SBML Model Report

Model name: "Begitt2014 - STAT1 cooperative DNA binding - double GAS polymer model"

May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 4 format. This model was created by the following three authors: Nick Juty[1], Vijayalakshmi Chelliah[2] and Michelle Baker[3] at January seventh 2014 at 4:44 p. m. and last time modified at February 28th 2014 at 4:16 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	35
events	0	constraints	0
reactions	57	function definitions	57
global parameters	7	unit definitions	0
rules	1	initial assignments	0

Model Notes

Begitt2014 - STAT1 cooperative DNA binding - double GAS polymer model

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The importance of STAT1-cooperative DNA binding in type 1 and type 2 interferon signalling has been studies using experimental and modelling approaches. The authors have developed two ODE models to describe STAT1 binding to short promoter regions of DNA, namely „single GAS polymer model„ and „double GAS polymer model„ considering binding to single or double GAS sites, respectively. The length of DNA in the single GAS model was three sites and four sites in double GAS model. This model correspond to the „double GAS polymer model„.

This model is described in the article:STAT1-cooperative DNA binding distinguishes type 1 from type 2 interferon signaling.Begitt A, Droescher M, Meyer T, Schmid CD, Baker M, Antunes F, Owen MR, Naumann R, Decker T, Vinkemeier UNat Immunol. 2014 Feb;15(2):168-76.

Abstract:

STAT1 is an indispensable component of a heterotrimer (ISGF3) and a STAT1 homodimer (GAF) that function as transcription regulators in type 1 and type 2 interferon signaling, respectively. To investigate the importance of STAT1-cooperative DNA binding, we generated gene-targeted mice expressing cooperativity-deficient STAT1 with alanine substituted for Phe77. Neither ISGF3 nor GAF bound DNA cooperatively in the STAT1F77A mouse strain, but type 1 and type 2 interferon responses were affected differently. Type 2 interferon-mediated transcription and antibacterial immunity essentially disappeared owing to defective promoter recruitment of GAF. In contrast, STAT1 recruitment to ISGF3 binding sites and type 1 interferon-dependent responses, including antiviral protection, remained intact. We conclude that STAT1 cooperativity is essential for its biological activity and underlies the cellular responses to type 2, but not type 1 interferon.

This model is hosted on BioModels Database and identifiedby: BIOMD0000000501 .

To cite BioModels Database, please use: BioModels Database: An enhanced, curated and annotated resourcefor published quantitative kinetic models .

2 Unit Definitions

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

2.1 Unit `substance`

Notes Mole is the predefined SBML unit for `substance`.

Definition mol

2.2 Unit `volume`

Notes Litre is the predefined SBML unit for `volume`.

Definition l

2.3 Unit `area`

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

Definition m^2

2.4 Unit `length`

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

Definition m

2.5 Unit `time`

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

Definition s

3 Compartment

This model contains one compartment.

Table 2: Properties of all compartments.

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

3.1 Compartment `nucleus`

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

Name nucleus

4 Species

This model contains 35 species. Section 9 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
S1	S1	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA0000	DNA0000	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA0001	DNA0001	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA0010	DNA0010	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA0100	DNA0100	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1000	DNA1000	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1100	DNA1100	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1010	DNA1010	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1001	DNA1001	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA0110	DNA0110	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA0101	DNA0101	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA0011	DNA0011	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1110	DNA1110	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1011	DNA1011	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1101	DNA1101	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA0111	DNA0111	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1111	DNA1111	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA001_1	DNA001_1	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA01_10	DNA01_10	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA01_11	DNA01_11	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA011_1	DNA011_1	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA01_1_1	DNA01_1_1	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
DNA101_1	DNA101_1	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1_100	DNA1_100	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1_101	DNA1_101	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1_110	DNA1_110	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA11_10	DNA11_10	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1_1_10	DNA1_1_10	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1_111	DNA1_111	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA11_11	DNA11_11	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA111_1	DNA111_1	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1_1_11	DNA1_1_11	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1_11_1	DNA1_11_1	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA11_1_1	DNA11_1_1	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
DNA1_1_1_1	DNA1_1_1_1	nucleus	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟

5 Parameters

This model contains seven global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
Kon_P1	Kon_P1	0000341	60000.000		☑
Koff_P1	Koff_P1	0000338	100.000		☑
Kon_G1	Kon_G1	0000341	$2 \cdot 10^{10}$		☑
Koff_G1	Koff_G1	0000338	100.000		☑
Kon_NG1	Kon_NG1	0000341	$2 \cdot 10^{10}$		☑
Koff_NG1	Koff_NG1	0000338	5000.000		☑
parameter_1	DoubleGasOccupancy	0000540	0.000		☐

6 Function definitions

This is an overview of 57 function definitions.

6.1 Function definition function_4_DNA4_1

Name function_4_DNA4_1

Arguments [DNA0010], [DNA0011], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0010}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA0011}]}{\text{vol}(\text{nucleus})} \tag{1}$$

6.2 Function definition function_4_DNA5_1

Name function_4_DNA5_1

Arguments [DNA0000], [DNA0100], Koff_G1, Kon_G1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_G1} \cdot [\text{DNA0000}] \cdot [\text{S1}] - \text{Koff\_G1} \cdot [\text{DNA0100}]}{\text{vol}(\text{nucleus})} \tag{2}$$

6.3 Function definition function_4_DNA6_1

Name function_4_DNA6_1

Arguments [DNA0100], [DNA0101], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0100}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA0101}]}{\text{vol}(\text{nucleus})} \tag{3}$$

6.4 Function definition function_4_DNA23_1

Name function_4_DNA23_1

Arguments [DNA0101], [DNA1101], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0101}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1101}]}{\text{vol}(\text{nucleus})} \tag{4}$$

6.5 Function definition function_4_DNA15_1

Name function_4_DNA15_1

Arguments [DNA1000], [DNA1001], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA1000}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1001}]}{\text{vol}(\text{nucleus})} \tag{5}$$

6.6 Function definition function_4_DNA13_1

Name function_4_DNA13_1

Arguments [DNA0000], [DNA1000], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0000}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1000}]}{\text{vol}(\text{nucleus})} \tag{6}$$

6.7 Function definition function_4_DNA19_1

Name function_4_DNA19_1

Arguments [DNA1001], [DNA1011], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA1001}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1011}]}{\text{vol}(\text{nucleus})} \tag{7}$$

6.8 Function definition function_4_DNA11_1

Name function_4_DNA11_1

Arguments [DNA0101], [DNA0111], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0101}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA0111}]}{\text{vol}(\text{nucleus})} \tag{8}$$

6.9 Function definition function_4_DNA8_1

Name function_4_DNA8_1

Arguments [DNA0010], [DNA0110], Koff_G1, Kon_G1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_G1} \cdot [\text{DNA0010}] \cdot [\text{S1}] - \text{Koff\_G1} \cdot [\text{DNA0110}]}{\text{vol}(\text{nucleus})} \tag{9}$$

6.10 Function definition function_4_DNA22_1

Name function_4_DNA22_1

Arguments [DNA0100], [DNA1100], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0100}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1100}]}{\text{vol}(\text{nucleus})} \tag{10}$$

