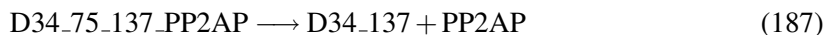


### 7.73 Reaction `vcat26`

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75:137\_dephospho\_by\_PP2AP\_on 75

#### Reaction equation



#### Reactant

Table 222: Properties of each reactant.

Id	Name	SBO
D34_75_137_PP2AP	D34:75:137_PP2AP	

#### Products

Table 223: Properties of each product.

Id	Name	SBO
D34_137	D34:137	
PP2AP	PP2AP	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{73} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_137\_PP2AP}] \cdot \text{kcat26} \quad (188)$$

Table 224: Properties of each parameter.

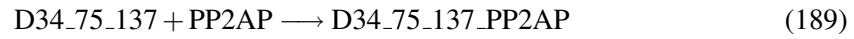
Id	Name	SBO	Value	Unit	Constant
kcat26	kcat26		24.0		<input checked="" type="checkbox"/>

### 7.74 Reaction `von26`

This is an irreversible reaction of two reactants forming one product.

**Name** D34:75:137\_PP2AP\_binding

### Reaction equation



### Reactants

Table 225: Properties of each reactant.

Id	Name	SBO
D34_75_137	D34:75:137	
PP2AP	PP2AP	

### Product

Table 226: Properties of each product.

Id	Name	SBO
D34_75_137_PP2AP	D34:75:137_PP2AP	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{74} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_137}] \cdot [\text{PP2AP}] \cdot \text{kon26} \quad (190)$$

Table 227: Properties of each parameter.

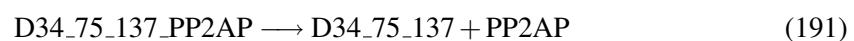
Id	Name	SBO	Value	Unit	Constant
kon26	kon26		$1.7 \cdot 10^7$		<input checked="" type="checkbox"/>

### 7.75 Reaction voff26

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75:137\_PP2AP\_unbinding

### Reaction equation



### Reactant

Table 228: Properties of each reactant.

Id	Name	SBO
D34_75_137_PP2AP	D34:75:137_PP2AP	

## Products

Table 229: Properties of each product.

Id	Name	SBO
D34_75_137_PP2AP	D34:75:137_PP2AP	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{75} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_137\_PP2AP}] \cdot \text{koff26} \quad (192)$$

Table 230: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff26	koff26		40.0		<input checked="" type="checkbox"/>

## 7.76 Reaction von20

This is an irreversible reaction of two reactants forming one product.

**Name** D34:137\_PP2C.binding

## Reaction equation



## Reactants

Table 231: Properties of each reactant.

Id	Name	SBO
D34_137_PP2C	D34:137_PP2C	

## Product

Table 232: Properties of each product.

Id	Name	SBO
D34_137_PP2C	D34:137_PP2C	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{76} = \text{vol}(\text{Spine}) \cdot [\text{D34}_\cdot 137] \cdot [\text{PP2C}] \cdot \text{kon20} \quad (194)$$

Table 233: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon20	kon20		7500000.0		<input checked="" type="checkbox"/>

### 7.77 Reaction `vcat20`

This is an irreversible reaction of one reactant forming two products.

**Name** D34:137\_dephospho\_by\_PP2C\_on\_137

## Reaction equation



## Reactant

Table 234: Properties of each reactant.

Id	Name	SBO
D34_137_PP2C	D34:137_PP2C	

## Products

Table 235: Properties of each product.

Id	Name	SBO
D34	D34	

Id	Name	SBO
PP2C	PP2C	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{77} = \text{vol}(\text{Spine}) \cdot [\text{D34\_137\_PP2C}] \cdot \text{kcat20} \quad (196)$$

Table 236: Properties of each parameter.

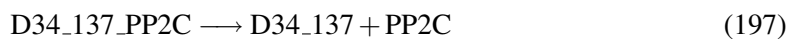
Id	Name	SBO	Value	Unit	Constant
kcat20	kcat20		3.0		<input checked="" type="checkbox"/>

## 7.78 Reaction voff20

This is an irreversible reaction of one reactant forming two products.

**Name** D34:137\_PP2C\_unbinding

## Reaction equation



## Reactant

Table 237: Properties of each reactant.

Id	Name	SBO
D34_137_PP2C	D34:137_PP2C	

## Products

Table 238: Properties of each product.

Id	Name	SBO
D34_137	D34:137	
PP2C	PP2C	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{78} = \text{vol}(\text{Spine}) \cdot [\text{D34\_137\_PP2C}] \cdot \text{koff20} \quad (198)$$

Table 239: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff20	koff20		12.0		<input checked="" type="checkbox"/>

## 7.79 Reaction von24

This is an irreversible reaction of two reactants forming one product.

**Name** D75:137\_PP2C.binding

## Reaction equation



## Reactants

Table 240: Properties of each reactant.

Id	Name	SBO
D75_137	D75:137	
PP2C	PP2C	

## Product

Table 241: Properties of each product.

Id	Name	SBO
D75_137_PP2C	D75:137_PP2C	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{79} = \text{vol}(\text{Spine}) \cdot [\text{D75\_137}] \cdot [\text{PP2C}] \cdot \text{kon24} \quad (200)$$

Table 242: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon24	kon24		7500000.0		<input checked="" type="checkbox"/>

### 7.80 Reaction `vcat24`

This is an irreversible reaction of one reactant forming two products.

**Name** `D75:137_dephospho_by_PP2C_137`

#### Reaction equation



#### Reactant

Table 243: Properties of each reactant.

Id	Name	SBO
D75_137_PP2C	D75:137_PP2C	

#### Products

Table 244: Properties of each product.

Id	Name	SBO
D75	D75	
PP2C	PP2C	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{80} = \text{vol}(\text{Spine}) \cdot [\text{D75\_137\_PP2C}] \cdot \text{kat24} \quad (202)$$

Table 245: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kat24	kat24		3.0		<input checked="" type="checkbox"/>

### 7.81 Reaction `voff24`

This is an irreversible reaction of one reactant forming two products.

**Name** D75:137\_PP2C\_unbinding

#### Reaction equation



#### Reactant

Table 246: Properties of each reactant.

Id	Name	SBO
D75_137_PP2C	D75:137_PP2C	

#### Products

Table 247: Properties of each product.

Id	Name	SBO
D75_137	D75:137	
PP2C	PP2C	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{81} = \text{vol}(\text{Spine}) \cdot [\text{D75\_137\_PP2C}] \cdot \text{koff24} \quad (204)$$

Table 248: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff24	koff24		12.0		<input checked="" type="checkbox"/>

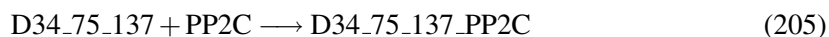
### 7.82 Reaction `von28`

This is an irreversible reaction of two reactants forming one product.

**Name** D34:75:137\_PP2C\_binding



### Reaction equation



### Reactants

Table 249: Properties of each reactant.

Id	Name	SBO
D34_75_137	D34:75:137	
PP2C	PP2C	

### Product

Table 250: Properties of each product.

Id	Name	SBO
D34_75_137_PP2C	D34:75:137_PP2C	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{82} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_137}] \cdot [\text{PP2C}] \cdot \text{kon28} \quad (206)$$

Table 251: Properties of each parameter.

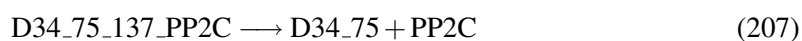
Id	Name	SBO	Value	Unit	Constant
kon28	kon28		7500000.0		<input checked="" type="checkbox"/>

## 7.83 Reaction `vcat28`

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75:137\_dephospho\_by\_PP2C\_on\_137

### Reaction equation



### Reactant

Table 252: Properties of each reactant.

