SBML Model Report

Model name: "Coggins2014 - CXCL12 dependent recruitment of beta arrestin"

May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 4 format. This model was created by the following eight authors: Nick Juty[1], Vijayalakshmi Chelliah[2], Ryan Gutenkunst[3], Timothy Leach[4], Syeda Kazmi[5], Alexander McNeish[6], David Byrne[7] and Jennifer Linderman[8] at April 18th 2016 at 11:39 a. m. and last time modified at April 18th 2016 at 2:58 p. m. Table 1 gives an overview of the quantities of all components of this model.

Table 1: Number of components in this model, which are described in the following sections.

Element	Quantity	Element	Quantity
compartment types	0	compartments	1
species types	0	species	30
events	0	constraints	0
reactions	37	function definitions	14
global parameters	40	unit definitions	2
rules	5	initial assignments	6

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2 Unit Definitions

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

2.1 Unit `volume`

Name volume

Definition dimensionless

2.2 Unit `substance`

Name substance

Definition item

2.3 Unit `area`

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

Definition m^2

2.4 Unit `length`

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

Definition m

2.5 Unit `time`

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

Definition s

3 Compartment

This model contains one compartment.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
`compartment_2`	Intracellular		3	1	dimensionless	☑	

3.1 Compartment `compartment_2`

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

Name Intracellular

4 Species

This model contains 30 species. Section 10 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
species_2	Be	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_3	Bp	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_4	C4	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_5	C4Be	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_6	C4Beii	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_7	C4Bp	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_8	C4Bpi	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_9	C7	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_10	C7Bei	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_11	C7Beii	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_12	C7Bp	compartment_2	item · dimensionless^{-1}	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
species_13	C7Bpi	compartment_2	item $\cdot$ dimensionless^{-1}	⊟	⊟
species_14	L12i	compartment_2	item $\cdot$ dimensionless^{-1}	⊟	⊟
species_15	R4	compartment_2	item $\cdot$ dimensionless^{-1}	⊟	⊟
species_16	R4Be	compartment_2	item $\cdot$ dimensionless^{-1}	⊟	⊟
species_17	C7Bpii	compartment_2	item $\cdot$ dimensionless^{-1}	⊟	⊟
species_18	R7Bpii	compartment_2	item $\cdot$ dimensionless^{-1}	⊟	⊟
species_19	R7Bp	compartment_2	item $\cdot$ dimensionless^{-1}	⊟	⊟
species_20	R7	compartment_2	item $\cdot$ dimensionless^{-1}	⊟	⊟
species_21	C4Bpii	compartment_2	item $\cdot$ dimensionless^{-1}	⊟	⊟
species_22	C4Bei	compartment_2	item $\cdot$ dimensionless^{-1}	⊟	⊟
species_23	R4Bpi	compartment_2	item $\cdot$ dimensionless^{-1}	⊟	⊟
species_24	R4Bp	compartment_2	item $\cdot$ dimensionless^{-1}	⊟	⊟
species_25	R7Be	compartment_2	item $\cdot$ dimensionless^{-1}	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
species_26	R7Bei	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_27	R7Beii	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_28	C7Be	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_29	R4Bei	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_30	R7Bpi	compartment_2	item · dimensionless^{-1}	⊟	⊟
species_1	L12	compartment_2	item · dimensionless^{-1}	⊟	⊟

5 Parameters

This model contains 40 global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
parameter_1	kf,L12,4		0.002		☑
parameter_2	kf,L12,7		0.001		☑
parameter_3	kf,B,4		$8.5 \cdot 10^{-9}$		☑
parameter_4	kf,B,7		$1.4 \cdot 10^{-8}$		☑
parameter_5	KD,R4,L12		40.000		☑
parameter_6	KD,R7,L12		0.840		☑
parameter_9	KD,C4,B		5100000.000		☑
parameter_10	KD,C7,B		650000.000		☑
parameter_11	ke,R4B		0.002		☑
parameter_12	ke,R7B		0.004		☑
parameter_13	ke,C7Bi		$5.5 \cdot 10^{-4}$		☑
parameter_14	koff,B,4		$7.4 \cdot 10^{-4}$		☑
parameter_15	koff,B,7		0.003		☑
parameter_16	krec,R4Bi		$6.9 \cdot 10^{-5}$		☑
parameter_17	krec,R7Bii		0.001		☑
parameter_18	krec,C7Bii		$2.8 \cdot 10^{-4}$		☑
parameter_19	kdeg,C4Bii		10^{-4}		☑
parameter_20	kdeg,L12i		10^{-4}		☑
parameter_21	KD,R4,B		7800000.000		☑
parameter_22	KD,R7,B		2300000.000		☑
parameter_23	ke,C4B		0.005		☑
parameter_24	ke,C7B		0.002		☑
parameter_25	n4		40000.000		☑
parameter_26	n7		40000.000		☑
parameter_27	n47		40000.000		☑
parameter_28	Nav		$6.02 \cdot 10^{23}$		☑
parameter_29	Vwell		$7 \cdot 10^{-5}$		☑
parameter_30	Vcell		$8.4 \cdot 10^{-12}$		☑
parameter_7	nmol_to_mol		10^{9}		☑
Total4	Total4		8151.729		⊟
Total7	Total7		249192.409		⊟
_Beta	%Beta		100.000		⊟
_CXCR4	%CXCR4		100.000		⊟
_CXCR7	%CXCR7		100.000		⊟
Metabolite_1	Initial for Be		328437.241		☑
Metabolite_3	Initial for Bp		492655.862		☑
Metabolite_5	Initial for C4		0.000		☑

Id	Name	SBO	Value	Unit	Constant
Metabolite_15	Initial for C7		0.000		☑
Metabolite_27	Initial for R4		133539.964		☑
Metabolite_37	Initial for R7		509483.771		☑

6 Initialassignments

This is an overview of six initialassignments.

6.1 Initialassignment Metabolite_1

Derived unit item

Math [species_2]

6.2 Initialassignment Metabolite_3

Derived unit item

Math [species_3]

6.3 Initialassignment Metabolite_5

Derived unit item

Math [species_4]

6.4 Initialassignment Metabolite_15

Derived unit item

Math [species_9]

6.5 Initialassignment Metabolite_27

Derived unit item

Math [species_15]

6.6 Initialassignment Metabolite_37

Derived unit item

Math [species_20]

7 Function definitions

This is an overview of 14 function definitions.

7.1 Function definition function_8

Name Mass action (reversible with KD)_12_1

Arguments parameter_22, parameter_4, [species_19], [species_20], [species_3]

Mathematical Expression

$$\text{parameter\_4} \cdot (\text{[species\_3]} \cdot \text{[species\_20]} - \text{parameter\_22} \cdot \text{[species\_19]}) \quad (1)$$

7.2 Function definition function_5

Name Mass action (reversible with KD)_10

Arguments parameter_22, parameter_4, [species_2], [species_20], [species_25]

Mathematical Expression

$$\text{parameter\_4} \cdot (\text{[species\_2]} \cdot \text{[species\_20]} - \text{parameter\_22} \cdot \text{[species\_25]}) \quad (2)$$

7.3 Function definition function_14

Name Mass action (reversible with KD)_5_4

Arguments parameter_10, parameter_2, parameter_22, parameter_28, parameter_30, parameter_6, parameter_7, [species_1], [species_12], [species_19]

Mathematical Expression

$$\text{parameter\_2} \cdot \frac{\text{parameter\_7}}{\text{parameter\_28} \cdot \text{parameter\_30}} \cdot \left(\text{[species\_1]} \cdot \text{[species\_19]} - \frac{\text{parameter\_6} \cdot \text{parameter\_10} \cdot \frac{\text{parameter\_28} \cdot \text{parameter\_30}}{\text{parameter\_7}}}{\text{parameter\_22}} \cdot \text{[species\_12]} \right) \quad (3)$$

7.4 Function definition function_13

Name Mass action (reversible with KD)_5_3

Arguments parameter_10, parameter_2, parameter_22, parameter_28, parameter_30, parameter_6, parameter_7, [species_1], [species_25], [species_28]

Mathematical Expression

$$\text{parameter\_2} \cdot \frac{\text{parameter\_7}}{\text{parameter\_28} \cdot \text{parameter\_30}} \cdot \left([\text{species\_1}] \cdot [\text{species\_25}] - \frac{\text{parameter\_6} \cdot \text{parameter\_10} \cdot \frac{\text{parameter\_28} \cdot \text{parameter\_30}}{\text{parameter\_7}}}{\text{parameter\_22}} \cdot [\text{species\_28}] \right) \tag{4}$$

7.5 Function definition function_9

Name Mass action (reversible with KD)_1_1

Arguments parameter_1, parameter_28, parameter_30, parameter_5, parameter_7, [species_1], [species_15], [species_4]

Mathematical Expression

$$\text{parameter\_1} \cdot \frac{\text{parameter\_7}}{\text{parameter\_28} \cdot \text{parameter\_30}} \cdot \left([\text{species\_15}] \cdot [\text{species\_1}] - \text{parameter\_5} \cdot \frac{\text{parameter\_28} \cdot \text{parameter\_30}}{\text{parameter\_7}} \cdot [\text{species\_4}] \right) \tag{5}$$

7.6 Function definition function_11

Name Mass action (reversible with KD)_5_1

Arguments parameter_1, parameter_21, parameter_28, parameter_30, parameter_5, parameter_7, parameter_9, [species_1], [species_16], [species_5]

Mathematical Expression

$$\text{parameter\_1} \cdot \frac{\text{parameter\_7}}{\text{parameter\_28} \cdot \text{parameter\_30}} \cdot \left([\text{species\_1}] \cdot [\text{species\_16}] - \frac{\text{parameter\_5} \cdot \text{parameter\_9} \cdot \frac{\text{parameter\_28} \cdot \text{parameter\_30}}{\text{parameter\_7}}}{\text{parameter\_21}} \cdot [\text{species\_5}] \right) \tag{6}$$

7.7 Function definition function_4

Name Mass action (reversible with KD)_9

Arguments parameter_3, parameter_9, [species_3], [species_4], [species_7]

Mathematical Expression

$$\text{parameter\_3} \cdot (\text{[species\_3]} \cdot \text{[species\_4]} - \text{parameter\_9} \cdot \text{[species\_7]}) \tag{7}$$

7.8 Function definition function_2

Name Mass action (reversible with KD)_7

Arguments parameter_21, parameter_3, [species_15], [species_24], [species_3]

Mathematical Expression

$$\text{parameter\_3} \cdot (\text{[species\_3]} \cdot \text{[species\_15]} - \text{parameter\_21} \cdot \text{[species\_24]}) \tag{8}$$