6.11 Function definition function_4_DNA10_1

Name function_4_DNA10_1

Arguments [DNA0011], [DNA0111], Koff_G1, Kon_G1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_G1} \cdot [\text{DNA0011}] \cdot [\text{S1}] - \text{Koff\_G1} \cdot [\text{DNA0111}]}{\text{vol}(\text{nucleus})} \tag{11}$$

6.12 Function definition function_4_DNA17_1

Name function_4_DNA17_1

Arguments [DNA0010], [DNA1010], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0010}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1010}]}{\text{vol}(\text{nucleus})} \tag{12}$$

6.13 Function definition function_4_DNA24_1

Name function_4_DNA24_1

Arguments [DNA1001], [DNA1101], Koff_G1, Kon_G1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_G1} \cdot [\text{DNA1001}] \cdot [\text{S1}] - \text{Koff\_G1} \cdot [\text{DNA1101}]}{\text{vol}(\text{nucleus})} \tag{13}$$

6.14 Function definition function_4_DNA18_1

Name function_4_DNA18_1

Arguments [DNA0011], [DNA1011], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0011}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1011}]}{\text{vol}(\text{nucleus})} \tag{14}$$

6.15 Function definition function_4_DNA21_1

Name function_4_DNA21_1

Arguments [DNA1000], [DNA1100], Koff_G1, Kon_G1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_G1} \cdot [\text{DNA1000}] \cdot [\text{S1}] - \text{Koff\_G1} \cdot [\text{DNA1100}]}{\text{vol}(\text{nucleus})} \tag{15}$$

6.16 Function definition function_4_DNA1_1

Name function_4_DNA1_1

Arguments [DNA0000], [DNA0001], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0000}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA0001}]}{\text{vol}(\text{nucleus})} \tag{16}$$

6.17 Function definition function_4_DNA2_1

Name function_4_DNA2_1

Arguments [DNA0000], [DNA0010], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0000}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA0010}]}{\text{vol}(\text{nucleus})} \tag{17}$$

6.18 Function definition function_4_DNA3_1

Name function_4_DNA3_1

Arguments [DNA0001], [DNA0011], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0001}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA0011}]}{\text{vol}(\text{nucleus})} \tag{18}$$

6.19 Function definition function_4_DNA26_1

Name function_4_DNA26_1

Arguments [DNA0110], [DNA1110], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0110}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1110}]}{\text{vol}(\text{nucleus})} \tag{19}$$

6.20 Function definition function_4_DNA9_1

Name function_4_DNA9_1

Arguments [DNA0100], [DNA0110], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0100}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA0110}]}{\text{vol}(\text{nucleus})} \tag{20}$$

6.21 Function definition function_4_DNA16_1

Name function_4_DNA16_1

Arguments [DNA1000], [DNA1010], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA1000}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1010}]}{\text{vol}(\text{nucleus})} \tag{21}$$

6.22 Function definition function_4_DNA20_1

Name function_4_DNA20_1

Arguments [DNA1010], [DNA1011], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA1010}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1011}]}{\text{vol}(\text{nucleus})} \tag{22}$$

6.23 Function definition function_4_DNA12_1

Name function_4_DNA12_1

Arguments [DNA0110], [DNA0111], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0110}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA0111}]}{\text{vol}(\text{nucleus})} \tag{23}$$

6.24 Function definition function_4_DNA25_1

Name function_4_DNA25_1

Arguments [DNA1100], [DNA1101], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA1100}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1101}]}{\text{vol}(\text{nucleus})} \tag{24}$$

6.25 Function definition function_4_DNA7_1

Name function_4_DNA7_1

Arguments [DNA0001], [DNA0101], Koff_G1, Kon_G1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_G1} \cdot [\text{DNA0001}] \cdot [\text{S1}] - \text{Koff\_G1} \cdot [\text{DNA0101}]}{\text{vol}(\text{nucleus})} \tag{25}$$

6.26 Function definition function_4_DNA27_1

Name function_4_DNA27_1

Arguments [DNA1010], [DNA1110], Koff_G1, Kon_G1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_G1} \cdot [\text{DNA1010}] \cdot [\text{S1}] - \text{Koff\_G1} \cdot [\text{DNA1110}]}{\text{vol}(\text{nucleus})} \tag{26}$$

6.27 Function definition function_4_DNA28_1

Name function_4_DNA28_1

Arguments [DNA1100], [DNA1110], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA1100}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1110}]}{\text{vol}(\text{nucleus})} \tag{27}$$

6.28 Function definition function_4_DNA29_1

Name function_4_DNA29_1

Arguments [DNA0111], [DNA1111], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0111}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1111}]}{\text{vol}(\text{nucleus})} \tag{28}$$

6.29 Function definition function_4_DNA30_1

Name function_4_DNA30_1

Arguments [DNA1011], [DNA1111], Koff_G1, Kon_G1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_G1} \cdot [\text{DNA1011}] \cdot [\text{S1}] - \text{Koff\_G1} \cdot [\text{DNA1111}]}{\text{vol}(\text{nucleus})} \tag{29}$$

6.30 Function definition function_4_DNA31_1

Name function_4_DNA31_1

Arguments [DNA1101], [DNA1111], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA1101}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1111}]}{\text{vol}(\text{nucleus})} \tag{30}$$

6.31 Function definition function_4_DNA32_1

Name function_4_DNA32_1

Arguments [DNA1110], [DNA1111], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA1110}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1111}]}{\text{vol}(\text{nucleus})} \tag{31}$$

6.32 Function definition function_4_DNA33_1

Name function_4_DNA33_1

Arguments [DNA0011], [DNA001_1], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA0011}] - \text{Koff\_P1} \cdot [\text{DNA001\_1}]}{\text{vol}(\text{nucleus})} \tag{32}$$

6.33 Function definition function_4_DNA34_1

Name function_4_DNA34_1

Arguments [DNA0110], [DNA01_10], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA0110}] - \text{Koff\_P1} \cdot [\text{DNA01\_10}]}{\text{vol}(\text{nucleus})} \tag{33}$$

6.34 Function definition function_4_DNA42_1

Name function_4_DNA42_1

Arguments [DNA1110], [DNA11_10], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA1110}] - \text{Koff\_P1} \cdot [\text{DNA11\_10}]}{\text{vol}(\text{nucleus})} \tag{34}$$

6.35 Function definition function_4_DNA35_1

Name function_4_DNA35_1

Arguments [DNA0111], [DNA01_11], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA0111}] - \text{Koff\_P1} \cdot [\text{DNA01\_11}]}{\text{vol}(\text{nucleus})} \tag{35}$$

6.36 Function definition function_4_DNA36_1

Name function_4_DNA36_1

Arguments [DNA0111], [DNA011_1], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA0111}] - \text{Koff\_P1} \cdot [\text{DNA011\_1}]}{\text{vol}(\text{nucleus})} \tag{36}$$

6.37 Function definition function_4_DNA37_1

Name function_4_DNA37_1

Arguments [DNA01_11], [DNA01_1_1], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA01\_11}] - \text{Koff\_P1} \cdot [\text{DNA01\_1\_1}]}{\text{vol}(\text{nucleus})} \tag{37}$$