Id	Name	SBO
D34_75_137_PP2C	D34:75:137_PP2C	

## Products

Table 253: Properties of each product.

Id	Name	SBO
D34_75_PP2C	D34:75_PP2C	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{83} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_137\_PP2C}] \cdot \text{kcat28} \quad (208)$$

Table 254: Properties of each parameter.

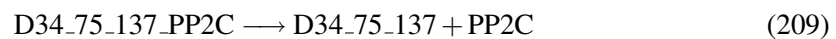
Id	Name	SBO	Value	Unit	Constant
kcat28	kcat28		3.0		<input checked="" type="checkbox"/>

## 7.84 Reaction voff28

This is an irreversible reaction of one reactant forming two products.

**Name** D34:75:137\_PP2C\_unbinding

## Reaction equation



## Reactant

Table 255: Properties of each reactant.

Id	Name	SBO
D34_75_137_PP2C	D34:75:137_PP2C	

## Products

Table 256: Properties of each product.

Id	Name	SBO
D34_75_137	D34:75:137	
PP2C	PP2C	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{84} = \text{vol}(\text{Spine}) \cdot [\text{D34\_75\_137\_PP2C}] \cdot \text{koff28} \quad (210)$$

Table 257: Properties of each parameter.

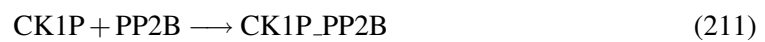
Id	Name	SBO	Value	Unit	Constant
koff28	koff28		12.0		<input checked="" type="checkbox"/>

## 7.85 Reaction von29

This is an irreversible reaction of two reactants forming one product.

**Name** CK1P\_PP2B\_binding

## Reaction equation



## Reactants

Table 258: Properties of each reactant.

Id	Name	SBO
CK1P	CK1P	
PP2B	PP2B	

## Product

Table 259: Properties of each product.

Id	Name	SBO
CK1P_PP2B	CK1P_PP2B	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{85} = \text{vol}(\text{Spine}) \cdot [\text{CK1P}] \cdot [\text{PP2B}] \cdot \text{kon29} \quad (212)$$

Table 260: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon29	kon29		$3 \cdot 10^7$		<input checked="" type="checkbox"/>

### 7.86 Reaction voff29

This is an irreversible reaction of one reactant forming two products.

**Name** CK1P\_PP2B\_unbinding

### Reaction equation



### Reactant

Table 261: Properties of each reactant.

Id	Name	SBO
CK1P_PP2B	CK1P_PP2B	

### Products

Table 262: Properties of each product.

Id	Name	SBO
CK1P	CK1P	
PP2B	PP2B	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{86} = \text{vol}(\text{Spine}) \cdot [\text{CK1P\_PP2B}] \cdot \text{koff29} \quad (214)$$

Table 263: Properties of each parameter.

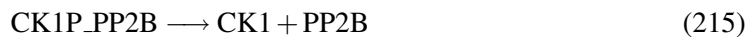
Id	Name	SBO	Value	Unit	Constant
koff29	koff29		24.0		<input checked="" type="checkbox"/>

## 7.87 Reaction $v_{\text{cat29}}$

This is an irreversible reaction of one reactant forming two products.

**Name** CK1P\_dephospho\_by\_PP2B

## Reaction equation



## Reactant

Table 264: Properties of each reactant.

Id	Name	SBO
CK1P_PP2B	CK1P_PP2B	

## Products

Table 265: Properties of each product.

Id	Name	SBO
CK1	CK1	
PP2B	PP2B	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{87} = \text{vol}(\text{Spine}) \cdot [\text{CK1P\_PP2B}] \cdot \text{kcat29} \quad (216)$$

Table 266: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat29	kcat29		6.0		<input checked="" type="checkbox"/>

### 7.88 Reaction vcat30

This is an irreversible reaction of one reactant forming one product.

**Name** CK1\_phosphorylation

#### Reaction equation



#### Reactant

Table 267: Properties of each reactant.

Id	Name	SBO
CK1	CK1	

#### Product

Table 268: Properties of each product.

Id	Name	SBO
CK1P	CK1P	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{88} = \text{vol}(\text{Spine}) \cdot [\text{CK1}] \cdot \text{kcat30} \quad (218)$$

Table 269: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat30	kcat30		1.0		<input checked="" type="checkbox"/>

### 7.89 Reaction von31

This is an irreversible reaction of two reactants forming one product.

**Name** PDE\_PKA\_binding

#### Reaction equation



#### Reactants

Table 270: Properties of each reactant.

Id	Name	SBO
PDE	PDE	
PKA	PKA	

#### Product

Table 271: Properties of each product.

Id	Name	SBO
PDE_PKA	PDE_PKA	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{89} = \text{vol}(\text{Spine}) \cdot [\text{PDE}] \cdot [\text{PKA}] \cdot \text{kon31} \quad (220)$$

Table 272: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon31	kon31		6000000.0		<input checked="" type="checkbox"/>

### 7.90 Reaction vcat31

This is an irreversible reaction of one reactant forming two products.

**Name** PDE\_phospho\_by\_PKA

### Reaction equation



### Reactant

Table 273: Properties of each reactant.

Id	Name	SBO
PDE_PKA	PDE_PKA	

### Products

Table 274: Properties of each product.

Id	Name	SBO
PDEP	PDEP	
PKA	PKA	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{90} = \text{vol}(\text{Spine}) \cdot [\text{PDE\_PKA}] \cdot \text{kcat31} \quad (222)$$

Table 275: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat31	kcat31		9.0		<input checked="" type="checkbox"/>

### 7.91 Reaction `voff31`

This is an irreversible reaction of one reactant forming two products.

**Name** PDE\_PKA\_unbinding

### Reaction equation



### Reactant



Table 276: Properties of each reactant.

Id	Name	SBO
PDE_PKA	PDE_PKA	

## Products

Table 277: Properties of each product.

Id	Name	SBO
PDE	PDE	
PKA	PKA	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{91} = \text{vol}(\text{Spine}) \cdot [\text{PDE\_PKA}] \cdot \text{koff31} \quad (224)$$

Table 278: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff31	koff31		36.0		<input checked="" type="checkbox"/>

## 7.92 Reaction vcat32

This is an irreversible reaction of one reactant forming one product.

**Name** PDEP\_dephospho

## Reaction equation



## Reactant

Table 279: Properties of each reactant.

Id	Name	SBO
PDEP	PDEP	

## Product

Table 280: Properties of each product.

Id	Name	SBO
PDE	PDE	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{92} = \text{vol}(\text{Spine}) \cdot [\text{PDEP}] \cdot \text{kcat32} \quad (226)$$

Table 281: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat32	kcat32		0.1		<input checked="" type="checkbox"/>

## 7.93 Reaction von33

This is an irreversible reaction of two reactants forming one product.

**Name** PP2A\_PKA\_binding

## Reaction equation



## Reactants

Table 282: Properties of each reactant.

Id	Name	SBO
PP2A	PP2A	
PKA	PKA	

## Product

Table 283: Properties of each product.

Id	Name	SBO
PP2A_PKA	PP2A_PKA	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{93} = \text{vol}(\text{Spine}) \cdot [\text{PP2A}] \cdot [\text{PKA}] \cdot \text{kon33} \quad (228)$$

Table 284: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon33	kon33		$10^7$		<input checked="" type="checkbox"/>

### 7.94 Reaction `voff33`

This is an irreversible reaction of one reactant forming two products.