7.9 Function definition function_1

Name Mass action (reversible with KD)_6

Arguments parameter_21, parameter_3, [species_15], [species_16], [species_2]

Mathematical Expression

$$\text{parameter\_3} \cdot (\text{[species\_2]} \cdot \text{[species\_15]} - \text{parameter\_21} \cdot \text{[species\_16]}) \tag{9}$$

7.10 Function definition function_10

Name Mass action (reversible with KD)_1_2

Arguments parameter_2, parameter_28, parameter_30, parameter_6, parameter_7, [species_1], [species_20], [species_9]

Mathematical Expression

$$\begin{aligned} &\text{parameter\_2} \cdot \frac{\text{parameter\_7}}{\text{parameter\_28} \cdot \text{parameter\_30}} \cdot \Bigg(\text{[species\_20]} \cdot \text{[species\_1]} \\ &- \text{parameter\_6} \cdot \frac{\text{parameter\_28} \cdot \text{parameter\_30}}{\text{parameter\_7}} \cdot \text{[species\_9]} \Bigg) \end{aligned} \tag{10}$$

7.11 Function definition function_6

Name Mass action (reversible with KD)_12

Arguments parameter_10, parameter_4, [species_2], [species_28], [species_9]

Mathematical Expression

$$\text{parameter\_4} \cdot (\text{[species\_2]} \cdot \text{[species\_9]} - \text{parameter\_10} \cdot \text{[species\_28]}) \quad (11)$$

7.12 Function definition function_3

Name Mass action (reversible with KD)_8

Arguments parameter_3, parameter_9, [species_2], [species_4], [species_5]

Mathematical Expression

$$\text{parameter\_3} \cdot (\text{[species\_2]} \cdot \text{[species\_4]} - \text{parameter\_9} \cdot \text{[species\_5]}) \quad (12)$$

7.13 Function definition function_12

Name Mass action (reversible with KD)_5_2

Arguments parameter_1, parameter_21, parameter_28, parameter_30, parameter_5, parameter_7, parameter_9, [species_1], [species_24], [species_7]

Mathematical Expression

$$\text{parameter\_1} \cdot \frac{\text{parameter\_7}}{\text{parameter\_28} \cdot \text{parameter\_30}} \cdot \left(\text{[species\_1]} \cdot \text{[species\_24]} - \frac{\text{parameter\_5} \cdot \text{parameter\_9} \cdot \frac{\text{parameter\_28} \cdot \text{parameter\_30}}{\text{parameter\_7}}}{\text{parameter\_21}} \cdot \text{[species\_7]} \right) \quad (13)$$

7.14 Function definition function_7

Name Mass action (reversible with KD)_13

Arguments parameter_10, parameter_4, [species_12], [species_3], [species_9]

Mathematical Expression

$$\text{parameter\_4} \cdot (\text{[species\_3]} \cdot \text{[species\_9]} - \text{parameter\_10} \cdot \text{[species\_12]}) \quad (14)$$

8 Rules

This is an overview of five rules.

8.1 Rule Total4

Rule Total4 is an assignment rule for parameter Total4:

$$\text{Total4} = [\text{species\_7}] + [\text{species\_8}] + [\text{species\_24}] \tag{15}$$

Derived unit item

8.2 Rule Total7

Rule Total7 is an assignment rule for parameter Total7:

$$\text{Total7} = [\text{species\_12}] + [\text{species\_13}] + [\text{species\_17}] + [\text{species\_19}] + [\text{species\_30}] \tag{16}$$

Derived unit item

8.3 Rule _Beta

Rule _Beta is an assignment rule for parameter _Beta:

$$\text{\_Beta} = \frac{[\text{species\_2}] + [\text{species\_3}]}{\text{Metabolite\_1} + \text{Metabolite\_3}} \cdot 100 \tag{17}$$

8.4 Rule _CXCR4

Rule _CXCR4 is an assignment rule for parameter _CXCR4:

$$\text{\_CXCR4} = \frac{[\text{species\_4}] + [\text{species\_15}]}{\text{Metabolite\_5} + \text{Metabolite\_27}} \cdot 100 \tag{18}$$

8.5 Rule _CXCR7

Rule _CXCR7 is an assignment rule for parameter _CXCR7:

$$\text{\_CXCR7} = \frac{[\text{species\_9}] + [\text{species\_20}]}{\text{Metabolite\_15} + \text{Metabolite\_37}} \cdot 100 \tag{19}$$

9 Reactions

This model contains 37 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

№	Id	Name	Reaction Equation	SBO
1	reaction_7	Be binding R4	$\text{species\_2} + \text{species\_15} \xrightleftharpoons{\text{species\_15, species\_16, species\_2}} \text{species\_16}$	
2	reaction_8	Bp binding R4	$\text{species\_3} + \text{species\_15} \xrightleftharpoons{\text{species\_15, species\_24, species\_3}} \text{species\_24}$	
3	reaction_9	Be binding C4	$\text{species\_2} + \text{species\_4} \xrightleftharpoons{\text{species\_2, species\_4, species\_5}} \text{species\_5}$	
4	reaction_10	Bp binding C4	$\text{species\_3} + \text{species\_4} \xrightleftharpoons{\text{species\_3, species\_4, species\_7}} \text{species\_7}$	
5	reaction_11	Be binding R7	$\text{species\_2} + \text{species\_20} \xrightleftharpoons{\text{species\_2, species\_20, species\_25}} \text{species\_25}$	
6	reaction_12	Bp binding R7	$\text{species\_3} + \text{species\_20} \xrightleftharpoons{\text{species\_19, species\_20, species\_3}} \text{species\_19}$	
7	reaction_13	Be binding C7	$\text{species\_2} + \text{species\_9} \xrightleftharpoons{\text{species\_2, species\_28, species\_9}} \text{species\_28}$	
8	reaction_14	Bp binding C7	$\text{species\_3} + \text{species\_9} \xrightleftharpoons{\text{species\_12, species\_3, species\_9}} \text{species\_12}$	
9	reaction_15	Internalization of R4Be	$\text{species\_16} \xrightarrow{\text{species\_16}} \text{species\_29} + \text{species\_2}$	
10	reaction_16	Internalization of R4Bp	$\text{species\_24} \xrightarrow{\text{species\_24}} \text{species\_23} + \text{species\_3}$	
11	reaction_17	Internalization of C4Be	$\text{species\_5} \xrightarrow{\text{species\_5}} \text{species\_22} + \text{species\_14}$	
12	reaction_18	Internalization of C4Bp	$\text{species\_7} \xrightarrow{\text{species\_7}} \text{species\_8} + \text{species\_14}$	
13	reaction_19	Internalization of R7Be	$\text{species\_25} \xrightarrow{\text{species\_25}} \text{species\_26}$	
14	reaction_20	Internalization of R7Bp	$\text{species\_19} \xrightarrow{\text{species\_19}} \text{species\_30}$	
15	reaction_21	Internalization of C7Be	$\text{species\_28} \xrightarrow{\text{species\_28}} \text{species\_10} + \text{species\_14}$	

№	Id	Name	Reaction Equation	SBO
16	reaction_22	Internalization of C7Bp	$\text{species\_12} \xrightarrow{\text{species\_12}} \text{species\_13} + \text{species\_14}$	
17	reaction_23	Dissocation of Be from C4Bei	$\text{species\_22} \xrightarrow{\text{species\_22}} \text{species\_6} + \text{species\_2}$	
18	reaction_24	Dissociation of Bp from C4Bpi	$\text{species\_8} \xrightarrow{\text{species\_8}} \text{species\_21} + \text{species\_3}$	
19	reaction_25	Dissociation of Be from R7Bei	$\text{species\_26} \xrightarrow{\text{species\_26}} \text{species\_27} + \text{species\_2}$	
20	reaction_26	Dissociation of Bp from R7Bpi	$\text{species\_30} \xrightarrow{\text{species\_30}} \text{species\_18} + \text{species\_3}$	
21	reaction_27	Trafficking of C7Bei to late endosomes	$\text{species\_10} \xrightarrow{\text{species\_10}} \text{species\_11}$	
22	reaction_28	Trafficking of C7Bpi to late endosomes	$\text{species\_13} \xrightarrow{\text{species\_13}} \text{species\_17}$	
23	reaction_29	Recycling of R4Bei	$\text{species\_29} \xrightarrow{\text{species\_29}} \text{species\_15}$	
24	reaction_30	Recycling of R4Bpi	$\text{species\_23} \xrightarrow{\text{species\_23}} \text{species\_15}$	
25	reaction_31	Recycling of R7Beii	$\text{species\_27} \xrightarrow{\text{species\_27}} \text{species\_20}$	
26	reaction_32	Recycling of R7Bpii	$\text{species\_18} \xrightarrow{\text{species\_18}} \text{species\_20}$	
27	reaction_33	Recycling of C7Beii	$\text{species\_11} \xrightarrow{\text{species\_11}} \text{species\_20} + \text{species\_2}$	
28	reaction_34	Recycling of C7Bpii	$\text{species\_17} \xrightarrow{\text{species\_17}} \text{species\_20} + \text{species\_3}$	
29	reaction_35	Degradation of C4Beii	$\text{species\_6} \xrightarrow{\text{species\_6}} \emptyset$	
30	reaction_36	Degradation of C4Bpii	$\text{species\_21} \xrightarrow{\text{species\_21}} \emptyset$	
31	reaction_37	Degradation of L12i	$\text{species\_14} \xrightarrow{\text{species\_14}} \emptyset$	
32	reaction_1	L12 binding R4	$\text{species\_1} + \text{species\_15} \underset{\text{species\_1, species\_15, species\_4}}{\rightleftharpoons} \text{species\_4}$	
33	reaction_2	L12 binding R7	$\text{species\_1} + \text{species\_20} \underset{\text{species\_1, species\_20, species\_9}}{\rightleftharpoons} \text{species\_9}$	
34	reaction_3	L12 binding R4Be	$\text{species\_1} + \text{species\_16} \underset{\text{species\_1, species\_16, species\_5}}{\rightleftharpoons} \text{species\_5}$	

№	Id	Name	Reaction Equation	SBO
35	reaction_4	L12 binding R4Bp	species_1 + species_24 $\xrightleftharpoons{\text{species\_1, species\_24, species\_7}}$ species_7	
36	reaction_5	L12 binding R7Be	species_1 + species_25 $\xrightleftharpoons{\text{species\_1, species\_25, species\_28}}$ species_28	
37	reaction_6	L12 binding R7Bp	species_1 + species_19 $\xrightleftharpoons{\text{species\_1, species\_12, species\_19}}$ species_12	

9.1 Reaction reaction_7

This is a reversible reaction of two reactants forming one product influenced by three modifiers.