6.38 Function definition function_4_DNA38_1

Name function_4_DNA38_1

Arguments [DNA011_1], [DNA01_1_1], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA011\_1}] - \text{Koff\_P1} \cdot [\text{DNA01\_1\_1}]}{\text{vol}(\text{nucleus})} \tag{38}$$

6.39 Function definition function_4_DNA39_1

Name function_4_DNA39_1

Arguments [DNA1100], [DNA1_100], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA1100}] - \text{Koff\_P1} \cdot [\text{DNA1\_100}]}{\text{vol}(\text{nucleus})} \tag{39}$$

6.40 Function definition function_4_DNA40_1

Name function_4_DNA40_1

Arguments [DNA1101], [DNA1_101], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA1101}] - \text{Koff\_P1} \cdot [\text{DNA1\_101}]}{\text{vol}(\text{nucleus})} \tag{40}$$

6.41 Function definition function_4_DNA41_1

Name function_4_DNA41_1

Arguments [DNA1110], [DNA1_110], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA1110}] - \text{Koff\_P1} \cdot [\text{DNA1\_110}]}{\text{vol}(\text{nucleus})} \tag{41}$$

6.42 Function definition function_4_DNA14_1

Name function_4_DNA14_1

Arguments [DNA0001], [DNA1001], Koff_NG1, Kon_NG1, [S1], vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_NG1} \cdot [\text{DNA0001}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1001}]}{\text{vol}(\text{nucleus})} \tag{42}$$

6.43 Function definition function_4_DNA50_1

Name function_4_DNA50_1

Arguments [DNA1_111], [DNA1_1_11], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA1\_111}] - \text{Koff\_P1} \cdot [\text{DNA1\_1\_11}]}{\text{vol}(\text{nucleus})} \tag{43}$$

6.44 Function definition function_4_DNA43_1

Name function_4_DNA43_1

Arguments [DNA1_110], [DNA1_1_10], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA1\_110}] - \text{Koff\_P1} \cdot [\text{DNA1\_1\_10}]}{\text{vol}(\text{nucleus})} \tag{44}$$

6.45 Function definition function_4_DNA44_1

Name function_4_DNA44_1

Arguments [DNA11_10], [DNA1_1_10], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA11\_10}] - \text{Koff\_P1} \cdot [\text{DNA1\_1\_10}]}{\text{vol}(\text{nucleus})} \tag{45}$$

6.46 Function definition function_4_DNA45_1

Name function_4_DNA45_1

Arguments [DNA1111], [DNA1_111], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA1111}] - \text{Koff\_P1} \cdot [\text{DNA1\_111}]}{\text{vol}(\text{nucleus})} \tag{46}$$

6.47 Function definition function_4_DNA46_1

Name function_4_DNA46_1

Arguments [DNA1111], [DNA11_11], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA1111}] - \text{Koff\_P1} \cdot [\text{DNA11\_11}]}{\text{vol}(\text{nucleus})} \tag{47}$$

6.48 Function definition function_4_DNA47_1

Name function_4_DNA47_1

Arguments [DNA1111], [DNA111_1], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA1111}] - \text{Koff\_P1} \cdot [\text{DNA111\_1}]}{\text{vol}(\text{nucleus})} \tag{48}$$

6.49 Function definition function_4_DNA48_1

Name function_4_DNA48_1

Arguments [DNA1_111], [DNA1_11_1], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA1\_111}] - \text{Koff\_P1} \cdot [\text{DNA1\_11\_1}]}{\text{vol}(\text{nucleus})} \tag{49}$$

6.50 Function definition function_4_DNA49_1

Name function_4_DNA49_1

Arguments [DNA111_1], [DNA1_11_1], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA111\_1}] - \text{Koff\_P1} \cdot [\text{DNA1\_11\_1}]}{\text{vol}(\text{nucleus})} \tag{50}$$

6.51 Function definition function_4_DNA52_1

Name function_4_DNA52_1

Arguments [DNA11_11], [DNA11_1_1], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA11\_11}] - \text{Koff\_P1} \cdot [\text{DNA11\_1\_1}]}{\text{vol}(\text{nucleus})} \tag{51}$$

6.52 Function definition function_4_DNA53_1

Name function_4_DNA53_1

Arguments [DNA111_1], [DNA11_1_1], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA111\_1}] - \text{Koff\_P1} \cdot [\text{DNA11\_1\_1}]}{\text{vol}(\text{nucleus})} \tag{52}$$

6.53 Function definition function_4_DNA54_1

Name function_4_DNA54_1

Arguments [DNA1_1_11], [DNA1_1_1_1], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA1\_1\_11}] - \text{Koff\_P1} \cdot [\text{DNA1\_1\_1\_1}]}{\text{vol}(\text{nucleus})} \tag{53}$$

6.54 Function definition function_4_DNA55_1

Name function_4_DNA55_1

Arguments [DNA1_11_1], [DNA1_1_1_1], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA1\_11\_1}] - \text{Koff\_P1} \cdot [\text{DNA1\_1\_1\_1}]}{\text{vol}(\text{nucleus})} \tag{54}$$

6.55 Function definition function_4_DNA56_1

Name function_4_DNA56_1

Arguments [DNA11_1_1], [DNA1_1_1_1], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA11\_1\_1}] - \text{Koff\_P1} \cdot [\text{DNA1\_1\_1\_1}]}{\text{vol}(\text{nucleus})} \tag{55}$$

6.56 Function definition function_4_DNA57

Name function_4_DNA57

Arguments [DNA1011], [DNA101_1], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA1011}] - \text{Koff\_P1} \cdot [\text{DNA101\_1}]}{\text{vol}(\text{nucleus})} \tag{56}$$

6.57 Function definition function_4_DNA51_1

Name function_4_DNA51_1

Arguments [DNA11_11], [DNA1_1_11], Koff_P1, Kon_P1, vol(nucleus)

Mathematical Expression

$$\frac{\text{Kon\_P1} \cdot [\text{DNA11\_11}] - \text{Koff\_P1} \cdot [\text{DNA1\_1\_11}]}{\text{vol}(\text{nucleus})} \tag{57}$$

7 Rule

This is an overview of one rule.

7.1 Rule parameter_1

Rule parameter_1 is an assignment rule for parameter parameter_1:

$$\begin{aligned}\text{parameter\_1} = {} & [\text{DNA0100}] + [\text{DNA1100}] + [\text{DNA0110}] + [\text{DNA0101}] + [\text{DNA1110}] \\ & + [\text{DNA1101}] + [\text{DNA0111}] + [\text{DNA1111}] + [\text{DNA1\_100}] + [\text{DNA01\_10}] \\ & + [\text{DNA1\_110}] + [\text{DNA11\_10}] + [\text{DNA1\_1\_10}] + [\text{DNA1\_101}] + [\text{DNA01\_11}] \\ & + [\text{DNA011\_1}] + [\text{DNA01\_1\_1}] + [\text{DNA1\_111}] + [\text{DNA11\_11}] + [\text{DNA111\_1}] \\ & + [\text{DNA1\_1\_11}] + [\text{DNA1\_11\_1}] + [\text{DNA11\_1\_1}] + [\text{DNA1\_1\_1\_1}]\end{aligned} \tag{58}$$