**Name** PP2A\_PKA\_unbinding

### Reaction equation



### Reactant

Table 285: Properties of each reactant.

Id	Name	SBO
PP2A_PKA	PP2A_PKA	

### Products

Table 286: Properties of each product.

Id	Name	SBO
PP2A	PP2A	
PKA	PKA	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{94} = \text{vol}(\text{Spine}) \cdot [\text{PP2A\_PKA}] \cdot \text{koff33} \quad (230)$$

Table 287: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff33	koff33		16.0		<input checked="" type="checkbox"/>

## 7.95 Reaction vcat33

This is an irreversible reaction of one reactant forming two products.

**Name** PP2A\_phospho\_by\_PKA

### Reaction equation



### Reactant

Table 288: Properties of each reactant.

Id	Name	SBO
PP2A_PKA	PP2A_PKA	

### Products

Table 289: Properties of each product.

Id	Name	SBO
PP2AP	PP2AP	
PKA	PKA	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{95} = \text{vol}(\text{Spine}) \cdot [\text{PP2A\_PKA}] \cdot \text{kcat33} \quad (232)$$

Table 290: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat33	kcat33		4.0		<input checked="" type="checkbox"/>

### 7.96 Reaction vcat34

This is an irreversible reaction of one reactant forming one product.

**Name** PP2AP\_dephospho

#### Reaction equation



#### Reactant

Table 291: Properties of each reactant.

Id	Name	SBO
PP2AP	PP2AP	

#### Product

Table 292: Properties of each product.

Id	Name	SBO
PP2A	PP2A	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{96} = \text{vol}(\text{Spine}) \cdot [\text{PP2AP}] \cdot \text{kcat34} \quad (234)$$

Table 293: Properties of each parameter.

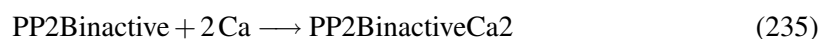
Id	Name	SBO	Value	Unit	Constant
kcat34	kcat34		5.0		<input checked="" type="checkbox"/>

### 7.97 Reaction von35

This is an irreversible reaction of two reactants forming one product.

**Name** PP2Binactive\_Ca\_binding

#### Reaction equation



#### Reactants

Table 294: Properties of each reactant.

Id	Name	SBO
PP2Binactive	PP2Binactive	
Ca	Ca	

#### Product

Table 295: Properties of each product.

Id	Name	SBO
PP2BinactiveCa2	PP2BinactiveCa2	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{97} = \text{vol}(\text{Spine}) \cdot [\text{PP2Binactive}] \cdot [\text{Ca}] \cdot [\text{Ca}] \cdot \text{kon35} \quad (236)$$

Table 296: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon35	kon35		10 <sup>15</sup>		<input checked="" type="checkbox"/>

### 7.98 Reaction von36

This is an irreversible reaction of two reactants forming one product.

**Name** PP2B\_activation

### Reaction equation



### Reactants

Table 297: Properties of each reactant.

Id	Name	SBO
PP2BinactiveCa2	PP2BinactiveCa2	
Ca	Ca	

### Product

Table 298: Properties of each product.

Id	Name	SBO
PP2B	PP2B	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{98} = \text{vol}(\text{Spine}) \cdot [\text{PP2BinactiveCa2}] \cdot [\text{Ca}] \cdot [\text{Ca}] \cdot \text{kon36} \quad (238)$$

Table 299: Properties of each parameter.

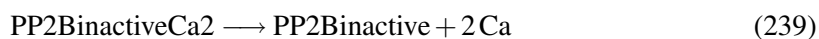
Id	Name	SBO	Value	Unit	Constant
kon36	kon36		$3 \cdot 10^{15}$		<input checked="" type="checkbox"/>

## 7.99 Reaction voff35

This is an irreversible reaction of one reactant forming two products.

**Name** PP2BinactiveCa2\_Ca\_unbinding

### Reaction equation



### Reactant

Table 300: Properties of each reactant.

Id	Name	SBO
PP2BinactiveCa2	PP2BinactiveCa2	

## Products

Table 301: Properties of each product.

Id	Name	SBO
PP2BinactiveCa	PP2BinactiveCa	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{99} = \text{vol}(\text{Spine}) \cdot [\text{PP2BinactiveCa2}] \cdot \text{koff35} \quad (240)$$

Table 302: Properties of each parameter.

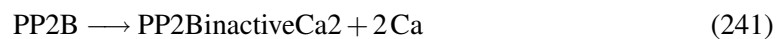
Id	Name	SBO	Value	Unit	Constant
koff35	koff35		1.0		<input checked="" type="checkbox"/>

### 7.100 Reaction voff36

This is an irreversible reaction of one reactant forming two products.

**Name** PP2B\_inactivation

## Reaction equation



## Reactant

Table 303: Properties of each reactant.

Id	Name	SBO
PP2B	PP2B	



## Products

Table 304: Properties of each product.

Id	Name	SBO
PP2BinactiveCa2	PP2BinactiveCa2	
Ca	Ca	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{100} = \text{vol}(\text{Spine}) \cdot [\text{PP2B}] \cdot \text{koff36} \quad (242)$$

Table 305: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff36	koff36		1.0		<input checked="" type="checkbox"/>

### 7.101 Reaction von37

This is an irreversible reaction of two reactants forming one product.

**Name** R2C2.cAMP\_binding

## Reaction equation



## Reactants

Table 306: Properties of each reactant.

Id	Name	SBO
R2C2	R2C2	
cAMP	cAMP	

## Product

Table 307: Properties of each product.

Id	Name	SBO
cAMP_R2C2	cAMP_R2C2	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{101} = \text{vol}(\text{Spine}) \cdot [\text{R2C2}] \cdot [\text{cAMP}] \cdot \text{kon37} \quad (244)$$

Table 308: Properties of each parameter.

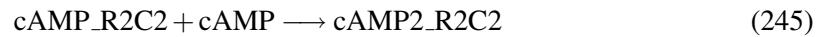
Id	Name	SBO	Value	Unit	Constant
kon37	kon37		$5.4 \cdot 10^7$		<input checked="" type="checkbox"/>

### 7.102 Reaction von38

This is an irreversible reaction of two reactants forming one product.

**Name** cAMP\_R2C2\_binding\_by\_cAMP

### Reaction equation



### Reactants

Table 309: Properties of each reactant.

Id	Name	SBO
cAMP_R2C2	cAMP_R2C2	
cAMP	cAMP	

### Product

Table 310: Properties of each product.

Id	Name	SBO
cAMP2_R2C2	cAMP2_R2C2	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{102} = \text{vol}(\text{Spine}) \cdot [\text{cAMP\_R2C2}] \cdot [\text{cAMP}] \cdot \text{kon38} \quad (246)$$

Table 311: Properties of each parameter.

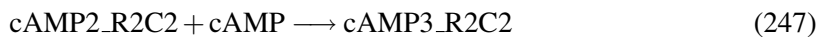
Id	Name	SBO	Value	Unit	Constant
kon38	kon38		$5.4 \cdot 10^7$		<input checked="" type="checkbox"/>

### 7.103 Reaction von39

This is an irreversible reaction of two reactants forming one product.

**Name** cAMP2\_R2C2\_binding\_by\_cAMP

## Reaction equation



## Reactants

Table 312: Properties of each reactant.

Id	Name	SBO
cAMP2_R2C2	cAMP2_R2C2	
cAMP	cAMP	

## Product

Table 313: Properties of each product.