Name Be binding R4

Reaction equation

$$\text{species\_2} + \text{species\_15} \xrightleftharpoons{\text{species\_15, species\_16, species\_2}} \text{species\_16} \tag{20}$$

Reactants

Table 6: Properties of each reactant.

Id	Name	SBO
species_2	Be	
species_15	R4	

Modifiers

Table 7: Properties of each modifier.

Id	Name	SBO
species_15	R4	
species_16	R4Be	
species_2	Be	

Product

Table 8: Properties of each product.

Id	Name	SBO
species_16	R4Be	

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_1 = {} & \text{vol}\left(\text{compartment\_2}\right) \\ & \cdot \text{function\_1}\left(\text{parameter\_21}, \text{parameter\_3}, [\text{species\_15}], [\text{species\_16}], [\text{species\_2}]\right) \end{aligned} \tag{21}$$

$$\begin{aligned}&\text{function\_1}\left(\text{parameter\_21}, \text{parameter\_3}, [\text{species\_15}], [\text{species\_16}], [\text{species\_2}]\right)\\&\quad = \text{parameter\_3} \cdot \left([\text{species\_2}] \cdot [\text{species\_15}] - \text{parameter\_21} \cdot [\text{species\_16}]\right)\end{aligned} \tag{22}$$

$$\begin{aligned}&\text{function\_1}\left(\text{parameter\_21}, \text{parameter\_3}, [\text{species\_15}], [\text{species\_16}], [\text{species\_2}]\right)\\&\quad = \text{parameter\_3} \cdot \left([\text{species\_2}] \cdot [\text{species\_15}] - \text{parameter\_21} \cdot [\text{species\_16}]\right)\end{aligned} \tag{23}$$

9.2 Reaction `reaction_8`

This is a reversible reaction of two reactants forming one product influenced by three modifiers.

Name Bp binding R4

Reaction equation

$$\text{species\_3} + \text{species\_15} \xrightleftharpoons{\text{species\_15, species\_24, species\_3}} \text{species\_24} \tag{24}$$

Reactants

Table 9: Properties of each reactant.

Id	Name	SBO
`species_3`	Bp	
`species_15`	R4	

Modifiers

Table 10: Properties of each modifier.

Id	Name	SBO
`species_15`	R4	
`species_24`	R4Bp	
`species_3`	Bp	

Product

Table 11: Properties of each product.

Id	Name	SBO
`species_24`	R4Bp	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{function\_2}\,(\mathrm{parameter\_21}, \mathrm{parameter\_3}, [\mathrm{species\_15}], [\mathrm{species\_24}], [\mathrm{species\_3}]) \tag{25}$$

$$\mathrm{function\_2}\,(\mathrm{parameter\_21}, \mathrm{parameter\_3}, [\mathrm{species\_15}], [\mathrm{species\_24}], [\mathrm{species\_3}]) = \mathrm{parameter\_3} \cdot ([\mathrm{species\_3}] \cdot [\mathrm{species\_15}] - \mathrm{parameter\_21} \cdot [\mathrm{species\_24}]) \tag{26}$$

$$\mathrm{function\_2}\,(\mathrm{parameter\_21}, \mathrm{parameter\_3}, [\mathrm{species\_15}], [\mathrm{species\_24}], [\mathrm{species\_3}]) = \mathrm{parameter\_3} \cdot ([\mathrm{species\_3}] \cdot [\mathrm{species\_15}] - \mathrm{parameter\_21} \cdot [\mathrm{species\_24}]) \tag{27}$$

9.3 Reaction `reaction_9`

This is a reversible reaction of two reactants forming one product influenced by three modifiers.

Name Be binding C4

Reaction equation

$$\mathrm{species\_2} + \mathrm{species\_4} \xrightleftharpoons{\mathrm{species\_2},\ \mathrm{species\_4},\ \mathrm{species\_5}} \mathrm{species\_5} \tag{28}$$

Reactants

Table 12: Properties of each reactant.

Id	Name	SBO
`species_2`	Be	
`species_4`	C4	

Modifiers

Table 13: Properties of each modifier.

Id	Name	SBO
`species_2`	Be	
`species_4`	C4	
`species_5`	C4Be	

Product

Table 14: Properties of each product.

Id	Name	SBO
species_5	C4Be	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{function\_3}\,(\mathrm{parameter\_3}, \mathrm{parameter\_9}, [\mathrm{species\_2}], [\mathrm{species\_4}], [\mathrm{species\_5}]) \tag{29}$$

$$\mathrm{function\_3}\,(\mathrm{parameter\_3}, \mathrm{parameter\_9}, [\mathrm{species\_2}], [\mathrm{species\_4}], [\mathrm{species\_5}]) = \mathrm{parameter\_3} \cdot ([\mathrm{species\_2}] \cdot [\mathrm{species\_4}] - \mathrm{parameter\_9} \cdot [\mathrm{species\_5}]) \tag{30}$$

$$\mathrm{function\_3}\,(\mathrm{parameter\_3}, \mathrm{parameter\_9}, [\mathrm{species\_2}], [\mathrm{species\_4}], [\mathrm{species\_5}]) = \mathrm{parameter\_3} \cdot ([\mathrm{species\_2}] \cdot [\mathrm{species\_4}] - \mathrm{parameter\_9} \cdot [\mathrm{species\_5}]) \tag{31}$$

9.4 Reaction reaction_10

This is a reversible reaction of two reactants forming one product influenced by three modifiers.

Name Bp binding C4

Reaction equation

$$\mathrm{species\_3} + \mathrm{species\_4} \xrightleftharpoons{\mathrm{species\_3},\ \mathrm{species\_4},\ \mathrm{species\_7}} \mathrm{species\_7} \tag{32}$$

Reactants

Table 15: Properties of each reactant.

Id	Name	SBO
species_3	Bp	
species_4	C4	

Modifiers

Table 16: Properties of each modifier.

Id	Name	SBO
species_3	Bp	
species_4	C4	
species_7	C4Bp	

Product

Table 17: Properties of each product.

Id	Name	SBO
species_7	C4Bp	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{function\_4}\,(\mathrm{parameter\_3}, \mathrm{parameter\_9}, [\mathrm{species\_3}], [\mathrm{species\_4}], [\mathrm{species\_7}]) \tag{33}$$

$$\mathrm{function\_4}\,(\mathrm{parameter\_3}, \mathrm{parameter\_9}, [\mathrm{species\_3}], [\mathrm{species\_4}], [\mathrm{species\_7}]) = \mathrm{parameter\_3} \cdot ([\mathrm{species\_3}] \cdot [\mathrm{species\_4}] - \mathrm{parameter\_9} \cdot [\mathrm{species\_7}]) \tag{34}$$

$$\mathrm{function\_4}\,(\mathrm{parameter\_3}, \mathrm{parameter\_9}, [\mathrm{species\_3}], [\mathrm{species\_4}], [\mathrm{species\_7}]) = \mathrm{parameter\_3} \cdot ([\mathrm{species\_3}] \cdot [\mathrm{species\_4}] - \mathrm{parameter\_9} \cdot [\mathrm{species\_7}]) \tag{35}$$

9.5 Reaction reaction_11

This is a reversible reaction of two reactants forming one product influenced by three modifiers.

Name Be binding R7

Reaction equation

$$\mathrm{species\_2} + \mathrm{species\_20} \xrightleftharpoons{\mathrm{species\_2},\ \mathrm{species\_20},\ \mathrm{species\_25}} \mathrm{species\_25} \tag{36}$$

Reactants

Table 18: Properties of each reactant.

Id	Name	SBO
species_2	Be	
species_20	R7	

Modifiers

Table 19: Properties of each modifier.

Id	Name	SBO
species_2	Be	
species_20	R7	
species_25	R7Be	

Product

Table 20: Properties of each product.

Id	Name	SBO
species_25	R7Be	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{function\_5}\,(\mathrm{parameter\_22}, \mathrm{parameter\_4}, [\mathrm{species\_2}], [\mathrm{species\_20}], [\mathrm{species\_25}]) \tag{37}$$

$$\mathrm{function\_5}\,(\mathrm{parameter\_22}, \mathrm{parameter\_4}, [\mathrm{species\_2}], [\mathrm{species\_20}], [\mathrm{species\_25}]) = \mathrm{parameter\_4} \cdot ([\mathrm{species\_2}] \cdot [\mathrm{species\_20}] - \mathrm{parameter\_22} \cdot [\mathrm{species\_25}]) \tag{38}$$

$$\mathrm{function\_5}\,(\mathrm{parameter\_22}, \mathrm{parameter\_4}, [\mathrm{species\_2}], [\mathrm{species\_20}], [\mathrm{species\_25}]) = \mathrm{parameter\_4} \cdot ([\mathrm{species\_2}] \cdot [\mathrm{species\_20}] - \mathrm{parameter\_22} \cdot [\mathrm{species\_25}]) \tag{39}$$

9.6 Reaction reaction_12

This is a reversible reaction of two reactants forming one product influenced by three modifiers.

Name Bp binding R7

Reaction equation

$$\text{species\_3} + \text{species\_20} \xrightleftharpoons{\text{species\_19, species\_20, species\_3}} \text{species\_19} \tag{40}$$

Reactants

Table 21: Properties of each reactant.

Id	Name	SBO
species_3	Bp	
species_20	R7	

Modifiers

Table 22: Properties of each modifier.

Id	Name	SBO
species_19	R7Bp	
species_20	R7	
species_3	Bp	

Product

Table 23: Properties of each product.

Id	Name	SBO
species_19	R7Bp	

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_6 = {} & \text{vol}\left(\text{compartment\_2}\right) \\ & \cdot \text{function\_8}\left(\text{parameter\_22}, \text{parameter\_4}, [\text{species\_19}], [\text{species\_20}], [\text{species\_3}]\right) \end{aligned} \tag{41}$$

$$\begin{aligned} & \text{function\_8}\left(\text{parameter\_22}, \text{parameter\_4}, [\text{species\_19}], [\text{species\_20}], [\text{species\_3}]\right) \\ & = \text{parameter\_4} \cdot \left([\text{species\_3}] \cdot [\text{species\_20}] - \text{parameter\_22} \cdot [\text{species\_19}]\right) \end{aligned} \tag{42}$$

$$\begin{aligned} & \text{function\_8}\left(\text{parameter\_22}, \text{parameter\_4}, [\text{species\_19}], [\text{species\_20}], [\text{species\_3}]\right) \\ & = \text{parameter\_4} \cdot \left([\text{species\_3}] \cdot [\text{species\_20}] - \text{parameter\_22} \cdot [\text{species\_19}]\right) \end{aligned} \tag{43}$$

9.7 Reaction reaction_13

This is a reversible reaction of two reactants forming one product influenced by three modifiers.