Derived unit $\text{mol} \cdot \text{l}^{-1}$

8 Reactions

This model contains 57 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	DNA1	DNA1	$\mathrm{DNA0000} + \mathrm{S1} \overset{\mathrm{DNA0000,\ DNA0001,\ S1}}{\rightleftharpoons} \mathrm{DNA0001}$	
2	DNA2	DNA2	$\mathrm{DNA0000} + \mathrm{S1} \overset{\mathrm{DNA0000,\ DNA0010,\ S1}}{\rightleftharpoons} \mathrm{DNA0010}$	
3	DNA3	DNA3	$\mathrm{DNA0001} + \mathrm{S1} \overset{\mathrm{DNA0001,\ DNA0011,\ S1}}{\rightleftharpoons} \mathrm{DNA0011}$	
4	DNA4	DNA4	$\mathrm{DNA0010} + \mathrm{S1} \overset{\mathrm{DNA0010,\ DNA0011,\ S1}}{\rightleftharpoons} \mathrm{DNA0011}$	
5	DNA5	DNA5	$\mathrm{DNA0000} + \mathrm{S1} \overset{\mathrm{DNA0000,\ DNA0100,\ S1}}{\rightleftharpoons} \mathrm{DNA0100}$	
6	DNA6	DNA6	$\mathrm{DNA0100} + \mathrm{S1} \overset{\mathrm{DNA0100,\ DNA0101,\ S1}}{\rightleftharpoons} \mathrm{DNA0101}$	
7	DNA7	DNA7	$\mathrm{DNA0001} + \mathrm{S1} \overset{\mathrm{DNA0001,\ DNA0101,\ S1}}{\rightleftharpoons} \mathrm{DNA0101}$	
8	DNA8	DNA8	$\mathrm{DNA0010} + \mathrm{S1} \overset{\mathrm{DNA0010,\ DNA0110,\ S1}}{\rightleftharpoons} \mathrm{DNA0110}$	
9	DNA9	DNA9	$\mathrm{DNA0100} + \mathrm{S1} \overset{\mathrm{DNA0100,\ DNA0110,\ S1}}{\rightleftharpoons} \mathrm{DNA0110}$	
10	DNA10	DNA10	$\mathrm{DNA0011} + \mathrm{S1} \overset{\mathrm{DNA0011,\ DNA0111,\ S1}}{\rightleftharpoons} \mathrm{DNA0111}$	
11	DNA11	DNA11	$\mathrm{DNA0101} + \mathrm{S1} \overset{\mathrm{DNA0101,\ DNA0111,\ S1}}{\rightleftharpoons} \mathrm{DNA0111}$	
12	DNA12	DNA12	$\mathrm{DNA0110} + \mathrm{S1} \overset{\mathrm{DNA0110,\ DNA0111,\ S1}}{\rightleftharpoons} \mathrm{DNA0111}$	
13	DNA13	DNA13	$\mathrm{DNA0000} + \mathrm{S1} \overset{\mathrm{DNA0000,\ DNA1000,\ S1}}{\rightleftharpoons} \mathrm{DNA1000}$	
14	DNA14	DNA14	$\mathrm{DNA0001} + \mathrm{S1} \overset{\mathrm{DNA0001,\ DNA1001,\ S1}}{\rightleftharpoons} \mathrm{DNA1001}$	
15	DNA15	DNA15	$\mathrm{DNA1000} + \mathrm{S1} \overset{\mathrm{DNA1000,\ DNA1001,\ S1}}{\rightleftharpoons} \mathrm{DNA1001}$	

№	Id	Name	Reaction Equation	SBO
16	DNA16	DNA16	$\mathrm{DNA1000} + \mathrm{S1} \overset{\mathrm{DNA1000,\ DNA1010,\ S1}}{\rightleftharpoons} \mathrm{DNA1010}$	
17	DNA17	DNA17	$\mathrm{DNA0010} + \mathrm{S1} \overset{\mathrm{DNA0010,\ DNA1010,\ S1}}{\rightleftharpoons} \mathrm{DNA1010}$	
18	DNA18	DNA18	$\mathrm{DNA0011} + \mathrm{S1} \overset{\mathrm{DNA0011,\ DNA1011,\ S1}}{\rightleftharpoons} \mathrm{DNA1011}$	
19	DNA19	DNA19	$\mathrm{DNA1001} + \mathrm{S1} \overset{\mathrm{DNA1001,\ DNA1011,\ S1}}{\rightleftharpoons} \mathrm{DNA1011}$	
20	DNA20	DNA20	$\mathrm{DNA1010} + \mathrm{S1} \overset{\mathrm{DNA1010,\ DNA1011,\ S1}}{\rightleftharpoons} \mathrm{DNA1011}$	
21	DNA21	DNA21	$\mathrm{DNA1000} + \mathrm{S1} \overset{\mathrm{DNA1000,\ DNA1100,\ S1}}{\rightleftharpoons} \mathrm{DNA1100}$	
22	DNA22	DNA22	$\mathrm{DNA0100} + \mathrm{S1} \overset{\mathrm{DNA0100,\ DNA1100,\ S1}}{\rightleftharpoons} \mathrm{DNA1100}$	
23	DNA23	DNA23	$\mathrm{DNA0101} + \mathrm{S1} \overset{\mathrm{DNA0101,\ DNA1101,\ S1}}{\rightleftharpoons} \mathrm{DNA1101}$	
24	DNA24	DNA24	$\mathrm{DNA1001} + \mathrm{S1} \overset{\mathrm{DNA1001,\ DNA1101,\ S1}}{\rightleftharpoons} \mathrm{DNA1101}$	
25	DNA25	DNA25	$\mathrm{DNA1100} + \mathrm{S1} \overset{\mathrm{DNA1100,\ DNA1101,\ S1}}{\rightleftharpoons} \mathrm{DNA1101}$	
26	DNA26	DNA26	$\mathrm{DNA0110} + \mathrm{S1} \overset{\mathrm{DNA0110,\ DNA1110,\ S1}}{\rightleftharpoons} \mathrm{DNA1110}$	
27	DNA27	DNA27	$\mathrm{DNA1010} + \mathrm{S1} \overset{\mathrm{DNA1010,\ DNA1110,\ S1}}{\rightleftharpoons} \mathrm{DNA1110}$	
28	DNA28	DNA28	$\mathrm{DNA1100} + \mathrm{S1} \overset{\mathrm{DNA1100,\ DNA1110,\ S1}}{\rightleftharpoons} \mathrm{DNA1110}$	
29	DNA29	DNA29	$\mathrm{DNA0111} + \mathrm{S1} \overset{\mathrm{DNA0111,\ DNA1111,\ S1}}{\rightleftharpoons} \mathrm{DNA1111}$	
30	DNA30	DNA30	$\mathrm{DNA1011} + \mathrm{S1} \overset{\mathrm{DNA1011,\ DNA1111,\ S1}}{\rightleftharpoons} \mathrm{DNA1111}$	
31	DNA31	DNA31	$\mathrm{DNA1101} + \mathrm{S1} \overset{\mathrm{DNA1101,\ DNA1111,\ S1}}{\rightleftharpoons} \mathrm{DNA1111}$	
32	DNA32	DNA32	$\mathrm{DNA1110} + \mathrm{S1} \overset{\mathrm{DNA1110,\ DNA1111,\ S1}}{\rightleftharpoons} \mathrm{DNA1111}$	
33	DNA33	DNA33	$\mathrm{DNA0011} \overset{\mathrm{DNA0011,\ DNA001\_1}}{\rightleftharpoons} \mathrm{DNA001\_1}$	
34	DNA34	DNA34	$\mathrm{DNA0110} \overset{\mathrm{DNA0110,\ DNA01\_10}}{\rightleftharpoons} \mathrm{DNA01\_10}$	