Id	Name	SBO
cAMP3_R2C2	cAMP3_R2C2	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{103} = \text{vol}(\text{Spine}) \cdot [\text{cAMP2\_R2C2}] \cdot [\text{cAMP}] \cdot \text{kon39} \quad (248)$$

Table 314: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon39	kon39		$7.5 \cdot 10^7$		<input checked="" type="checkbox"/>

### 7.104 Reaction von40

This is an irreversible reaction of two reactants forming one product.

**Name** cAMP3\_R2C2\_binding\_by\_cAMP

#### Reaction equation



#### Reactants

Table 315: Properties of each reactant.

Id	Name	SBO
cAMP3_R2C2	cAMP3_R2C2	
cAMP	cAMP	

#### Product

Table 316: Properties of each product.

Id	Name	SBO
cAMP4_R2C2	cAMP4_R2C2	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{104} = \text{vol}(\text{Spine}) \cdot [\text{cAMP3\_R2C2}] \cdot [\text{cAMP}] \cdot \text{kon40} \quad (250)$$

Table 317: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon40	kon40		$7.5 \cdot 10^7$		<input checked="" type="checkbox"/>

### 7.105 Reaction `voff37`

This is an irreversible reaction of one reactant forming two products.

**Name** `cAMP_R2C2_unbinding`

#### Reaction equation



#### Reactant

Table 318: Properties of each reactant.

Id	Name	SBO
<code>cAMP_R2C2</code>	<code>cAMP_R2C2</code>	

#### Products

Table 319: Properties of each product.

Id	Name	SBO
<code>R2C2</code>	<code>R2C2</code>	
<code>cAMP</code>	<code>cAMP</code>	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{105} = \text{vol}(\text{Spine}) \cdot [\text{cAMP\_R2C2}] \cdot \text{koff37} \quad (252)$$

Table 320: Properties of each parameter.

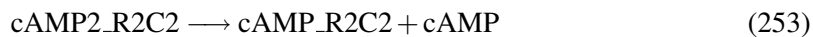
Id	Name	SBO	Value	Unit	Constant
<code>koff37</code>	<code>koff37</code>		33.0		<input checked="" type="checkbox"/>

### 7.106 Reaction `voff38`

This is an irreversible reaction of one reactant forming two products.

**Name** `cAMP2_R2C2_unbinding`

### Reaction equation



### Reactant

Table 321: Properties of each reactant.

Id	Name	SBO
cAMP2_R2C2	cAMP2_R2C2	

### Products

Table 322: Properties of each product.

Id	Name	SBO
cAMP_R2C2	cAMP_R2C2	
cAMP	cAMP	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{106} = \text{vol}(\text{Spine}) \cdot [\text{cAMP2\_R2C2}] \cdot \text{koff38} \quad (254)$$

Table 323: Properties of each parameter.

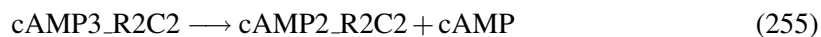
Id	Name	SBO	Value	Unit	Constant
koff38	koff38		33.0		<input checked="" type="checkbox"/>

### 7.107 Reaction voff39

This is an irreversible reaction of one reactant forming two products.

**Name** cAMP3\_R2C2\_unbinding

### Reaction equation



### Reactant

Table 324: Properties of each reactant.

Id	Name	SBO
cAMP3_R2C2	cAMP3_R2C2	

## Products

Table 325: Properties of each product.

Id	Name	SBO
cAMP2_R2C2	cAMP2_R2C2	
cAMP	cAMP	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{107} = \text{vol}(\text{Spine}) \cdot [\text{cAMP3\_R2C2}] \cdot \text{koff39} \quad (256)$$

Table 326: Properties of each parameter.

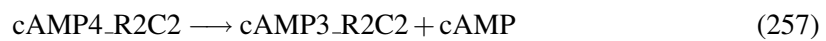
Id	Name	SBO	Value	Unit	Constant
koff39	koff39		110.0		<input checked="" type="checkbox"/>

### 7.108 Reaction voff40

This is an irreversible reaction of one reactant forming two products.

**Name** cAMP4\_R2C2\_unbinding

## Reaction equation



## Reactant

Table 327: Properties of each reactant.

Id	Name	SBO
cAMP4_R2C2	cAMP4_R2C2	

## Products

Table 328: Properties of each product.

Id	Name	SBO
cAMP3_R2C2	cAMP3_R2C2	
cAMP	cAMP	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{108} = \text{vol}(\text{Spine}) \cdot [\text{cAMP4\_R2C2}] \cdot \text{koff40} \quad (258)$$

Table 329: Properties of each parameter.

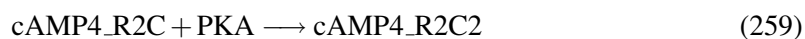
Id	Name	SBO	Value	Unit	Constant
koff40	koff40		32.5		<input checked="" type="checkbox"/>

### 7.109 Reaction von41

This is an irreversible reaction of two reactants forming one product.

**Name** cAMP4\_R2C\_PKA\_binding

## Reaction equation



## Reactants

Table 330: Properties of each reactant.

Id	Name	SBO
cAMP4_R2C	cAMP4_R2C	
PKA	PKA	

## Product



Table 331: Properties of each product.

Id	Name	SBO
cAMP4_R2C2	cAMP4_R2C2	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{109} = \text{vol}(\text{Spine}) \cdot [\text{cAMP4\_R2C}] \cdot [\text{PKA}] \cdot \text{kon41} \quad (260)$$

Table 332: Properties of each parameter.

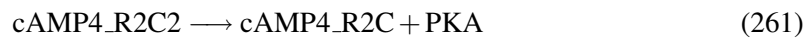
Id	Name	SBO	Value	Unit	Constant
kon41	kon41		$1.8 \cdot 10^7$		<input checked="" type="checkbox"/>

### 7.110 Reaction voff41

This is an irreversible reaction of one reactant forming two products.

**Name** cAMP4\_R2C2\_PKA\_unbinding

### Reaction equation



### Reactant

Table 333: Properties of each reactant.

Id	Name	SBO
cAMP4_R2C2	cAMP4_R2C2	

### Products

Table 334: Properties of each product.

Id	Name	SBO
cAMP4_R2C	cAMP4_R2C	
PKA	PKA	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{110} = \text{vol}(\text{Spine}) \cdot [\text{cAMP4\_R2C2}] \cdot \text{koff41} \quad (262)$$

Table 335: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff41	koff41		60.0		<input checked="" type="checkbox"/>

### 7.111 Reaction von42

This is an irreversible reaction of two reactants forming one product.

**Name** cAMP4\_R2\_PKA\_binding

#### Reaction equation



#### Reactants

Table 336: Properties of each reactant.

Id	Name	SBO
cAMP4_R2	cAMP4_R2	
PKA	PKA	

#### Product

Table 337: Properties of each product.

Id	Name	SBO
cAMP4_R2C	cAMP4_R2C	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{111} = \text{vol}(\text{Spine}) \cdot [\text{cAMP4\_R2}] \cdot [\text{PKA}] \cdot \text{kon42} \quad (264)$$

Table 338: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon42	kon42		$1.8 \cdot 10^7$		<input checked="" type="checkbox"/>

### 7.112 Reaction von43

This is an irreversible reaction of one reactant forming two products.

**Name** cAMP4\_R2C\_PKA\_unbinding

#### Reaction equation



#### Reactant

Table 339: Properties of each reactant.

Id	Name	SBO
cAMP4_R2C	cAMP4_R2C	

#### Products

Table 340: Properties of each product.

Id	Name	SBO
cAMP4_R2	cAMP4_R2	
PKA	PKA	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{112} = \text{vol}(\text{Spine}) \cdot [\text{cAMP4\_R2C}] \cdot \text{kon43} \quad (266)$$

Table 341: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon43	kon43		60.0		<input checked="" type="checkbox"/>

### 7.113 Reaction von44

This is an irreversible reaction of two reactants forming one product.