Name Be binding C7

Reaction equation

$$\text{species\_2} + \text{species\_9} \xrightleftharpoons{\text{species\_2, species\_28, species\_9}} \text{species\_28} \tag{44}$$

Reactants

Table 24: Properties of each reactant.

Id	Name	SBO
species_2	Be	
species_9	C7	

Modifiers

Table 25: Properties of each modifier.

Id	Name	SBO
species_2	Be	
species_28	C7Be	
species_9	C7	

Product

Table 26: Properties of each product.

Id	Name	SBO
species_28	C7Be	

Kinetic Law

Derived unit contains undeclared units

$$\begin{aligned} v_7 = {} & \text{vol}\left(\text{compartment\_2}\right) \\ & \cdot \text{function\_6}\left(\text{parameter\_10}, \text{parameter\_4}, [\text{species\_2}], [\text{species\_28}], [\text{species\_9}]\right) \end{aligned} \tag{45}$$

$$\begin{aligned}&\text{function\_6}\left(\text{parameter\_10}, \text{parameter\_4}, [\text{species\_2}], [\text{species\_28}], [\text{species\_9}]\right)\\&\quad = \text{parameter\_4} \cdot \left([\text{species\_2}] \cdot [\text{species\_9}] - \text{parameter\_10} \cdot [\text{species\_28}]\right)\end{aligned} \tag{46}$$

$$\begin{aligned}&\text{function\_6}\left(\text{parameter\_10}, \text{parameter\_4}, [\text{species\_2}], [\text{species\_28}], [\text{species\_9}]\right)\\&\quad = \text{parameter\_4} \cdot \left([\text{species\_2}] \cdot [\text{species\_9}] - \text{parameter\_10} \cdot [\text{species\_28}]\right)\end{aligned} \tag{47}$$

9.8 Reaction `reaction_14`

This is a reversible reaction of two reactants forming one product influenced by three modifiers.

Name Bp binding C7

Reaction equation

$$\text{species\_3} + \text{species\_9} \xrightleftharpoons{\text{species\_12, species\_3, species\_9}} \text{species\_12} \tag{48}$$

Reactants

Table 27: Properties of each reactant.

Id	Name	SBO
`species_3`	Bp	
`species_9`	C7	

Modifiers

Table 28: Properties of each modifier.

Id	Name	SBO
`species_12`	C7Bp	
`species_3`	Bp	
`species_9`	C7	

Product

Table 29: Properties of each product.

Id	Name	SBO
`species_12`	C7Bp	

Kinetic Law

Derived unit contains undeclared units

$$v_8 = \mathrm{vol}\left(\mathrm{compartment\_2}\right) \cdot \mathrm{function\_7}\left(\mathrm{parameter\_10}, \mathrm{parameter\_4}, [\mathrm{species\_12}], [\mathrm{species\_3}], [\mathrm{species\_9}]\right) \tag{49}$$

$$\mathrm{function\_7}\left(\mathrm{parameter\_10}, \mathrm{parameter\_4}, [\mathrm{species\_12}], [\mathrm{species\_3}], [\mathrm{species\_9}]\right) = \mathrm{parameter\_4} \cdot \left([\mathrm{species\_3}] \cdot [\mathrm{species\_9}] - \mathrm{parameter\_10} \cdot [\mathrm{species\_12}]\right) \tag{50}$$

$$\mathrm{function\_7}\left(\mathrm{parameter\_10}, \mathrm{parameter\_4}, [\mathrm{species\_12}], [\mathrm{species\_3}], [\mathrm{species\_9}]\right) = \mathrm{parameter\_4} \cdot \left([\mathrm{species\_3}] \cdot [\mathrm{species\_9}] - \mathrm{parameter\_10} \cdot [\mathrm{species\_12}]\right) \tag{51}$$

9.9 Reaction `reaction_15`

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

Name Internalization of R4Be

Reaction equation

$$\mathrm{species\_16} \xrightarrow{\mathrm{species\_16}} \mathrm{species\_29} + \mathrm{species\_2} \tag{52}$$

Reactant

Table 30: Properties of each reactant.

Id	Name	SBO
`species_16`	R4Be	

Modifier

Table 31: Properties of each modifier.

Id	Name	SBO
`species_16`	R4Be	

Products

Table 32: Properties of each product.

Id	Name	SBO
species_29	R4Bei	
species_2	Be	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_11} \cdot [\mathrm{species\_16}] \tag{53}$$

9.10 Reaction reaction_16

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

Name Internalization of R4Bp

Reaction equation

$$\mathrm{species\_24} \xrightarrow{\mathrm{species\_24}} \mathrm{species\_23} + \mathrm{species\_3} \tag{54}$$

Reactant

Table 33: Properties of each reactant.

Id	Name	SBO
species_24	R4Bp	

Modifier

Table 34: Properties of each modifier.

Id	Name	SBO
species_24	R4Bp	

Products

Table 35: Properties of each product.

Id	Name	SBO
species_23	R4Bpi	
species_3	Bp	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_11} \cdot [\mathrm{species\_24}] \tag{55}$$

9.11 Reaction reaction_17

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

Name Internalization of C4Be

Reaction equation

$$\mathrm{species\_5} \xrightarrow{\mathrm{species\_5}} \mathrm{species\_22} + \mathrm{species\_14} \tag{56}$$

Reactant

Table 36: Properties of each reactant.

Id	Name	SBO
species_5	C4Be	

Modifier

Table 37: Properties of each modifier.

Id	Name	SBO
species_5	C4Be	

Products

Table 38: Properties of each product.

Id	Name	SBO
species_22	C4Bei	
species_14	L12i	

Kinetic Law

Derived unit contains undeclared units

$$v_{11} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_23} \cdot [\mathrm{species\_5}] \tag{57}$$

9.12 Reaction reaction_18

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

Name Internalization of C4Bp

Reaction equation

$$\mathrm{species\_7} \xrightarrow{\mathrm{species\_7}} \mathrm{species\_8} + \mathrm{species\_14} \tag{58}$$

Reactant

Table 39: Properties of each reactant.

Id	Name	SBO
species_7	C4Bp	

Modifier

Table 40: Properties of each modifier.

Id	Name	SBO
species_7	C4Bp	

Products

Table 41: Properties of each product.

Id	Name	SBO
species_8	C4Bpi	
species_14	L12i	

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_23} \cdot [\mathrm{species\_7}] \tag{59}$$

9.13 Reaction reaction_19

This is an irreversible reaction of one reactant forming one product influenced by one modifier.

Name Internalization of R7Be

Reaction equation

$$\mathrm{species\_25} \xrightarrow{\mathrm{species\_25}} \mathrm{species\_26} \tag{60}$$

Reactant

Table 42: Properties of each reactant.

Id	Name	SBO
species_25	R7Be	

Modifier

Table 43: Properties of each modifier.

Id	Name	SBO
species_25	R7Be	

Product

Table 44: Properties of each product.

Id	Name	SBO
species_26	R7Bei	

Kinetic Law

Derived unit contains undeclared units

$$v_{13} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_12} \cdot [\mathrm{species\_25}] \tag{61}$$

9.14 Reaction reaction_20

This is an irreversible reaction of one reactant forming one product influenced by one modifier.

Name Internalization of R7Bp

Reaction equation

$$\mathrm{species\_19} \xrightarrow{\mathrm{species\_19}} \mathrm{species\_30} \tag{62}$$

Reactant

Table 45: Properties of each reactant.

Id	Name	SBO
species_19	R7Bp	

Modifier

Table 46: Properties of each modifier.

Id	Name	SBO
species_19	R7Bp	

Product

Table 47: Properties of each product.

Id	Name	SBO
species_30	R7Bpi	

Kinetic Law

Derived unit contains undeclared units

$$v_{14} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_12} \cdot [\mathrm{species\_19}] \tag{63}$$

9.15 Reaction `reaction_21`

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

Name Internalization of C7Be

Reaction equation

$$\mathrm{species\_28} \xrightarrow{\mathrm{species\_28}} \mathrm{species\_10} + \mathrm{species\_14} \tag{64}$$

Reactant

Table 48: Properties of each reactant.

Id	Name	SBO
`species_28`	C7Be	

Modifier

Table 49: Properties of each modifier.

Id	Name	SBO
`species_28`	C7Be	

Products

Table 50: Properties of each product.

Id	Name	SBO
`species_10`	C7Bei	
`species_14`	L12i	

Kinetic Law

Derived unit contains undeclared units

$$v_{15} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_24} \cdot [\mathrm{species\_28}] \tag{65}$$

9.16 Reaction `reaction_22`

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

Name Internalization of C7Bp

Reaction equation

$$\mathrm{species\_12} \xrightarrow{\mathrm{species\_12}} \mathrm{species\_13} + \mathrm{species\_14} \tag{66}$$

Reactant

Table 51: Properties of each reactant.

Id	Name	SBO
`species_12`	C7Bp	

Modifier

Table 52: Properties of each modifier.

Id	Name	SBO
`species_12`	C7Bp	

Products

Table 53: Properties of each product.

Id	Name	SBO
`species_13`	C7Bpi	
`species_14`	L12i	

Kinetic Law

Derived unit contains undeclared units

$$v_{16} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_24} \cdot [\mathrm{species\_12}] \tag{67}$$

9.17 Reaction `reaction_23`

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

Name Dissocation of Be from C4Bei

Reaction equation

$$\text{species\_22} \xrightarrow{\text{species\_22}} \text{species\_6} + \text{species\_2} \tag{68}$$

Reactant

Table 54: Properties of each reactant.

Id	Name	SBO
species_22	C4Bei	

Modifier

Table 55: Properties of each modifier.

Id	Name	SBO
species_22	C4Bei	

Products

Table 56: Properties of each product.

Id	Name	SBO
species_6	C4Beii	
species_2	Be	

Kinetic Law

Derived unit contains undeclared units

$$v_{17} = \text{vol}\left(\text{compartment\_2}\right) \cdot \text{parameter\_14} \cdot [\text{species\_22}] \tag{69}$$

9.18 Reaction reaction_24

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

Name Dissociation of Bp from C4Bpi

Reaction equation

$$\text{species\_8} \xrightarrow{\text{species\_8}} \text{species\_21} + \text{species\_3} \tag{70}$$

Reactant

Table 57: Properties of each reactant.

Id	Name	SBO
species_8	C4Bpi	

Modifier

Table 58: Properties of each modifier.

Id	Name	SBO
species_8	C4Bpi	

Products

Table 59: Properties of each product.