№	Id	Name	Reaction Equation	SBO
35	DNA35	DNA35	$\mathrm{DNA0111} \underset{\leftarrow}{\overset{\mathrm{DNA0111,\ DNA01\_11}}{\rightleftharpoons}} \mathrm{DNA01\_11}$	
36	DNA36	DNA36	$\mathrm{DNA0111} \underset{\leftarrow}{\overset{\mathrm{DNA0111,\ DNA011\_1}}{\rightleftharpoons}} \mathrm{DNA011\_1}$	
37	DNA37	DNA37	$\mathrm{DNA01\_11} \underset{\leftarrow}{\overset{\mathrm{DNA01\_11,\ DNA01\_1\_1}}{\rightleftharpoons}} \mathrm{DNA01\_1\_1}$	
38	DNA38	DNA38	$\mathrm{DNA011\_1} \underset{\leftarrow}{\overset{\mathrm{DNA011\_1,\ DNA01\_1\_1}}{\rightleftharpoons}} \mathrm{DNA01\_1\_1}$	
39	DNA39	DNA39	$\mathrm{DNA1100} \underset{\leftarrow}{\overset{\mathrm{DNA1100,\ DNA1\_100}}{\rightleftharpoons}} \mathrm{DNA1\_100}$	
40	DNA40	DNA40	$\mathrm{DNA1101} \underset{\leftarrow}{\overset{\mathrm{DNA1101,\ DNA1\_101}}{\rightleftharpoons}} \mathrm{DNA1\_101}$	
41	DNA41	DNA41	$\mathrm{DNA1110} \underset{\leftarrow}{\overset{\mathrm{DNA1110,\ DNA1\_110}}{\rightleftharpoons}} \mathrm{DNA1\_110}$	
42	DNA42	DNA42	$\mathrm{DNA1110} \underset{\leftarrow}{\overset{\mathrm{DNA1110,\ DNA11\_10}}{\rightleftharpoons}} \mathrm{DNA11\_10}$	
43	DNA43	DNA43	$\mathrm{DNA1\_110} \underset{\leftarrow}{\overset{\mathrm{DNA1\_110,\ DNA1\_1\_10}}{\rightleftharpoons}} \mathrm{DNA1\_1\_10}$	
44	DNA44	DNA44	$\mathrm{DNA11\_10} \underset{\leftarrow}{\overset{\mathrm{DNA11\_10,\ DNA1\_1\_10}}{\rightleftharpoons}} \mathrm{DNA1\_1\_10}$	
45	DNA45	DNA45	$\mathrm{DNA1111} \underset{\leftarrow}{\overset{\mathrm{DNA1111,\ DNA1\_111}}{\rightleftharpoons}} \mathrm{DNA1\_111}$	
46	DNA46	DNA46	$\mathrm{DNA1111} \underset{\leftarrow}{\overset{\mathrm{DNA1111,\ DNA11\_11}}{\rightleftharpoons}} \mathrm{DNA11\_11}$	
47	DNA47	DNA47	$\mathrm{DNA1111} \underset{\leftarrow}{\overset{\mathrm{DNA1111,\ DNA111\_1}}{\rightleftharpoons}} \mathrm{DNA111\_1}$	
48	DNA48	DNA48	$\mathrm{DNA1\_111} \underset{\leftarrow}{\overset{\mathrm{DNA1\_111,\ DNA1\_11\_1}}{\rightleftharpoons}} \mathrm{DNA1\_11\_1}$	
49	DNA49	DNA49	$\mathrm{DNA111\_1} \underset{\leftarrow}{\overset{\mathrm{DNA111\_1,\ DNA1\_11\_1}}{\rightleftharpoons}} \mathrm{DNA1\_11\_1}$	
50	DNA50	DNA50	$\mathrm{DNA1\_111} \underset{\leftarrow}{\overset{\mathrm{DNA1\_111,\ DNA1\_1\_11}}{\rightleftharpoons}} \mathrm{DNA1\_1\_11}$	
51	DNA51	DNA51	$\mathrm{DNA11\_11} \underset{\leftarrow}{\overset{\mathrm{DNA11\_11,\ DNA1\_1\_11}}{\rightleftharpoons}} \mathrm{DNA1\_1\_11}$	
52	DNA52	DNA52	$\mathrm{DNA11\_11} \underset{\leftarrow}{\overset{\mathrm{DNA11\_11,\ DNA11\_1\_1}}{\rightleftharpoons}} \mathrm{DNA11\_1\_1}$	
53	DNA53	DNA53	$\mathrm{DNA111\_1} \underset{\leftarrow}{\overset{\mathrm{DNA111\_1,\ DNA11\_1\_1}}{\rightleftharpoons}} \mathrm{DNA11\_1\_1}$	

№	Id	Name	Reaction Equation	SBO
54	DNA54	DNA54	$\mathrm{DNA1\_1\_11} \overset{\mathrm{DNA1\_1\_11,\ DNA1\_1\_1\_1}}{\rightleftharpoons} \mathrm{DNA1\_1\_1\_1}$	
55	DNA55	DNA55	$\mathrm{DNA1\_11\_1} \overset{\mathrm{DNA1\_11\_1,\ DNA1\_1\_1\_1}}{\rightleftharpoons} \mathrm{DNA1\_1\_1\_1}$	
56	DNA56	DNA56	$\mathrm{DNA11\_1\_1} \overset{\mathrm{DNA11\_1\_1,\ DNA1\_1\_1\_1}}{\rightleftharpoons} \mathrm{DNA1\_1\_1\_1}$	
57	DNA57	DNA57	$\mathrm{DNA1011} \overset{\mathrm{DNA1011,\ DNA101\_1}}{\rightleftharpoons} \mathrm{DNA101\_1}$	

8.1 Reaction DNA1

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

Name DNA1

Reaction equation

$$\mathrm{DNA0000} + \mathrm{S1} \xrightleftharpoons{\mathrm{DNA0000,\ DNA0001,\ S1}} \mathrm{DNA0001} \tag{59}$$

Reactants

Table 6: Properties of each reactant.

Id	Name	SBO
DNA0000	DNA0000	
S1	S1	

Modifiers

Table 7: Properties of each modifier.

Id	Name	SBO
DNA0000	DNA0000	
DNA0001	DNA0001	
S1	S1	

Product

Table 8: Properties of each product.