**Name** cAMP\_PDE\_binding

#### Reaction equation



#### Reactants

Table 342: Properties of each reactant.

Id	Name	SBO
cAMP	cAMP	
PDE	PDE	

#### Product

Table 343: Properties of each product.

Id	Name	SBO
cAMP_PDE	cAMP_PDE	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{113} = \text{vol}(\text{Spine}) \cdot [\text{cAMP}] \cdot [\text{PDE}] \cdot \text{kon44} \quad (268)$$

Table 344: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon44	kon44		2520000.0		<input checked="" type="checkbox"/>

### 7.114 Reaction voff44

This is an irreversible reaction of one reactant forming two products.

**Name** cAMP\_PDE\_unbinding

### Reaction equation



### Reactant

Table 345: Properties of each reactant.

Id	Name	SBO
cAMP_PDE	cAMP_PDE	

### Products

Table 346: Properties of each product.

Id	Name	SBO
cAMP PDE	cAMP PDE	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{114} = \text{vol}(\text{Spine}) \cdot [\text{cAMP\_PDE}] \cdot \text{koff44} \quad (270)$$

Table 347: Properties of each parameter.

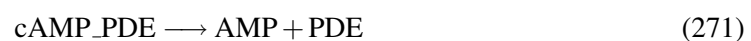
Id	Name	SBO	Value	Unit	Constant
koff44	koff44		40.0		<input checked="" type="checkbox"/>

### 7.115 Reaction vcat44

This is an irreversible reaction of one reactant forming two products.

**Name** cAMP\_PDE\_degradation

### Reaction equation



### Reactant

Table 348: Properties of each reactant.

Id	Name	SBO
cAMP_PDE	cAMP_PDE	

## Products

Table 349: Properties of each product.

Id	Name	SBO
AMP	AMP	
PDE	PDE	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{115} = \text{vol}(\text{Spine}) \cdot [\text{cAMP\_PDE}] \cdot \text{kcat44} \quad (272)$$

Table 350: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat44	kcat44		10.0		<input checked="" type="checkbox"/>

### 7.116 Reaction von45

This is an irreversible reaction of two reactants forming one product.

**Name** cAMP\_PDEP\_binding

## Reaction equation



## Reactants

Table 351: Properties of each reactant.

Id	Name	SBO
cAMP	cAMP	
PDEP	PDEP	

## Product

Table 352: Properties of each product.

Id	Name	SBO
cAMP_PDEP	cAMP_PDEP	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{116} = \text{vol}(\text{Spine}) \cdot [\text{cAMP}] \cdot [\text{PDEP}] \cdot \text{kon45} \quad (274)$$

Table 353: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kon45	kon45		5040000.0		<input checked="" type="checkbox"/>

### 7.117 Reaction $v_{\text{off45}}$

This is an irreversible reaction of one reactant forming two products.

**Name** cAMP\_PDEP\_unbinding

## Reaction equation



## Reactant

Table 354: Properties of each reactant.

Id	Name	SBO
cAMP_PDEP	cAMP_PDEP	

## Products

Table 355: Properties of each product.

Id	Name	SBO
cAMP	cAMP	

Id	Name	SBO
PDEP	PDEP	

### Kinetic Law

**Derived unit** contains undeclared units

$$v_{117} = \text{vol}(\text{Spine}) \cdot [\text{cAMP\_PDEP}] \cdot \text{koff45} \quad (276)$$

Table 356: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
koff45	koff45		80.0		<input checked="" type="checkbox"/>

### 7.118 Reaction `vcat45`

This is an irreversible reaction of one reactant forming two products.

**Name** `cAMP_PDEP_degradation`

### Reaction equation



### Reactant

Table 357: Properties of each reactant.

Id	Name	SBO
cAMP_PDEP	cAMP_PDEP	

### Products

Table 358: Properties of each product.

Id	Name	SBO
AMP	AMP	
PDEP	PDEP	



## Kinetic Law

**Derived unit** contains undeclared units

$$v_{118} = \text{vol}(\text{Spine}) \cdot [\text{cAMP\_PDEP}] \cdot \text{kcat45} \quad (278)$$

Table 359: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
kcat45	kcat45		20.0		<input checked="" type="checkbox"/>

## 7.119 Reaction v57

This is an irreversible reaction of one reactant forming one product.

**Name** Ca.in

## Reaction equation



## Reactant

Table 360: Properties of each reactant.

Id	Name	SBO
Empty	Empty	

## Product

Table 361: Properties of each product.

Id	Name	SBO
Ca	Ca	

## Kinetic Law

**Derived unit** contains undeclared units

$$v_{119} = \text{vol}(\text{Spine}) \cdot \text{k57} \quad (280)$$

### 7.120 Reaction v58

This is an irreversible reaction of one reactant forming one product.

**Name** Ca.destroy

#### Reaction equation



#### Reactant

Table 362: Properties of each reactant.

Id	Name	SBO
Ca	Ca	

#### Product

Table 363: Properties of each product.

Id	Name	SBO
Empty	Empty	

#### Kinetic Law

**Derived unit** contains undeclared units

$$v_{120} = \text{vol}(\text{Spine}) \cdot [\text{Ca}] \cdot k58 \quad (282)$$

Table 364: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k58	k58		1.7		<input checked="" type="checkbox"/>

## 8 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.

## 8.1 Species D

**Name** D

**Initial concentration**  $4.98 \cdot 10^{-6} \text{ mol} \cdot \text{l}^{-1}$

This species takes part in ten reactions (as a reactant in [von1](#), [von2](#), [von3](#) and as a product in [voff1](#), [voff2](#), [voff3](#), [vcat6](#), [vcat9](#), [vcat10](#), [vcat13](#)).

$$\frac{d}{dt}D = v_2 + v_5 + v_8 + v_{17} + v_{27} + v_{29} + v_{38} - v_1 - v_4 - v_7 \quad (283)$$

## 8.2 Species CDK5

**Name** CDK5

**Initial concentration**  $2 \cdot 10^{-7} \text{ mol} \cdot \text{l}^{-1}$

This species takes part in twelve reactions (as a reactant in [von1](#), [von4](#), [von11](#), [von18](#) and as a product in [voff1](#), [vcat1](#), [voff4](#), [vcat4](#), [voff11](#), [vcat11](#), [voff18](#), [vcat18](#)).

$$\frac{d}{dt}CDK5 = v_2 + v_3 + v_{13} + v_{14} + v_{34} + v_{35} + v_{42} + v_{45} - v_1 - v_{10} - v_{31} - v_{41} \quad (284)$$

## 8.3 Species D\_CDK5

**Name** D\_CDK5

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

This species takes part in three reactions (as a reactant in [voff1](#), [vcat1](#) and as a product in [von1](#)).

$$\frac{d}{dt}D\_CDK5 = v_1 - v_2 - v_3 \quad (285)$$

## 8.4 Species D75

**Name** D75

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in eleven reactions (as a reactant in [von7](#), [von8](#), [von9](#), [von10](#) and as a product in [vcat1](#), [voff7](#), [voff8](#), [voff9](#), [voff10](#), [vcat17](#), [vcat24](#)).

$$\frac{d}{dt}D75 = v_3 + v_{23} + v_{26} + v_{28} + v_{30} + v_{51} + v_{80} - v_{19} - v_{20} - v_{21} - v_{22} \quad (286)$$