Id	Name	SBO
species_21	C4Bpii	
species_3	Bp	

Kinetic Law

Derived unit contains undeclared units

$$v_{18} = \text{vol}\left(\text{compartment\_2}\right) \cdot \text{parameter\_14} \cdot [\text{species\_8}] \tag{71}$$

9.19 Reaction reaction_25

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

Name Dissociation of Be from R7Bei

Reaction equation

$$\text{species\_26} \xrightarrow{\text{species\_26}} \text{species\_27} + \text{species\_2} \tag{72}$$

Reactant

Table 60: Properties of each reactant.

Id	Name	SBO
species_26	R7Bei	

Modifier

Table 61: Properties of each modifier.

Id	Name	SBO
species_26	R7Bei	

Products

Table 62: Properties of each product.

Id	Name	SBO
species_27	R7Beii	
species_2	Be	

Kinetic Law

Derived unit contains undeclared units

$$v_{19} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_15} \cdot [\mathrm{species\_26}] \tag{73}$$

9.20 Reaction reaction_26

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

Name Dissociation of Bp from R7Bpi

Reaction equation

$$\mathrm{species\_30} \xrightarrow{\mathrm{species\_30}} \mathrm{species\_18} + \mathrm{species\_3} \tag{74}$$

Reactant

Table 63: Properties of each reactant.

Id	Name	SBO
species_30	R7Bpi	

Modifier

Table 64: Properties of each modifier.

Id	Name	SBO
species_30	R7Bpi	

Products

Table 65: Properties of each product.

Id	Name	SBO
species_18	R7Bpii	
species_3	Bp	

Kinetic Law

Derived unit contains undeclared units

$$v_{20} = \mathrm{vol}\left(\mathrm{compartment\_2}\right) \cdot \mathrm{parameter\_15} \cdot [\mathrm{species\_30}] \tag{75}$$

9.21 Reaction reaction_27

This is an irreversible reaction of one reactant forming one product influenced by one modifier.

Name Trafficking of C7Bei to late endosomes

Reaction equation

$$\mathrm{species\_10} \xrightarrow{\mathrm{species\_10}} \mathrm{species\_11} \tag{76}$$

Reactant

Table 66: Properties of each reactant.

Id	Name	SBO
species_10	C7Bei	

Modifier

Table 67: Properties of each modifier.

Id	Name	SBO
species_10	C7Bei	

Product

Table 68: Properties of each product.

Id	Name	SBO
species_11	C7Beii	

Kinetic Law

Derived unit contains undeclared units

$$v_{21} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_13} \cdot [\mathrm{species\_10}] \tag{77}$$

9.22 Reaction reaction_28

This is an irreversible reaction of one reactant forming one product influenced by one modifier.

Name Trafficking of C7Bpi to late endosomes

Reaction equation

$$\mathrm{species\_13} \xrightarrow{\mathrm{species\_13}} \mathrm{species\_17} \tag{78}$$

Reactant

Table 69: Properties of each reactant.

Id	Name	SBO
species_13	C7Bpi	

Modifier

Table 70: Properties of each modifier.

Id	Name	SBO
species_13	C7Bpi	

Product

Table 71: Properties of each product.

Id	Name	SBO
species_17	C7Bpii	

Kinetic Law

Derived unit contains undeclared units

$$v_{22} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_13} \cdot [\mathrm{species\_13}] \tag{79}$$

9.23 Reaction reaction_29

This is an irreversible reaction of one reactant forming one product influenced by one modifier.

Name Recycling of R4Bei

Reaction equation

$$\mathrm{species\_29} \xrightarrow{\mathrm{species\_29}} \mathrm{species\_15} \tag{80}$$

Reactant

Table 72: Properties of each reactant.

Id	Name	SBO
species_29	R4Bei	

Modifier

Table 73: Properties of each modifier.

Id	Name	SBO
species_29	R4Bei	

Product

Table 74: Properties of each product.

Id	Name	SBO
species_15	R4	

Kinetic Law

Derived unit contains undeclared units

$$v_{23} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_16} \cdot [\mathrm{species\_29}] \tag{81}$$

9.24 Reaction reaction_30

This is an irreversible reaction of one reactant forming one product influenced by one modifier.

Name Recycling of R4Bpi

Reaction equation

$$\mathrm{species\_23} \xrightarrow{\mathrm{species\_23}} \mathrm{species\_15} \tag{82}$$

Reactant

Table 75: Properties of each reactant.

Id	Name	SBO
species_23	R4Bpi	

Modifier

Table 76: Properties of each modifier.

Id	Name	SBO
species_23	R4Bpi	

Product

Table 77: Properties of each product.

Id	Name	SBO
species_15	R4	

Kinetic Law

Derived unit contains undeclared units

$$v_{24} = \mathrm{vol}\left(\mathrm{compartment\_2}\right) \cdot \mathrm{parameter\_16} \cdot [\mathrm{species\_23}] \tag{83}$$

9.25 Reaction reaction_31

This is an irreversible reaction of one reactant forming one product influenced by one modifier.

Name Recycling of R7Beii

Reaction equation

$$\mathrm{species\_27} \xrightarrow{\mathrm{species\_27}} \mathrm{species\_20} \tag{84}$$

Reactant

Table 78: Properties of each reactant.

Id	Name	SBO
species_27	R7Beii	

Modifier

Table 79: Properties of each modifier.

Id	Name	SBO
species_27	R7Beii	

Product

Table 80: Properties of each product.

Id	Name	SBO
species_20	R7	

Kinetic Law

Derived unit contains undeclared units

$$v_{25} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_17} \cdot [\mathrm{species\_27}] \tag{85}$$

9.26 Reaction reaction_32

This is an irreversible reaction of one reactant forming one product influenced by one modifier.

Name Recycling of R7Bpii

Reaction equation

$$\mathrm{species\_18} \xrightarrow{\mathrm{species\_18}} \mathrm{species\_20} \tag{86}$$

Reactant

Table 81: Properties of each reactant.

Id	Name	SBO
species_18	R7Bpii	

Modifier

Table 82: Properties of each modifier.

Id	Name	SBO
species_18	R7Bpii	

Product

Table 83: Properties of each product.

Id	Name	SBO
species_20	R7	

Kinetic Law

Derived unit contains undeclared units

$$v_{26} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_17} \cdot [\mathrm{species\_18}] \tag{87}$$

9.27 Reaction `reaction_33`

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

Name Recycling of C7Beii

Reaction equation

$$\mathrm{species\_11} \xrightarrow{\mathrm{species\_11}} \mathrm{species\_20} + \mathrm{species\_2} \tag{88}$$

Reactant

Table 84: Properties of each reactant.

Id	Name	SBO
`species_11`	C7Beii	

Modifier

Table 85: Properties of each modifier.

Id	Name	SBO
`species_11`	C7Beii	

Products

Table 86: Properties of each product.

Id	Name	SBO
`species_20`	R7	
`species_2`	Be	

Kinetic Law

Derived unit contains undeclared units

$$v_{27} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_18} \cdot [\mathrm{species\_11}] \tag{89}$$

9.28 Reaction reaction_34

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

Name Recycling of C7Bpii

Reaction equation

$$\mathrm{species\_17} \xrightarrow{\mathrm{species\_17}} \mathrm{species\_20} + \mathrm{species\_3} \tag{90}$$

Reactant

Table 87: Properties of each reactant.

Id	Name	SBO
species_17	C7Bpii	

Modifier

Table 88: Properties of each modifier.

Id	Name	SBO
species_17	C7Bpii	

Products

Table 89: Properties of each product.

Id	Name	SBO
species_20	R7	
species_3	Bp	

Kinetic Law

Derived unit contains undeclared units

$$v_{28} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_18} \cdot [\mathrm{species\_17}] \tag{91}$$

9.29 Reaction reaction_35

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

Name Degradation of C4Beii

Reaction equation

$$\text{species\_6} \xrightarrow{\text{species\_6}} \emptyset \tag{92}$$

Reactant

Table 90: Properties of each reactant.

Id	Name	SBO
species_6	C4Beii	

Modifier

Table 91: Properties of each modifier.

Id	Name	SBO
species_6	C4Beii	

Kinetic Law

Derived unit contains undeclared units

$$v_{29} = \text{vol}(\text{compartment\_2}) \cdot \text{parameter\_19} \cdot [\text{species\_6}] \tag{93}$$

9.30 Reaction reaction_36

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

Name Degradation of C4Bpii

Reaction equation

$$\text{species\_21} \xrightarrow{\text{species\_21}} \emptyset \tag{94}$$

Reactant

Table 92: Properties of each reactant.

Id	Name	SBO
species_21	C4Bpii	

Modifier

Table 93: Properties of each modifier.

Id	Name	SBO
species_21	C4Bpii	

Kinetic Law

Derived unit contains undeclared units

$$v_{30} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_19} \cdot [\mathrm{species\_21}] \tag{95}$$

9.31 Reaction reaction_37

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

Name Degradation of L12i

Reaction equation

$$\mathrm{species\_14} \xrightarrow{\mathrm{species\_14}} \emptyset \tag{96}$$

Reactant

Table 94: Properties of each reactant.

Id	Name	SBO
species_14	L12i	

Modifier

Table 95: Properties of each modifier.

Id	Name	SBO
species_14	L12i	

Kinetic Law

Derived unit contains undeclared units

$$v_{31} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{parameter\_20} \cdot [\mathrm{species\_14}] \tag{97}$$

9.32 Reaction reaction_1

This is a reversible reaction of two reactants forming one product influenced by three modifiers.

Name L12 binding R4

Reaction equation

$$\text{species\_1} + \text{species\_15} \xrightleftharpoons{\text{species\_1, species\_15, species\_4}} \text{species\_4} \tag{98}$$

Reactants

Table 96: Properties of each reactant.

Id	Name	SBO
species_1	L12	
species_15	R4	

Modifiers

Table 97: Properties of each modifier.

Id	Name	SBO
species_1	L12	
species_15	R4	
species_4	C4	

Product

Table 98: Properties of each product.