Id	Name	SBO
DNA0001	DNA0001	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA1\_1}\left(\left[\mathrm{DNA0000}\right], \left[\mathrm{DNA0001}\right], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{60}$$

$$\begin{aligned}&\text{function\_4\_DNA1\_1}\left([\text{DNA0000}], [\text{DNA0001}], \text{Koff\_NG1}, \text{Kon\_NG1}, [\text{S1}], \text{vol}\left(\text{nucleus}\right)\right)\\ &= \frac{\text{Kon\_NG1} \cdot [\text{DNA0000}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA0001}]}{\text{vol}\left(\text{nucleus}\right)}\end{aligned} \tag{61}$$

$$\begin{aligned}&\text{function\_4\_DNA1\_1}\left([\text{DNA0000}], [\text{DNA0001}], \text{Koff\_NG1}, \text{Kon\_NG1}, [\text{S1}], \text{vol}\left(\text{nucleus}\right)\right)\\ &= \frac{\text{Kon\_NG1} \cdot [\text{DNA0000}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA0001}]}{\text{vol}\left(\text{nucleus}\right)}\end{aligned} \tag{62}$$

8.2 Reaction DNA2

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

Name DNA2

Reaction equation

$$\text{DNA0000} + \text{S1} \overset{\text{DNA0000, DNA0010, S1}}{\rightleftharpoons} \text{DNA0010} \tag{63}$$

Reactants

Table 9: Properties of each reactant.

Id	Name	SBO
DNA0000	DNA0000	
S1	S1	

Modifiers

Table 10: Properties of each modifier.

Id	Name	SBO
DNA0000	DNA0000	
DNA0010	DNA0010	
S1	S1	

Product

Table 11: Properties of each product.

Id	Name	SBO
DNA0010	DNA0010	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA2\_1}\,([\mathrm{DNA0000}], [\mathrm{DNA0010}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{64}$$

$$\mathrm{function\_4\_DNA2\_1}\,([\mathrm{DNA0000}], [\mathrm{DNA0010}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0000}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA0010}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{65}$$

$$\mathrm{function\_4\_DNA2\_1}\,([\mathrm{DNA0000}], [\mathrm{DNA0010}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0000}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA0010}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{66}$$

8.3 Reaction DNA3

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

Name DNA3

Reaction equation

$$\mathrm{DNA0001} + \mathrm{S1} \xrightleftharpoons{\text{DNA0001, DNA0011, S1}} \mathrm{DNA0011} \tag{67}$$

Reactants

Table 12: Properties of each reactant.

Id	Name	SBO
DNA0001	DNA0001	
S1	S1	

Modifiers

Table 13: Properties of each modifier.

Id	Name	SBO
DNA0001	DNA0001	
DNA0011	DNA0011	
S1	S1	

Product

Table 14: Properties of each product.

Id	Name	SBO
DNA0011	DNA0011	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA3\_1}\,([\mathrm{DNA0001}], [\mathrm{DNA0011}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{68}$$

$$\mathrm{function\_4\_DNA3\_1}\,([\mathrm{DNA0001}], [\mathrm{DNA0011}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0001}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA0011}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{69}$$

$$\mathrm{function\_4\_DNA3\_1}\,([\mathrm{DNA0001}], [\mathrm{DNA0011}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0001}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA0011}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{70}$$

8.4 Reaction DNA4

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

Name DNA4

Reaction equation

$$\mathrm{DNA0010} + \mathrm{S1} \xrightleftharpoons{\mathrm{DNA0010,\ DNA0011,\ S1}} \mathrm{DNA0011} \tag{71}$$

Reactants

Table 15: Properties of each reactant.

Id	Name	SBO
DNA0010	DNA0010	
S1	S1	

Modifiers

Table 16: Properties of each modifier.

Id	Name	SBO
DNA0010	DNA0010	
DNA0011	DNA0011	
S1	S1	

Product

Table 17: Properties of each product.

Id	Name	SBO
DNA0011	DNA0011	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA4\_1}\left(\left[\mathrm{DNA0010}\right], \left[\mathrm{DNA0011}\right], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{72}$$

$$\mathrm{function\_4\_DNA4\_1}\left(\left[\mathrm{DNA0010}\right], \left[\mathrm{DNA0011}\right], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_NG1} \cdot \left[\mathrm{DNA0010}\right] \cdot \left[\mathrm{S1}\right] - \mathrm{Koff\_NG1} \cdot \left[\mathrm{DNA0011}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{73}$$

$$\mathrm{function\_4\_DNA4\_1}\left(\left[\mathrm{DNA0010}\right], \left[\mathrm{DNA0011}\right], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_NG1} \cdot \left[\mathrm{DNA0010}\right] \cdot \left[\mathrm{S1}\right] - \mathrm{Koff\_NG1} \cdot \left[\mathrm{DNA0011}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{74}$$

8.5 Reaction DNA5

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

Name DNA5

Reaction equation

$$\mathrm{DNA0000} + \mathrm{S1} \xrightleftharpoons{\text{DNA0000, DNA0100, S1}} \mathrm{DNA0100} \tag{75}$$

Reactants

Table 18: Properties of each reactant.

Id	Name	SBO
DNA0000	DNA0000	
S1	S1	

Modifiers

Table 19: Properties of each modifier.

Id	Name	SBO
DNA0000	DNA0000	
DNA0100	DNA0100	
S1	S1	

Product

Table 20: Properties of each product.

Id	Name	SBO
DNA0100	DNA0100	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA5\_1}\left(\left[\mathrm{DNA0000}\right], \left[\mathrm{DNA0100}\right], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{76}$$

$$\begin{aligned} &\mathrm{function\_4\_DNA5\_1}\left(\left[\mathrm{DNA0000}\right], \left[\mathrm{DNA0100}\right], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \\ &= \frac{\mathrm{Kon\_G1} \cdot \left[\mathrm{DNA0000}\right] \cdot \left[\mathrm{S1}\right] - \mathrm{Koff\_G1} \cdot \left[\mathrm{DNA0100}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \end{aligned} \tag{77}$$

$$\begin{aligned}&\text{function\_4\_DNA5\_1}\left([\text{DNA0000}], [\text{DNA0100}], \text{Koff\_G1}, \text{Kon\_G1}, [\text{S1}], \text{vol}\left(\text{nucleus}\right)\right)\\ &= \frac{\text{Kon\_G1} \cdot [\text{DNA0000}] \cdot [\text{S1}] - \text{Koff\_G1} \cdot [\text{DNA0100}]}{\text{vol}\left(\text{nucleus}\right)}\end{aligned} \tag{78}$$

8.6 Reaction DNA6

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

Name DNA6

Reaction equation

$$\text{DNA0100} + \text{S1} \overset{\text{DNA0100, DNA0101, S1}}{\rightleftharpoons} \text{DNA0101} \tag{79}$$

Reactants

Table 21: Properties of each reactant.

Id	Name	SBO
DNA0100	DNA0100	
S1	S1	

Modifiers

Table 22: Properties of each modifier.

Id	Name	SBO
DNA0100	DNA0100	
DNA0101	DNA0101	
S1	S1	

Product

Table 23: Properties of each product.