## 8.5 Species CK1

**Name** CK1

**Initial concentration** 1.66 · 10<sup>-7</sup> mol · l<sup>-1</sup>

This species takes part in 14 reactions (as a reactant in [von2](#), [von5](#), [von7](#), [von14](#), [vcat30](#) and as a product in [voff2](#), [vcat2](#), [voff5](#), [vcat5](#), [voff7](#), [vcat7](#), [voff14](#), [vcat14](#), [vcat29](#)).

$$\begin{aligned} \frac{d}{dt}CK1 = & v_5 + v_6 + v_{15} + v_{16} + v_{23} + v_{24} + v_{43} \\ & + v_{44} + v_{87} - v_4 - v_{11} - v_{19} - v_{40} - v_{88} \end{aligned} \quad (287)$$

## 8.6 Species D\_CK1

**Name** D\_CK1

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [voff2](#), [vcat2](#) and as a product in [von2](#)).

$$\frac{d}{dt}D\_CK1 = v_4 - v_5 - v_6 \quad (288)$$

## 8.7 Species D137

**Name** D137

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in ten reactions (as a reactant in [von11](#), [von12](#), [von13](#) and as a product in [vcat2](#), [voff11](#), [voff12](#), [voff13](#), [vcat19](#), [vcat22](#), [vcat23](#)).

$$\frac{d}{dt}D137 = v_6 + v_{34} + v_{36} + v_{39} + v_{53} + v_{62} + v_{71} - v_{31} - v_{32} - v_{33} \quad (289)$$

## 8.8 Species PKA

**Name** PKA

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in 22 reactions (as a reactant in [von3](#), [von8](#), [von12](#), [von21](#), [von31](#), [von33](#), [von41](#), [von42](#) and as a product in [voff3](#), [vcat3](#), [vcat8](#), [voff8](#), [voff12](#), [vcat12](#), [vcat21](#), [voff21](#), [vcat31](#), [voff31](#), [voff33](#), [vcat33](#), [voff41](#), [von43](#)).

$$\begin{aligned} \frac{d}{dt}PKA = & v_8 + v_9 + v_{25} + v_{26} + v_{36} + v_{37} + v_{47} + v_{48} + v_{90} + v_{91} + v_{94} \\ & + v_{95} + v_{110} + v_{112} - v_7 - v_{20} - v_{32} - v_{46} - v_{89} - v_{93} - v_{109} - v_{111} \end{aligned} \quad (290)$$

## 8.9 Species D\_PKA

**Name** D\_PKA

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [voff3](#), [vcat3](#) and as a product in [von3](#)).

$$\frac{d}{dt}D\_PKA = v_7 - v_8 - v_9 \quad (291)$$

## 8.10 Species D34

**Name** D34

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in ten reactions (as a reactant in [von4](#), [von5](#), [von6](#) and as a product in [vcat3](#), [voff4](#), [voff5](#), [voff6](#), [vcat15](#), [vcat16](#), [vcat20](#)).

$$\frac{d}{dt}D34 = v_9 + v_{13} + v_{15} + v_{18} + v_{59} + v_{68} + v_{77} - v_{10} - v_{11} - v_{12} \quad (292)$$

## 8.11 Species D34\_CDK5

**Name** D34\_CDK5

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [voff4](#), [vcat4](#) and as a product in [von4](#)).

$$\frac{d}{dt}D34\_CDK5 = v_{10} - v_{13} - v_{14} \quad (293)$$

## 8.12 Species D34\_CK1

**Name** D34\_CK1

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [voff5](#), [vcat5](#) and as a product in [von5](#)).

$$\frac{d}{dt}D34\_CK1 = v_{11} - v_{15} - v_{16} \quad (294)$$

## 8.13 Species PP2B

**Name** PP2B

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in 17 reactions (as a reactant in [von6](#), [von17](#), [von19](#), [von27](#), [von29](#), [voff36](#) and as a product in [vcat6](#), [voff6](#), [voff17](#), [vcat17](#), [vcat19](#), [voff19](#), [voff27](#), [vcat27](#), [voff29](#), [vcat29](#), [von36](#)).

$$\begin{aligned} \frac{d}{dt}PP2B = & v_{17} + v_{18} + v_{50} + v_{51} + v_{53} + v_{54} + v_{56} + v_{57} + v_{86} \\ & + v_{87} + v_{98} - v_{12} - v_{49} - v_{52} - v_{55} - v_{85} - v_{100} \end{aligned} \quad (295)$$

## 8.14 Species D34\_PP2B

**Name** D34\_PP2B

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat6](#), [voff6](#) and as a product in [von6](#)).

$$\frac{d}{dt}D34\_PP2B = v_{12} - v_{17} - v_{18} \quad (296)$$

## 8.15 Species D34\_75

**Name** D34:75

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in eleven reactions (as a reactant in [von14](#), [von17](#), [von15](#), [von16](#) and as a product in [vcat4](#), [vcat8](#), [voff14](#), [voff17](#), [voff15](#), [voff16](#), [vcat28](#)).

$$\frac{d}{dt}D34\_75 = v_{14} + v_{25} + v_{43} + v_{50} + v_{60} + v_{69} + v_{83} - v_{40} - v_{49} - v_{58} - v_{67} \quad (297)$$

### 8.16 Species D34\_137

**Name** D34:137

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in ten reactions (as a reactant in [von18](#), [von19](#), [von20](#) and as a product in [vcat5](#), [vcat12](#), [voff18](#), [voff19](#), [vcat25](#), [vcat26](#), [voff20](#)).

$$\frac{d}{dt}D34\_137 = v_{16} + v_{37} + v_{42} + v_{54} + v_{65} + v_{73} + v_{78} - v_{41} - v_{52} - v_{76} \quad (298)$$

### 8.17 Species D75CK1

**Name** D75\_CK1

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [voff7](#), [vcat7](#) and as a product in [von7](#)).

$$\frac{d}{dt}D75CK1 = v_{19} - v_{23} - v_{24} \quad (299)$$

### 8.18 Species D75\_PKA

**Name** D75\_PKA

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat8](#), [voff8](#) and as a product in [von8](#)).

$$\frac{d}{dt}D75\_PKA = v_{20} - v_{25} - v_{26} \quad (300)$$

### 8.19 Species PP2A

**Name** PP2A

**Initial concentration** 2 · 10<sup>-7</sup> mol · l<sup>-1</sup>

This species takes part in 15 reactions (as a reactant in [von9](#), [von15](#), [von22](#), [von25](#), [von33](#) and as a product in [vcat9](#), [voff9](#), [vcat15](#), [voff15](#), [vcat22](#), [voff22](#), [vcat25](#), [voff25](#), [voff33](#), [vcat34](#)).

$$\begin{aligned} \frac{d}{dt}PP2A = & v_{27} + v_{28} + v_{59} + v_{60} + v_{62} + v_{63} + v_{65} + v_{66} \\ & + v_{94} + v_{96} - v_{21} - v_{58} - v_{61} - v_{64} - v_{93} \end{aligned} \quad (301)$$

## 8.20 Species D75\_PP2A

**Name** D75\_PP2A

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat9](#), [voff9](#) and as a product in [von9](#)).

$$\frac{d}{dt}D75\_PP2A = v_{21} - v_{27} - v_{28} \quad (302)$$

## 8.21 Species PP2AP

**Name** PP2AP

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in 14 reactions (as a reactant in [von10](#), [von16](#), [von23](#), [von26](#), [vcat34](#) and as a product in [vcat10](#), [voff10](#), [vcat16](#), [voff16](#), [vcat23](#), [voff23](#), [vcat26](#), [voff26](#), [vcat33](#)).

$$\begin{aligned} \frac{d}{dt}PP2AP = & v_{29} + v_{30} + v_{68} + v_{69} + v_{71} + v_{72} + v_{73} \\ & + v_{75} + v_{95} - v_{22} - v_{67} - v_{70} - v_{74} - v_{96} \end{aligned} \quad (303)$$