Id	Name	SBO
species_4	C4	

Kinetic Law

Derived unit contains undeclared units

$$v_{32} = \text{vol}(\text{compartment\_2}) \cdot \text{function\_9}(\text{parameter\_1}, \text{parameter\_28}, \text{parameter\_30}, \text{parameter\_5}, \text{parameter\_7}, [\text{species\_1}], [\text{species\_15}], [\text{species\_4}]) \tag{99}$$

$$\begin{aligned}\text{function\_9}(&\text{parameter\_1}, \text{parameter\_28}, \text{parameter\_30}, \text{parameter\_5}, \text{parameter\_7},\\ &[\text{species\_1}], [\text{species\_15}], [\text{species\_4}]) = \text{parameter\_1} \cdot \frac{\text{parameter\_7}}{\text{parameter\_28} \cdot \text{parameter\_30}}\\ &\cdot \left([\text{species\_15}] \cdot [\text{species\_1}] - \text{parameter\_5} \cdot \frac{\text{parameter\_28} \cdot \text{parameter\_30}}{\text{parameter\_7}} \cdot [\text{species\_4}] \right)\end{aligned} \tag{100}$$

$$\begin{aligned}\text{function\_9}(&\text{parameter\_1}, \text{parameter\_28}, \text{parameter\_30}, \text{parameter\_5}, \text{parameter\_7},\\ &[\text{species\_1}], [\text{species\_15}], [\text{species\_4}]) = \text{parameter\_1} \cdot \frac{\text{parameter\_7}}{\text{parameter\_28} \cdot \text{parameter\_30}}\\ &\cdot \left([\text{species\_15}] \cdot [\text{species\_1}] - \text{parameter\_5} \cdot \frac{\text{parameter\_28} \cdot \text{parameter\_30}}{\text{parameter\_7}} \cdot [\text{species\_4}] \right)\end{aligned} \tag{101}$$

9.33 Reaction `reaction_2`

This is a reversible reaction of two reactants forming one product influenced by three modifiers.

Name L12 binding R7

Reaction equation

$$\text{species\_1} + \text{species\_20} \xrightleftharpoons{\text{species\_1, species\_20, species\_9}} \text{species\_9} \tag{102}$$

Reactants

Table 99: Properties of each reactant.

Id	Name	SBO
`species_1`	L12	
`species_20`	R7	

Modifiers

Table 100: Properties of each modifier.

Id	Name	SBO
`species_1`	L12	
`species_20`	R7	
`species_9`	C7	

Product

Table 101: Properties of each product.

Id	Name	SBO
species_9	C7	

Kinetic Law

Derived unit contains undeclared units

$$v_{33} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{function\_10}\,(\mathrm{parameter\_2}, \mathrm{parameter\_28}, \mathrm{parameter\_30}, \mathrm{parameter\_6}, \mathrm{parameter\_7}, [\mathrm{species\_1}], [\mathrm{species\_20}], [\mathrm{species\_9}]) \tag{103}$$

$$\mathrm{function\_10}\,(\mathrm{parameter\_2}, \mathrm{parameter\_28}, \mathrm{parameter\_30}, \mathrm{parameter\_6}, \mathrm{parameter\_7}, [\mathrm{species\_1}], [\mathrm{species\_20}], [\mathrm{species\_9}]) = \mathrm{parameter\_2} \cdot \frac{\mathrm{parameter\_7}}{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}} \cdot \left([\mathrm{species\_20}] \cdot [\mathrm{species\_1}] - \mathrm{parameter\_6} \cdot \frac{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}}{\mathrm{parameter\_7}} \cdot [\mathrm{species\_9}] \right) \tag{104}$$

$$\mathrm{function\_10}\,(\mathrm{parameter\_2}, \mathrm{parameter\_28}, \mathrm{parameter\_30}, \mathrm{parameter\_6}, \mathrm{parameter\_7}, [\mathrm{species\_1}], [\mathrm{species\_20}], [\mathrm{species\_9}]) = \mathrm{parameter\_2} \cdot \frac{\mathrm{parameter\_7}}{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}} \cdot \left([\mathrm{species\_20}] \cdot [\mathrm{species\_1}] - \mathrm{parameter\_6} \cdot \frac{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}}{\mathrm{parameter\_7}} \cdot [\mathrm{species\_9}] \right) \tag{105}$$

9.34 Reaction reaction_3

This is a reversible reaction of two reactants forming one product influenced by three modifiers.

Name L12 binding R4Be

Reaction equation

$$\mathrm{species\_1} + \mathrm{species\_16} \xrightleftharpoons{\mathrm{species\_1},\ \mathrm{species\_16},\ \mathrm{species\_5}} \mathrm{species\_5} \tag{106}$$

Reactants

Table 102: Properties of each reactant.

Id	Name	SBO
species_1	L12	
species_16	R4Be	

Modifiers

Table 103: Properties of each modifier.

Id	Name	SBO
species_1	L12	
species_16	R4Be	
species_5	C4Be	

Product

Table 104: Properties of each product.

Id	Name	SBO
species_5	C4Be	

Kinetic Law

Derived unit contains undeclared units

$$v_{34} = \mathrm{vol}\left(\mathrm{compartment\_2}\right) \cdot \mathrm{function\_11}\left(\mathrm{parameter\_1}, \mathrm{parameter\_21}, \mathrm{parameter\_28}, \mathrm{parameter\_30}, \mathrm{parameter\_5}, \mathrm{parameter\_7}, \mathrm{parameter\_9}, [\mathrm{species\_1}], [\mathrm{species\_16}], [\mathrm{species\_5}]\right) \tag{107}$$

$$\mathrm{function\_11}\left(\mathrm{parameter\_1}, \mathrm{parameter\_21}, \mathrm{parameter\_28}, \mathrm{parameter\_30}, \mathrm{parameter\_5}, \mathrm{parameter\_7}, \mathrm{parameter\_9}, [\mathrm{species\_1}], [\mathrm{species\_16}], [\mathrm{species\_5}]\right) = \mathrm{parameter\_1} \cdot \frac{\mathrm{parameter\_7}}{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}} \cdot \left([\mathrm{species\_1}] \cdot [\mathrm{species\_16}] - \frac{\mathrm{parameter\_5} \cdot \mathrm{parameter\_9} \cdot \frac{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}}{\mathrm{parameter\_7}}}{\mathrm{parameter\_21}} \cdot [\mathrm{species\_5}] \right) \tag{108}$$

$$\begin{aligned}\text{function\_11}\left(\text{parameter\_1}, \text{parameter\_21}, \text{parameter\_28}, \text{parameter\_30}, \text{parameter\_5}, \right.\\ \left.\text{parameter\_7}, \text{parameter\_9}, [\text{species\_1}], [\text{species\_16}], [\text{species\_5}]\right) = \text{parameter\_1}\\ \cdot \frac{\text{parameter\_7}}{\text{parameter\_28} \cdot \text{parameter\_30}} \cdot \left([\text{species\_1}] \cdot [\text{species\_16}] \right.\\ \left. - \frac{\text{parameter\_5} \cdot \text{parameter\_9} \cdot \frac{\text{parameter\_28} \cdot \text{parameter\_30}}{\text{parameter\_7}}}{\text{parameter\_21}} \cdot [\text{species\_5}] \right)\end{aligned} \tag{109}$$

9.35 Reaction `reaction_4`

This is a reversible reaction of two reactants forming one product influenced by three modifiers.

Name L12 binding R4Bp

Reaction equation

$$\text{species\_1} + \text{species\_24} \underset{}{\overset{\text{species\_1, species\_24, species\_7}}{\rightleftharpoons}} \text{species\_7} \tag{110}$$

Reactants

Table 105: Properties of each reactant.

Id	Name	SBO
`species_1`	L12	
`species_24`	R4Bp	

Modifiers

Table 106: Properties of each modifier.

Id	Name	SBO
`species_1`	L12	
`species_24`	R4Bp	
`species_7`	C4Bp	

Product

Table 107: Properties of each product.

Id	Name	SBO
`species_7`	C4Bp	

Id	Name	SBO

Kinetic Law

Derived unit contains undeclared units

$$v_{35} = \mathrm{vol}\left(\mathrm{compartment\_2}\right) \cdot \mathrm{function\_12}\left(\mathrm{parameter\_1}, \mathrm{parameter\_21}, \mathrm{parameter\_28}, \mathrm{parameter\_30}, \mathrm{parameter\_5}, \mathrm{parameter\_7}, \mathrm{parameter\_9}, [\mathrm{species\_1}], [\mathrm{species\_24}], [\mathrm{species\_7}]\right) \tag{111}$$

$$\mathrm{function\_12}\left(\mathrm{parameter\_1}, \mathrm{parameter\_21}, \mathrm{parameter\_28}, \mathrm{parameter\_30}, \mathrm{parameter\_5}, \mathrm{parameter\_7}, \mathrm{parameter\_9}, [\mathrm{species\_1}], [\mathrm{species\_24}], [\mathrm{species\_7}]\right) = \mathrm{parameter\_1} \cdot \frac{\mathrm{parameter\_7}}{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}} \cdot \left([\mathrm{species\_1}] \cdot [\mathrm{species\_24}] - \frac{\mathrm{parameter\_5} \cdot \mathrm{parameter\_9} \cdot \frac{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}}{\mathrm{parameter\_7}}}{\mathrm{parameter\_21}} \cdot [\mathrm{species\_7}] \right) \tag{112}$$

$$\mathrm{function\_12}\left(\mathrm{parameter\_1}, \mathrm{parameter\_21}, \mathrm{parameter\_28}, \mathrm{parameter\_30}, \mathrm{parameter\_5}, \mathrm{parameter\_7}, \mathrm{parameter\_9}, [\mathrm{species\_1}], [\mathrm{species\_24}], [\mathrm{species\_7}]\right) = \mathrm{parameter\_1} \cdot \frac{\mathrm{parameter\_7}}{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}} \cdot \left([\mathrm{species\_1}] \cdot [\mathrm{species\_24}] - \frac{\mathrm{parameter\_5} \cdot \mathrm{parameter\_9} \cdot \frac{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}}{\mathrm{parameter\_7}}}{\mathrm{parameter\_21}} \cdot [\mathrm{species\_7}] \right) \tag{113}$$

9.36 Reaction `reaction_5`

This is a reversible reaction of two reactants forming one product influenced by three modifiers.

Name L12 binding R7Be

Reaction equation

$$\mathrm{species\_1} + \mathrm{species\_25} \xrightleftharpoons{\mathrm{species\_1},\ \mathrm{species\_25},\ \mathrm{species\_28}} \mathrm{species\_28} \tag{114}$$

Reactants

Table 108: Properties of each reactant.

Id	Name	SBO
species_1	L12	
species_25	R7Be	

Modifiers

Table 109: Properties of each modifier.

Id	Name	SBO
species_1	L12	
species_25	R7Be	
species_28	C7Be	

Product

Table 110: Properties of each product.