Id	Name	SBO
DNA0101	DNA0101	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA6\_1}\left(\left[\mathrm{DNA0100}\right], \left[\mathrm{DNA0101}\right], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{80}$$

$$\mathrm{function\_4\_DNA6\_1}\left(\left[\mathrm{DNA0100}\right], \left[\mathrm{DNA0101}\right], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_NG1} \cdot \left[\mathrm{DNA0100}\right] \cdot \left[\mathrm{S1}\right] - \mathrm{Koff\_NG1} \cdot \left[\mathrm{DNA0101}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{81}$$

$$\mathrm{function\_4\_DNA6\_1}\left(\left[\mathrm{DNA0100}\right], \left[\mathrm{DNA0101}\right], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_NG1} \cdot \left[\mathrm{DNA0100}\right] \cdot \left[\mathrm{S1}\right] - \mathrm{Koff\_NG1} \cdot \left[\mathrm{DNA0101}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{82}$$

8.7 Reaction DNA7

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

Name DNA7

Reaction equation

$$\mathrm{DNA0001} + \mathrm{S1} \underset{}{\overset{\mathrm{DNA0001,\ DNA0101,\ S1}}{\rightleftharpoons}} \mathrm{DNA0101} \tag{83}$$

Reactants

Table 24: Properties of each reactant.

Id	Name	SBO
DNA0001	DNA0001	
S1	S1	

Modifiers

Table 25: Properties of each modifier.

Id	Name	SBO
DNA0001	DNA0001	
DNA0101	DNA0101	
S1	S1	

Product

Table 26: Properties of each product.

Id	Name	SBO
DNA0101	DNA0101	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA7\_1}\,([\mathrm{DNA0001}], [\mathrm{DNA0101}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{84}$$

$$\mathrm{function\_4\_DNA7\_1}\,([\mathrm{DNA0001}], [\mathrm{DNA0101}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_G1} \cdot [\mathrm{DNA0001}] \cdot [\mathrm{S1}] - \mathrm{Koff\_G1} \cdot [\mathrm{DNA0101}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{85}$$

$$\mathrm{function\_4\_DNA7\_1}\,([\mathrm{DNA0001}], [\mathrm{DNA0101}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_G1} \cdot [\mathrm{DNA0001}] \cdot [\mathrm{S1}] - \mathrm{Koff\_G1} \cdot [\mathrm{DNA0101}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{86}$$

8.8 Reaction DNA8

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

Name DNA8

Reaction equation

$$\mathrm{DNA0010} + \mathrm{S1} \underset{\leftarrow}{\overset{\mathrm{DNA0010,\ DNA0110,\ S1}}{\rightarrow}} \mathrm{DNA0110} \tag{87}$$

Reactants

Table 27: Properties of each reactant.

Id	Name	SBO
DNA0010	DNA0010	
S1	S1	

Modifiers

Table 28: Properties of each modifier.

Id	Name	SBO
DNA0010	DNA0010	
DNA0110	DNA0110	
S1	S1	

Product

Table 29: Properties of each product.

Id	Name	SBO
DNA0110	DNA0110	

Kinetic Law

Derived unit contains undeclared units

$$v_8 = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA8\_1}\,([\mathrm{DNA0010}], [\mathrm{DNA0110}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{88}$$

$$\mathrm{function\_4\_DNA8\_1}\,([\mathrm{DNA0010}], [\mathrm{DNA0110}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_G1} \cdot [\mathrm{DNA0010}] \cdot [\mathrm{S1}] - \mathrm{Koff\_G1} \cdot [\mathrm{DNA0110}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{89}$$

$$\mathrm{function\_4\_DNA8\_1}\,([\mathrm{DNA0010}], [\mathrm{DNA0110}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_G1} \cdot [\mathrm{DNA0010}] \cdot [\mathrm{S1}] - \mathrm{Koff\_G1} \cdot [\mathrm{DNA0110}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{90}$$

8.9 Reaction DNA9

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

Name DNA9

Reaction equation

$$\mathrm{DNA0100} + \mathrm{S1} \xrightleftharpoons{\mathrm{DNA0100,\ DNA0110,\ S1}} \mathrm{DNA0110} \tag{91}$$

Reactants

Table 30: Properties of each reactant.

Id	Name	SBO
DNA0100	DNA0100	
S1	S1	

Modifiers

Table 31: Properties of each modifier.

Id	Name	SBO
DNA0100	DNA0100	
DNA0110	DNA0110	
S1	S1	

Product

Table 32: Properties of each product.

Id	Name	SBO
DNA0110	DNA0110	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA9\_1}\,([\mathrm{DNA0100}], [\mathrm{DNA0110}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{92}$$

$$\mathrm{function\_4\_DNA9\_1}\,([\mathrm{DNA0100}], [\mathrm{DNA0110}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0100}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA0110}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{93}$$

$$\mathrm{function\_4\_DNA9\_1}\,([\mathrm{DNA0100}], [\mathrm{DNA0110}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0100}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA0110}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{94}$$

8.10 Reaction DNA10

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

Name DNA10

Reaction equation

$$\mathrm{DNA0011} + \mathrm{S1} \xrightleftharpoons{\mathrm{DNA0011,\ DNA0111,\ S1}} \mathrm{DNA0111} \tag{95}$$

Reactants

Table 33: Properties of each reactant.

Id	Name	SBO
DNA0011	DNA0011	
S1	S1	

Modifiers

Table 34: Properties of each modifier.

Id	Name	SBO
DNA0011	DNA0011	
DNA0111	DNA0111	
S1	S1	

Product

Table 35: Properties of each product.

Id	Name	SBO
DNA0111	DNA0111	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA10\_1}\left(\left[\mathrm{DNA0011}\right], \left[\mathrm{DNA0111}\right], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{96}$$

$$\begin{aligned} &\mathrm{function\_4\_DNA10\_1}\left(\left[\mathrm{DNA0011}\right], \left[\mathrm{DNA0111}\right], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \\ &= \frac{\mathrm{Kon\_G1} \cdot \left[\mathrm{DNA0011}\right] \cdot \left[\mathrm{S1}\right] - \mathrm{Koff\_G1} \cdot \left[\mathrm{DNA0111}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \end{aligned} \tag{97}$$

$$\begin{aligned}&\text{function\_4\_DNA10\_1}\left([\text{DNA0011}],[\text{DNA0111}],\text{Koff\_G1},\text{Kon\_G1},[\text{S1}],\text{vol}\left(\text{nucleus}\right)\right)\\&=\frac{\text{Kon\_G1}\cdot[\text{DNA0011}]\cdot[\text{S1}]-\text{Koff\_G1}\cdot[\text{DNA0111}]}{\text{vol}\left(\text{nucleus}\right)}\end{aligned}\tag{98}$$

8.11 Reaction DNA11

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

Name DNA11

Reaction equation

$$\text{DNA0101}+\text{S1}\overset{\text{DNA0101, DNA0111, S1}}{\rightleftharpoons}\text{DNA0111}\tag{99}$$

Reactants

Table 36: Properties of each reactant.

Id	Name	SBO
DNA0101	DNA0101	
S1	S1	

Modifiers

Table 37: Properties of each modifier.

Id	Name	SBO
DNA0101	DNA0101	
DNA0111	DNA0111	
S1	S1	

Product

Table 38: Properties of each product.