## 8.22 Species D75\_PP2AP

**Name** D75\_PP2AP

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat10](#), [voff10](#) and as a product in [von10](#)).

$$\frac{d}{dt}D75\_PP2AP = v_{22} - v_{29} - v_{30} \quad (304)$$

## 8.23 Species D75\_137

**Name** D75:137

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in eleven reactions (as a reactant in [von21](#), [von22](#), [von23](#), [von24](#) and as a product in [vcat7](#), [vcat11](#), [voff21](#), [vcat27](#), [voff22](#), [voff23](#), [voff24](#)).

$$\frac{d}{dt}D75\_137 = v_{24} + v_{35} + v_{48} + v_{57} + v_{63} + v_{72} + v_{81} - v_{46} - v_{61} - v_{70} - v_{79} \quad (305)$$



### 8.24 Species D137\_CDK5

**Name** D137\_CDK5

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [voff11](#), [vcat11](#) and as a product in [von11](#)).

$$\frac{d}{dt} \text{D137\_CDK5} = v_{31} - v_{34} - v_{35} \quad (306)$$

### 8.25 Species D137\_PKA

**Name** D137\_PKA

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [voff12](#), [vcat12](#) and as a product in [von12](#)).

$$\frac{d}{dt} \text{D137\_PKA} = v_{32} - v_{36} - v_{37} \quad (307)$$

### 8.26 Species D137\_PP2C

**Name** D137\_PP2C

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat13](#), [voff13](#) and as a product in [von13](#)).

$$\frac{d}{dt} \text{D137\_PP2C} = v_{33} - v_{38} - v_{39} \quad (308)$$

### 8.27 Species PP2C

**Name** PP2C

**Initial concentration** 1.33 · 10<sup>-7</sup> mol · l<sup>-1</sup>

This species takes part in twelve reactions (as a reactant in [von13](#), [von20](#), [von24](#), [von28](#) and as a product in [vcat13](#), [voff13](#), [vcat20](#), [voff20](#), [vcat24](#), [voff24](#), [vcat28](#), [voff28](#)).

$$\frac{d}{dt} \text{PP2C} = v_{38} + v_{39} + v_{77} + v_{78} + v_{80} + v_{81} + v_{83} + v_{84} - v_{33} - v_{76} - v_{79} - v_{82} \quad (309)$$

### 8.28 Species D34\_75\_CK1

**Name** D34:75\_CK1

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [voff14](#), [vcat14](#) and as a product in [von14](#)).

$$\frac{d}{dt}D34\_75\_CK1 = v_{40} - v_{43} - v_{44} \quad (310)$$

### 8.29 Species D34\_137\_CDK5

**Name** D34:137\_CDK5

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [voff18](#), [vcat18](#) and as a product in [von18](#)).

$$\frac{d}{dt}D34\_137\_CDK5 = v_{41} - v_{42} - v_{45} \quad (311)$$

### 8.30 Species D34\_75\_137

**Name** D34:75:137

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in eleven reactions (as a reactant in [von27](#), [von25](#), [von26](#), [von28](#) and as a product in [vcat14](#), [vcat18](#), [vcat21](#), [voff27](#), [voff25](#), [voff26](#), [voff28](#)).

$$\frac{d}{dt}D34\_75\_137 = v_{44} + v_{45} + v_{47} + v_{56} + v_{66} + v_{75} + v_{84} - v_{55} - v_{64} - v_{74} - v_{82} \quad (312)$$

### 8.31 Species D75\_137\_PKA

**Name** D75:137\_PKA

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat21](#), [voff21](#) and as a product in [von21](#)).

$$\frac{d}{dt}D75\_137\_PKA = v_{46} - v_{47} - v_{48} \quad (313)$$

### 8.32 Species D34\_75\_PP2B

**Name** D34:75\_PP2B

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [voff17](#), [vcat17](#) and as a product in [von17](#)).

$$\frac{d}{dt}D34\_75\_PP2B = v_{49} - v_{50} - v_{51} \quad (314)$$

### 8.33 Species D34\_137\_PP2B

**Name** D34:137\_PP2B

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat19](#), [voff19](#) and as a product in [von19](#)).

$$\frac{d}{dt}D34\_137\_PP2B = v_{52} - v_{53} - v_{54} \quad (315)$$

### 8.34 Species D34\_75\_137\_PP2B

**Name** D34:75:137\_PP2B

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [voff27](#), [vcat27](#) and as a product in [von27](#)).

$$\frac{d}{dt}D34\_75\_137\_PP2B = v_{55} - v_{56} - v_{57} \quad (316)$$

### 8.35 Species D34\_75\_PP2A

**Name** D34:75\_PP2A

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat15](#), [voff15](#) and as a product in [von15](#)).

$$\frac{d}{dt}D34\_75\_PP2A = v_{58} - v_{59} - v_{60} \quad (317)$$

### 8.36 Species D75\_137\_PP2A

**Name** D75:137\_PP2A

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat22](#), [voff22](#) and as a product in [von22](#)).

$$\frac{d}{dt}D75\_137\_PP2A = v_{61} - v_{62} - v_{63} \quad (318)$$

### 8.37 Species D34\_75\_134\_PP2A

**Name** D34:75:137\_PP2A

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat25](#), [voff25](#) and as a product in [von25](#)).

$$\frac{d}{dt}D34\_75\_134\_PP2A = v_{64} - v_{65} - v_{66} \quad (319)$$

### 8.38 Species D34\_75\_PP2AP

**Name** D34:75\_PP2AP

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat16](#), [voff16](#) and as a product in [von16](#)).

$$\frac{d}{dt}D34\_75\_PP2AP = v_{67} - v_{68} - v_{69} \quad (320)$$

### 8.39 Species D75\_137\_PP2AP

**Name** D75:137\_PP2AP

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat23](#), [voff23](#) and as a product in [von23](#)).

$$\frac{d}{dt}D75\_137\_PP2AP = v_{70} - v_{71} - v_{72} \quad (321)$$

#### 8.40 Species D34\_75\_137\_PP2AP

**Name** D34:75:137\_PP2AP

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat26](#), [voff26](#) and as a product in [von26](#)).

$$\frac{d}{dt}D34\_75\_137\_PP2AP = v_{74} - v_{73} - v_{75} \quad (322)$$

#### 8.41 Species D34\_137\_PP2C

**Name** D34:137\_PP2C

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat20](#), [voff20](#) and as a product in [von20](#)).

$$\frac{d}{dt}D34\_137\_PP2C = v_{76} - v_{77} - v_{78} \quad (323)$$

#### 8.42 Species D75\_137\_PP2C

**Name** D75:137\_PP2C

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat24](#), [voff24](#) and as a product in [von24](#)).

$$\frac{d}{dt}D75\_137\_PP2C = v_{79} - v_{80} - v_{81} \quad (324)$$

#### 8.43 Species PDE

**Name** PDE

**Initial concentration** 2 · 10<sup>-6</sup> mol · l<sup>-1</sup>

This species takes part in six reactions (as a reactant in [von31](#), [von44](#) and as a product in [voff31](#), [vcat32](#), [voff44](#), [vcat44](#)).

$$\frac{d}{dt}PDE = v_{91} + v_{92} + v_{114} + v_{115} - v_{89} - v_{113} \quad (325)$$

#### 8.44 Species PP2Binactive

**Name** PP2Binactive

**Initial concentration**  $3.32 \cdot 10^{-7} \text{ mol} \cdot \text{l}^{-1}$

This species takes part in two reactions (as a reactant in [von35](#) and as a product in [voff35](#)).