Id	Name	SBO
species_28	C7Be	

Kinetic Law

Derived unit contains undeclared units

$$v_{36} = \mathrm{vol}\left(\mathrm{compartment\_2}\right) \cdot \mathrm{function\_13}\left(\mathrm{parameter\_10}, \mathrm{parameter\_2}, \mathrm{parameter\_22}, \mathrm{parameter\_28}, \mathrm{parameter\_30}, \mathrm{parameter\_6}, \mathrm{parameter\_7}, [\mathrm{species\_1}], [\mathrm{species\_25}], [\mathrm{species\_28}]\right) \tag{115}$$

$$\mathrm{function\_13}\left(\mathrm{parameter\_10}, \mathrm{parameter\_2}, \mathrm{parameter\_22}, \mathrm{parameter\_28}, \mathrm{parameter\_30}, \mathrm{parameter\_6}, \mathrm{parameter\_7}, [\mathrm{species\_1}], [\mathrm{species\_25}], [\mathrm{species\_28}]\right) = \mathrm{parameter\_2} \cdot \frac{\mathrm{parameter\_7}}{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}} \cdot \left([\mathrm{species\_1}] \cdot [\mathrm{species\_25}] - \frac{\mathrm{parameter\_6} \cdot \mathrm{parameter\_10} \cdot \frac{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}}{\mathrm{parameter\_7}}}{\mathrm{parameter\_22}} \cdot [\mathrm{species\_28}] \right) \tag{116}$$

$$\begin{aligned}\text{function\_13}\left(\text{parameter\_10}, \text{parameter\_2}, \text{parameter\_22}, \text{parameter\_28}, \text{parameter\_30},\right.\\ \left.\text{parameter\_6}, \text{parameter\_7}, [\text{species\_1}], [\text{species\_25}], [\text{species\_28}]\right) = \text{parameter\_2}\\ \cdot \frac{\text{parameter\_7}}{\text{parameter\_28} \cdot \text{parameter\_30}} \cdot \left([\text{species\_1}] \cdot [\text{species\_25}] \right.\\ \left. - \frac{\text{parameter\_6} \cdot \text{parameter\_10} \cdot \frac{\text{parameter\_28} \cdot \text{parameter\_30}}{\text{parameter\_7}}}{\text{parameter\_22}} \cdot [\text{species\_28}] \right)\end{aligned} \tag{117}$$

9.37 Reaction `reaction_6`

This is a reversible reaction of two reactants forming one product influenced by three modifiers.

Name L12 binding R7Bp

Reaction equation

$$\text{species\_1} + \text{species\_19} \xrightleftharpoons{\text{species\_1, species\_12, species\_19}} \text{species\_12} \tag{118}$$

Reactants

Table 111: Properties of each reactant.

Id	Name	SBO
`species_1`	L12	
`species_19`	R7Bp	

Modifiers

Table 112: Properties of each modifier.

Id	Name	SBO
`species_1`	L12	
`species_12`	C7Bp	
`species_19`	R7Bp	

Product

Table 113: Properties of each product.

Id	Name	SBO
`species_12`	C7Bp	

Id	Name	SBO

Kinetic Law

Derived unit contains undeclared units

$$v_{37} = \mathrm{vol}\,(\mathrm{compartment\_2}) \cdot \mathrm{function\_14}\,(\mathrm{parameter\_10}, \mathrm{parameter\_2}, \mathrm{parameter\_22}, \mathrm{parameter\_28}, \mathrm{parameter\_30}, \mathrm{parameter\_6}, \mathrm{parameter\_7}, [\mathrm{species\_1}], [\mathrm{species\_12}], [\mathrm{species\_19}]) \tag{119}$$

$$\mathrm{function\_14}\,(\mathrm{parameter\_10}, \mathrm{parameter\_2}, \mathrm{parameter\_22}, \mathrm{parameter\_28}, \mathrm{parameter\_30}, \mathrm{parameter\_6}, \mathrm{parameter\_7}, [\mathrm{species\_1}], [\mathrm{species\_12}], [\mathrm{species\_19}]) = \mathrm{parameter\_2} \cdot \frac{\mathrm{parameter\_7}}{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}} \cdot \left([\mathrm{species\_1}] \cdot [\mathrm{species\_19}] - \frac{\mathrm{parameter\_6} \cdot \mathrm{parameter\_10} \cdot \frac{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}}{\mathrm{parameter\_7}}}{\mathrm{parameter\_22}} \cdot [\mathrm{species\_12}] \right) \tag{120}$$

$$\mathrm{function\_14}\,(\mathrm{parameter\_10}, \mathrm{parameter\_2}, \mathrm{parameter\_22}, \mathrm{parameter\_28}, \mathrm{parameter\_30}, \mathrm{parameter\_6}, \mathrm{parameter\_7}, [\mathrm{species\_1}], [\mathrm{species\_12}], [\mathrm{species\_19}]) = \mathrm{parameter\_2} \cdot \frac{\mathrm{parameter\_7}}{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}} \cdot \left([\mathrm{species\_1}] \cdot [\mathrm{species\_19}] - \frac{\mathrm{parameter\_6} \cdot \mathrm{parameter\_10} \cdot \frac{\mathrm{parameter\_28} \cdot \mathrm{parameter\_30}}{\mathrm{parameter\_7}}}{\mathrm{parameter\_22}} \cdot [\mathrm{species\_12}] \right) \tag{121}$$

10 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.

10.1 Species species_2

Name Be

Notes Be (is) human Beta-arrestin-2. It is not labelled. Be in the model is endogenous.

Initial concentration 328437.241399281 item · dimensionless^{-1}

This species takes part in twelve reactions (as a reactant in reaction_7, reaction_9, reaction_11, reaction_13 and as a product in reaction_15, reaction_23, reaction_25, reaction_33 and as a modifier in reaction_7, reaction_9, reaction_11, reaction_13).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_2} = v_9 + v_{17} + v_{19} + v_{27} - v_1 - v_3 - v_5 - v_7 \tag{122}$$

10.2 Species species_3

Name Bp

Notes Bp is human Beta-arrestin-2 tagged with C-terminal of click beetle luciferase. Used

Initial concentration 492655.862098776 item · dimensionless^{-1}

This species takes part in twelve reactions (as a reactant in reaction_8, reaction_10, reaction_12, reaction_14 and as a product in reaction_16, reaction_24, reaction_26, reaction_34 and as a modifier in reaction_8, reaction_10, reaction_12, reaction_14).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_3} = v_{10} + v_{18} + v_{20} + v_{28} - v_2 - v_4 - v_6 - v_8 \tag{123}$$

10.3 Species species_4

Name C4

Notes Complex of:
-R4 is Complementation receptor (human) CXCR4, with N-terminus of click beetle lucif
-L12 is human CXCL12, Stromal cell-derived factor-1. This is not labelled.

Initial concentration 0 item · dimensionless^{-1}

This species takes part in six reactions (as a reactant in reaction_9, reaction_10 and as a product in reaction_1 and as a modifier in reaction_9, reaction_10, reaction_1).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_4} = v_{32} - v_3 - v_4 \tag{124}$$

10.4 Species species_5

Name C4Be

Notes Complex of:
-R4 is Complementation receptor (human) CXCR4, with N-terminus of click beetle lucif
-L12 is human CXCL12, Stromal cell-derived factor-1. This is not labelled.
-Be is human Beta-arrestin-2. It is not labelled. Be in the model is endogenous.

Initial concentration $0\,\text{item}\cdot\text{dimensionless}^{-1}$

This species takes part in six reactions (as a reactant in reaction_17 and as a product in reaction_9, reaction_3 and as a modifier in reaction_9, reaction_17, reaction_3).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_5} = v_3 + v_{34} - v_{11} \tag{125}$$

10.5 Species species_6

Name C4Beii

Notes Intracellular complex (after dissociation of endogenous Beta-arrestin-2) of:
-R4 is Complementation receptor (human) CXCR4, with N-terminus of click beetle lucif
-L12 is human CXCL12, Stromal cell-derived factor-1. This is not labelled.

Initial concentration $0\,\text{item}\cdot\text{dimensionless}^{-1}$

This species takes part in three reactions (as a reactant in reaction_35 and as a product in reaction_23 and as a modifier in reaction_35).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_6} = v_{17} - v_{29} \tag{126}$$

10.6 Species species_7

Name C4Bp

Notes Complex of:
-R4 is Complementation receptor (human) CXCR4, with N-terminus of click beetle lucif
-L12 is human CXCL12, Stromal cell-derived factor-1. This is not labelled.
-Bp is human Beta-arrestin-2 tagged with C-terminal of click beetle luciferase.

Initial concentration $0\,\text{item}\cdot\text{dimensionless}^{-1}$

This species takes part in six reactions (as a reactant in reaction_18 and as a product in reaction_10, reaction_4 and as a modifier in reaction_10, reaction_18, reaction_4).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_7} = v_4 + v_{35} - v_{12} \tag{127}$$

10.7 Species species_8

Name C4Bpi

Notes Intracellular Complex of:
-R4 is Complementation receptor (human) CXCR4, with N-terminus of click beetle lucif
-L12 is human CXCL12, Stromal cell-derived factor-1. This is not labelled.
-Bp is human Beta-arrestin-2 tagged with C-terminal of click beetle luciferase.

Initial concentration $0\,\text{item}\cdot\text{dimensionless}^{-1}$

This species takes part in three reactions (as a reactant in reaction_24 and as a product in reaction_18 and as a modifier in reaction_24).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_8} = v_{12} - v_{18} \tag{128}$$

10.8 Species species_9

Name C7

Notes Complex of:
-R7 is Complementation receptor (human) CXCR7, with N-terminus of click beetle lucif
-L12 is human CXCL12, Stromal cell-derived factor-1. This is not labelled.

Initial concentration $0\,\text{item}\cdot\text{dimensionless}^{-1}$

This species takes part in six reactions (as a reactant in reaction_13, reaction_14 and as a product in reaction_2 and as a modifier in reaction_13, reaction_14, reaction_2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_9} = v_{33} - v_{7} - v_{8} \tag{129}$$

10.9 Species species_10

Name C7Bei

Notes Intracellular Complex of:
-R7 is Complementation receptor (human) CXCR7, with N-terminus of click beetle lucif
-L12 is human CXCL12, Stromal cell-derived factor-1. This is not labelled.
-Be is human Beta-arrestin-2. It is not labelled. Be in the model is endogenous.

Initial concentration $0\,\text{item}\cdot\text{dimensionless}^{-1}$

This species takes part in three reactions (as a reactant in reaction_27 and as a product in reaction_21 and as a modifier in reaction_27).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_10} = v_{15} - v_{21} \tag{130}$$

10.10 Species species_11

Name C7Beii

Notes Intracellular Complex (after traficking to late endosomes) of:
-R7 is Complementation receptor (human) CXCR7, with N-terminus of click beetle lucif
-L12 is human CXCL12, Stromal cell-derived factor-1. This is not labelled.
-Be is human Beta-arrestin-2. It is not labelled. Be in the model is endogenous.

Initial concentration $0\,\text{item}\cdot\text{dimensionless}^{-1}$

This species takes part in three reactions (as a reactant in reaction_33 and as a product in reaction_27 and as a modifier in reaction_33).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_11} = v_{21} - v_{27} \tag{131}$$

10.11 Species species_12

Name C7Bp

Notes Complex of:
-R7 is Complementation receptor (human) CXCR7, with N-terminus of click beetle lucif
-L12 is human CXCL12, Stromal cell-derived factor-1. This is not labelled.
-Bp is human Beta-arrestin-2 tagged with C-terminal of click beetle luciferase.

Initial concentration $0\,\text{item}\cdot\text{dimensionless}^{-1}$

This species takes part in six reactions (as a reactant in reaction_22 and as a product in reaction_14, reaction_6 and as a modifier in reaction_14, reaction_22, reaction_6).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_12} = v_{8} + v_{37} - v_{16} \tag{132}$$

10.12 Species species_13

Name C7Bpi

Notes Intracellular Complex of:
-R7 is Complementation receptor (human) CXCR7, with N-terminus of click beetle lucif
-L12 is human CXCL12, Stromal cell-derived factor-1. This is not labelled.
-Bp is human Beta-arrestin-2 tagged with C-terminal of click beetle luciferase.

Initial concentration $0\,\text{item}\cdot\text{dimensionless}^{-1}$

This species takes part in three reactions (as a reactant in reaction_28 and as a product in reaction_22 and as a modifier in reaction_28).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_13} = v_{16} - v_{22} \tag{133}$$

10.13 Species species_14

Name L12i

Notes Intracellular
-L12 is human CXCL12, Stromal cell-derived factor-1. It is not labelled.

Initial concentration $0\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in six reactions (as a reactant in reaction_37 and as a product in reaction_17, reaction_18, reaction_21, reaction_22 and as a modifier in reaction_37).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_14} = v_{11} + v_{12} + v_{15} + v_{16} - v_{31} \tag{134}$$

10.14 Species species_15

Name R4

Notes Complementation receptor (human) CXCR4, with N-terminus of click beetle luciferase
-(Has Part) of human CXCR4 since it is CXCR4, and (Has Part) of click beetle lucifer

Initial concentration $133539.963932179\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in eight reactions (as a reactant in reaction_7, reaction_8, reaction_1 and as a product in reaction_29, reaction_30 and as a modifier in reaction_7, reaction_8, reaction_1).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_15} = v_{23} + v_{24} - v_{1} - v_{2} - v_{32} \tag{135}$$

10.15 Species species_16

Name R4Be

Notes Complex of:
-R4 is Complementation receptor (human) CXCR4, with N-terminus of click beetle lucif
-Be (is) human Beta-arrestin-2. It is not labelled. Be in the model is endogenous.

Initial concentration $5434.48582568463\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in six reactions (as a reactant in reaction_15, reaction_3 and as a product in reaction_7 and as a modifier in reaction_7, reaction_15, reaction_3).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_16} = v_{1} - v_{9} - v_{34} \tag{136}$$

10.16 Species species_17

Name C7Bpii

Notes Intracellular Complex (after traficking to late endosomes) of:
-R7 is Complementation receptor (human) CXCR7, with N-terminus of click beetle lucif
-L12 is human CXCL12, Stromal cell-derived factor-1. This is not labelled.
-Bp is human Beta-arrestin-2 tagged with C-terminal of click beetle luciferase.

Initial concentration $0\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in three reactions (as a reactant in reaction_34 and as a product in reaction_28 and as a modifier in reaction_34).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_17} = v_{22} - v_{28} \tag{137}$$

10.17 Species species_18

Name R7Bpii

Notes Intracellular receptor (after dissociation of Beta-arrestin-2 tagged with C-termina
-R7 is Complementation receptor (human) CXCR7, with N-terminus of click beetle lucif

Initial concentration $345117.328033337\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in three reactions (as a reactant in reaction_32 and as a product in reaction_26 and as a modifier in reaction_32).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_18} = v_{20} - v_{26} \tag{138}$$

10.18 Species species_19

Name R7Bp

Notes Complex of:
-R7 is Complementation receptor (human) CXCR7, with N-terminus of click beetle lucif
-Bp is human Beta-arrestin-2 tagged with C-terminal of click beetle luciferase.

Initial concentration $97340.7848290227\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in six reactions (as a reactant in reaction_20, reaction_6 and as a product in reaction_12 and as a modifier in reaction_12, reaction_20, reaction_6).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_19} = v_{6} - v_{14} - v_{37} \tag{139}$$

10.19 Species species_20

Name R7

Notes Complementation receptor (human) CXCR7, with N-terminus of click beetle luciferase
-(Has Part) of human CXCR7 since it is CXCR7, and (Has Part) of click beetle lucifer

Initial concentration 509483.771339917 item · dimensionless^{-1}

This species takes part in ten reactions (as a reactant in reaction_11, reaction_12, reaction_2 and as a product in reaction_31, reaction_32, reaction_33, reaction_34 and as a modifier in reaction_11, reaction_12, reaction_2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_20} = v_{25} + v_{26} + v_{27} + v_{28} - v_5 - v_6 - v_{33} \tag{140}$$

10.20 Species species_21

Name C4Bpii

Notes Intracellular Complex (after dissociation of Beta-arrestin-2 tagged with C-terminal
-R4 is Complementation receptor (human) CXCR4, with N-terminus of click beetle lucif
-L12 is human CXCL12, Stromal cell-derived factor-1. This is not labelled.

Initial concentration 0 item · dimensionless^{-1}

This species takes part in three reactions (as a reactant in reaction_36 and as a product in reaction_24 and as a modifier in reaction_36).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_21} = v_{18} - v_{30} \tag{141}$$

10.21 Species species_22

Name C4Bei

Notes Intracellular Complex of:
-R4 is Complementation receptor (human) CXCR4, with N-terminus of click beetle lucif
-L12 is human CXCL12, Stromal cell-derived factor-1. This is not labelled.
-Be is human Beta-arrestin-2. It is not labelled. Be in the model is endogenous.

Initial concentration 0 item · dimensionless^{-1}

This species takes part in three reactions (as a reactant in reaction_23 and as a product in reaction_17 and as a modifier in reaction_23).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_22} = v_{11} - v_{17} \tag{142}$$

10.22 Species species_23

Name R4Bpi

Notes Intracellular Complex of:
-R4 is Complementation receptor (human) CXCR4, with N-terminus of click beetle lucif
-Bp is human Beta-arrestin-2 tagged with C-terminal of click beetle luciferase.

Initial concentration 271724.292902136 item · dimensionless^{-1}

This species takes part in three reactions (as a reactant in reaction_30 and as a product in reaction_16 and as a modifier in reaction_30).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_23} = v_{10} - v_{24} \tag{143}$$

10.23 Species species_24

Name R4Bp

Notes Complex of:
-R4 is Complementation receptor (human) CXCR4, with N-terminus of click beetle lucif
-Bp is human Beta-arrestin-2 tagged with C-terminal of click beetle luciferase.

Initial concentration 8151.72873852455 item · dimensionless^{-1}

This species takes part in six reactions (as a reactant in reaction_16, reaction_4 and as a product in reaction_8 and as a modifier in reaction_8, reaction_16, reaction_4).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_24} = v_{2} - v_{10} - v_{35} \tag{144}$$

10.24 Species species_25

Name R7Be

Notes Complex of:
-R7 is Complementation receptor (human) CXCR7, with N-terminus of click beetle lucif
-Be is human Beta-arrestin-2. It is not labelled. Be in the model is endogenous.

Initial concentration 64893.856552701 item · dimensionless^{-1}

This species takes part in six reactions (as a reactant in reaction_19, reaction_5 and as a product in reaction_11 and as a modifier in reaction_11, reaction_19, reaction_5).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_25} = v_{5} - v_{13} - v_{36} \tag{145}$$

10.25 Species species_26

Name R7Bei

Notes Intracellular Complex of:
-R7 is Complementation receptor (human) CXCR7, with N-terminus of click beetle lucif
-Be is human Beta-arrestin-2. It is not labelled. Be in the model is endogenous.

Initial concentration 101234.416222443 item · dimensionless^{-1}

This species takes part in three reactions (as a reactant in reaction_25 and as a product in reaction_19 and as a modifier in reaction_25).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_26} = v_{13} - v_{19} \tag{146}$$

10.26 Species species_27

Name R7Beii

Notes Intracellular receptor (after dissociation of endogenous Beta-arrestin-2) of:
-R7 is Complementation receptor (human) CXCR7, with N-terminus of click beetle lucif

Initial concentration 230078.21868896 item · dimensionless^{-1}

This species takes part in three reactions (as a reactant in reaction_31 and as a product in reaction_25 and as a modifier in reaction_31).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_27} = v_{19} - v_{25} \tag{147}$$

10.27 Species species_28

Name C7Be

Notes Complex of:
-R7 is Complementation receptor (human) CXCR7, with N-terminus of click beetle lucif
-L12 is human CXCL12, Stromal cell-derived factor-1. This is not labelled.
-Be is human Beta-arrestin-2. It is not labelled. Be in the model is endogenous.

Initial concentration 0 item · dimensionless^{-1}

This species takes part in six reactions (as a reactant in reaction_21 and as a product in reaction_13, reaction_5 and as a modifier in reaction_13, reaction_21, reaction_5).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_28} = v_{7} + v_{36} - v_{15} \tag{148}$$

10.28 Species species_29

Name R4Bei

Notes Intracellular Complex of:
-R4 is Complementation receptor (human) CXCR4, with N-terminus of click beetle lucif
-Be (is) human Beta-arrestin-2. It is not labelled. Be in the model is endogenous.

Initial concentration $181149.528601477\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in three reactions (as a reactant in reaction_29 and as a product in reaction_15 and as a modifier in reaction_29).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_29} = v_9 - v_{23} \tag{149}$$

10.29 Species species_30

Name R7Bpi

Notes Intracellular Complex of:
-R7 is Complementation receptor (human) CXCR7, with N-terminus of click beetle lucif
-Bp is human Beta-arrestin-2 tagged with C-terminal of click beetle luciferase.

Initial concentration $151851.62433362\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in three reactions (as a reactant in reaction_26 and as a product in reaction_20 and as a modifier in reaction_26).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_30} = v_{14} - v_{20} \tag{150}$$

10.30 Species species_1

Name L12

Notes L12 is human CXCL12, Stromal cell-derived factor-1. It is not labelled.

Initial concentration $1.16 \cdot 10^{8}\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in twelve reactions (as a reactant in reaction_1, reaction_2, reaction_3, reaction_4, reaction_5, reaction_6 and as a modifier in reaction_1, reaction_2, reaction_3, reaction_4, reaction_5, reaction_6).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{species\_1} = -v_{32} - v_{33} - v_{34} - v_{35} - v_{36} - v_{37} \tag{151}$$

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