$$\frac{d}{dt}\text{PP2Binactive} = v_{99} - v_{97} \quad (326)$$

#### 8.45 Species D34\_75\_137\_PP2C

**Name** D34:75:137\_PP2C

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

This species takes part in three reactions (as a reactant in [vcat28](#), [voff28](#) and as a product in [von28](#)).

$$\frac{d}{dt}\text{D34_75_137_PP2C} = v_{82} - v_{83} - v_{84} \quad (327)$$

#### 8.46 Species CK1P

**Name** CK1P

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

This species takes part in three reactions (as a reactant in [von29](#) and as a product in [voff29](#), [vcat30](#)).

$$\frac{d}{dt}\text{CK1P} = v_{86} + v_{88} - v_{85} \quad (328)$$

#### 8.47 Species CK1P\_PP2B

**Name** CK1P\_PP2B

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

This species takes part in three reactions (as a reactant in [voff29](#), [vcat29](#) and as a product in [von29](#)).

$$\frac{d}{dt}\text{CK1P_PP2B} = v_{85} - v_{86} - v_{87} \quad (329)$$

### 8.48 Species PDE\_PKA

**Name** PDE\_PKA

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [vcat31](#), [voff31](#) and as a product in [von31](#)).

$$\frac{d}{dt} \text{PDE\_PKA} = v_{89} - v_{90} - v_{91} \quad (330)$$

### 8.49 Species PDEP

**Name** PDEP

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in five reactions (as a reactant in [vcat32](#), [von45](#) and as a product in [vcat31](#), [voff45](#), [vcat45](#)).

$$\frac{d}{dt} \text{PDEP} = v_{90} + v_{117} + v_{118} - v_{92} - v_{116} \quad (331)$$

### 8.50 Species PP2A\_PKA

**Name** PP2A\_PKA

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [voff33](#), [vcat33](#) and as a product in [von33](#)).

$$\frac{d}{dt} \text{PP2A\_PKA} = v_{93} - v_{94} - v_{95} \quad (332)$$

### 8.51 Species Ca

**Name** Ca

**Initial concentration** 0 mol · l<sup>-1</sup>

**Charge** 2

This species takes part in six reactions (as a reactant in [von35](#), [von36](#), [v58](#) and as a product in [voff35](#), [voff36](#), [v57](#)).

$$\frac{d}{dt} \text{Ca} = 2 v_{99} + 2 v_{100} + v_{119} - 2 v_{97} - 2 v_{98} - v_{120} \quad (333)$$

### 8.52 Species PP2BinactiveCa2

**Name** PP2BinactiveCa2

**Initial concentration** 0 mol · l<sup>-1</sup>

**Charge** 2

This species takes part in four reactions (as a reactant in [von36](#), [voff35](#) and as a product in [von35](#), [voff36](#)).

$$\frac{d}{dt} \text{PP2BinactiveCa2} = v_{97} + v_{100} - v_{98} - v_{99} \quad (334)$$

### 8.53 Species R2C2

**Name** R2C2

**Initial concentration** 6.64 · 10<sup>-6</sup> mol · l<sup>-1</sup>

This species takes part in two reactions (as a reactant in [von37](#) and as a product in [voff37](#)).

$$\frac{d}{dt} \text{R2C2} = v_{105} - v_{101} \quad (335)$$

### 8.54 Species cAMP

**Name** cAMP

**Initial concentration** 0 mol · l<sup>-1</sup>

**Involved in event** [cAMP\\_pulse](#)

This species takes part in twelve reactions (as a reactant in [von37](#), [von38](#), [von39](#), [von40](#), [von44](#), [von45](#) and as a product in [voff37](#), [voff38](#), [voff39](#), [voff40](#), [voff44](#), [voff45](#)).

$$\begin{aligned} \frac{d}{dt} \text{cAMP} = & v_{105} + v_{106} + v_{107} + v_{108} + v_{114} + v_{117} \\ & - v_{101} - v_{102} - v_{103} - v_{104} - v_{113} - v_{116} \end{aligned} \quad (336)$$

Furthermore, one event influences this species' rate of change.

### 8.55 Species cAMP\_R2C2

**Name** cAMP\_R2C2

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in four reactions (as a reactant in [von38](#), [voff37](#) and as a product in [von37](#), [voff38](#)).

$$\frac{d}{dt} \text{cAMP\_R2C2} = v_{101} + v_{106} - v_{102} - v_{105} \quad (337)$$



### 8.56 Species cAMP2\_R2C2

**Name** cAMP2\_R2C2

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in four reactions (as a reactant in [von39](#), [voff38](#) and as a product in [von38](#), [voff39](#)).

$$\frac{d}{dt}cAMP2\_R2C2 = v_{102} + v_{107} - v_{103} - v_{106} \quad (338)$$

### 8.57 Species cAMP3\_R2C2

**Name** cAMP3\_R2C2

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in four reactions (as a reactant in [von40](#), [voff39](#) and as a product in [von39](#), [voff40](#)).

$$\frac{d}{dt}cAMP3\_R2C2 = v_{103} + v_{108} - v_{104} - v_{107} \quad (339)$$

### 8.58 Species cAMP4\_R2C2

**Name** cAMP4\_R2C2

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in four reactions (as a reactant in [voff40](#), [voff41](#) and as a product in [von40](#), [von41](#)).

$$\frac{d}{dt}cAMP4\_R2C2 = v_{104} + v_{109} - v_{108} - v_{110} \quad (340)$$

### 8.59 Species cAMP4\_R2C

**Name** cAMP4\_R2C

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in four reactions (as a reactant in [von41](#), [von43](#) and as a product in [voff41](#), [von42](#)).

$$\frac{d}{dt}cAMP4\_R2C = v_{110} + v_{111} - v_{109} - v_{112} \quad (341)$$

### 8.60 Species cAMP4\_R2

**Name** cAMP4\_R2

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in two reactions (as a reactant in [von42](#) and as a product in [von43](#)).

$$\frac{d}{dt}cAMP4\_R2 = v_{112} - v_{111} \quad (342)$$

### 8.61 Species cAMP\_PDE

**Name** cAMP\_PDE

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [voff44](#), [vcat44](#) and as a product in [von44](#)).

$$\frac{d}{dt}cAMP\_PDE = v_{113} - v_{114} - v_{115} \quad (343)$$

### 8.62 Species AMP

**Name** AMP

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in two reactions (as a product in [vcat44](#), [vcat45](#)).

$$\frac{d}{dt}AMP = v_{115} + v_{118} \quad (344)$$

### 8.63 Species cAMP\_PDEP

**Name** cAMP\_PDEP

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in three reactions (as a reactant in [voff45](#), [vcat45](#) and as a product in [von45](#)).

$$\frac{d}{dt}cAMP\_PDEP = v_{116} - v_{117} - v_{118} \quad (345)$$

## 8.64 Species Empty

**Name** Empty

**Initial concentration** 0 mol · l<sup>-1</sup>

This species takes part in two reactions (as a reactant in v57 and as a product in v58), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{d}{dt}\text{Empty} = 0 \quad (346)$$

SBML2<sup>A</sup>TeX was developed by Andreas Dräger<sup>a</sup>, Hannes Planatscher<sup>a</sup>, Dieudonné M Wouamba<sup>a</sup>, Adrian Schröder<sup>a</sup>, Michael Hucka<sup>b</sup>, Lukas Endler<sup>c</sup>, Martin Golebiewski<sup>d</sup> and Andreas Zell<sup>a</sup>. Please see <http://www.ra.cs.uni-tuebingen.de/software/SBML2LaTeX> for more information.

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