Id	Name	SBO
DNA0111	DNA0111	

Kinetic Law

Derived unit contains undeclared units

$$v_{11} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA11\_1}\,([\mathrm{DNA0101}], [\mathrm{DNA0111}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{100}$$

$$\mathrm{function\_4\_DNA11\_1}\,([\mathrm{DNA0101}], [\mathrm{DNA0111}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0101}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA0111}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{101}$$

$$\mathrm{function\_4\_DNA11\_1}\,([\mathrm{DNA0101}], [\mathrm{DNA0111}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0101}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA0111}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{102}$$

8.12 Reaction DNA12

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

Name DNA12

Reaction equation

$$\mathrm{DNA0110} + \mathrm{S1} \underset{}{\overset{\mathrm{DNA0110,\ DNA0111,\ S1}}{\rightleftharpoons}} \mathrm{DNA0111} \tag{103}$$

Reactants

Table 39: Properties of each reactant.

Id	Name	SBO
DNA0110	DNA0110	
S1	S1	

Modifiers

Table 40: Properties of each modifier.

Id	Name	SBO
DNA0110	DNA0110	
DNA0111	DNA0111	
S1	S1	

Product

Table 41: Properties of each product.

Id	Name	SBO
DNA0111	DNA0111	

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA12\_1}\,([\mathrm{DNA0110}], [\mathrm{DNA0111}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{104}$$

$$\mathrm{function\_4\_DNA12\_1}\,([\mathrm{DNA0110}], [\mathrm{DNA0111}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0110}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA0111}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{105}$$

$$\mathrm{function\_4\_DNA12\_1}\,([\mathrm{DNA0110}], [\mathrm{DNA0111}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0110}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA0111}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{106}$$

8.13 Reaction DNA13

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

Name DNA13

Reaction equation

$$\mathrm{DNA0000} + \mathrm{S1} \underset{}{\overset{\mathrm{DNA0000,\ DNA1000,\ S1}}{\rightleftharpoons}} \mathrm{DNA1000} \tag{107}$$

Reactants

Table 42: Properties of each reactant.

Id	Name	SBO
DNA0000	DNA0000	
S1	S1	

Modifiers

Table 43: Properties of each modifier.

Id	Name	SBO
DNA0000	DNA0000	
DNA1000	DNA1000	
S1	S1	

Product

Table 44: Properties of each product.

Id	Name	SBO
DNA1000	DNA1000	

Kinetic Law

Derived unit contains undeclared units

$$v_{13} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA13\_1}\,([\mathrm{DNA0000}], [\mathrm{DNA1000}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{108}$$

$$\mathrm{function\_4\_DNA13\_1}\,([\mathrm{DNA0000}], [\mathrm{DNA1000}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0000}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1000}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{109}$$

$$\mathrm{function\_4\_DNA13\_1}\,([\mathrm{DNA0000}], [\mathrm{DNA1000}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0000}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1000}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{110}$$

8.14 Reaction DNA14

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

Name DNA14

Reaction equation

$$\mathrm{DNA0001} + \mathrm{S1} \xrightleftharpoons{\mathrm{DNA0001,\ DNA1001,\ S1}} \mathrm{DNA1001} \tag{111}$$

Reactants

Table 45: Properties of each reactant.

Id	Name	SBO
DNA0001	DNA0001	
S1	S1	

Modifiers

Table 46: Properties of each modifier.

Id	Name	SBO
DNA0001	DNA0001	
DNA1001	DNA1001	
S1	S1	

Product

Table 47: Properties of each product.

Id	Name	SBO
DNA1001	DNA1001	

Kinetic Law

Derived unit contains undeclared units

$$v_{14} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA14\_1}\,([\mathrm{DNA0001}], [\mathrm{DNA1001}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{112}$$

$$\mathrm{function\_4\_DNA14\_1}\,([\mathrm{DNA0001}], [\mathrm{DNA1001}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0001}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1001}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{113}$$

$$\mathrm{function\_4\_DNA14\_1}\,([\mathrm{DNA0001}], [\mathrm{DNA1001}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0001}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1001}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{114}$$

8.15 Reaction DNA15

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

Name DNA15

Reaction equation

$$\mathrm{DNA1000} + \mathrm{S1} \xrightleftharpoons{\text{DNA1000, DNA1001, S1}} \mathrm{DNA1001} \tag{115}$$

Reactants

Table 48: Properties of each reactant.

Id	Name	SBO
DNA1000	DNA1000	
S1	S1	

Modifiers

Table 49: Properties of each modifier.

Id	Name	SBO
DNA1000	DNA1000	
DNA1001	DNA1001	
S1	S1	

Product

Table 50: Properties of each product.

Id	Name	SBO
DNA1001	DNA1001	

Kinetic Law

Derived unit contains undeclared units

$$v_{15} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA15\_1}\left(\left[\mathrm{DNA1000}\right], \left[\mathrm{DNA1001}\right], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{116}$$

$$\mathrm{function\_4\_DNA15\_1}\left(\left[\mathrm{DNA1000}\right], \left[\mathrm{DNA1001}\right], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_NG1} \cdot \left[\mathrm{DNA1000}\right] \cdot \left[\mathrm{S1}\right] - \mathrm{Koff\_NG1} \cdot \left[\mathrm{DNA1001}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{117}$$

$$\begin{aligned}\text{function\_4\_DNA15\_1}\left([\text{DNA1000}], [\text{DNA1001}], \text{Koff\_NG1}, \text{Kon\_NG1}, [\text{S1}],\right.\\ \left.\text{vol}\left(\text{nucleus}\right)\right) = \frac{\text{Kon\_NG1} \cdot [\text{DNA1000}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1001}]}{\text{vol}\left(\text{nucleus}\right)}\end{aligned} \tag{118}$$

8.16 Reaction DNA16

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

Name DNA16

Reaction equation

$$\text{DNA1000} + \text{S1} \underset{}{\overset{\text{DNA1000, DNA1010, S1}}{\rightleftharpoons}} \text{DNA1010} \tag{119}$$

Reactants

Table 51: Properties of each reactant.

Id	Name	SBO
DNA1000	DNA1000	
S1	S1	

Modifiers

Table 52: Properties of each modifier.

Id	Name	SBO
DNA1000	DNA1000	
DNA1010	DNA1010	
S1	S1	

Product

Table 53: Properties of each product.

Id	Name	SBO
DNA1010	DNA1010	

Kinetic Law

Derived unit contains undeclared units

$$v_{16} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA16\_1}\,([\mathrm{DNA1000}], [\mathrm{DNA1010}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{120}$$

$$\mathrm{function\_4\_DNA16\_1}\,([\mathrm{DNA1000}], [\mathrm{DNA1010}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA1000}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1010}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{121}$$

$$\mathrm{function\_4\_DNA16\_1}\,([\mathrm{DNA1000}], [\mathrm{DNA1010}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA1000}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1010}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{122}$$

8.17 Reaction DNA17

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

Name DNA17

Reaction equation

$$\mathrm{DNA0010} + \mathrm{S1} \underset{}{\overset{\text{DNA0010, DNA1010, S1}}{\rightleftharpoons}} \mathrm{DNA1010} \tag{123}$$

Reactants

Table 54: Properties of each reactant.

Id	Name	SBO
DNA0010	DNA0010	
S1	S1	

Modifiers

Table 55: Properties of each modifier.

Id	Name	SBO
DNA0010	DNA0010	
DNA1010	DNA1010	
S1	S1	

Product

Table 56: Properties of each product.

Id	Name	SBO
DNA1010	DNA1010	

Kinetic Law

Derived unit contains undeclared units

$$v_{17} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA17\_1}\,([\mathrm{DNA0010}], [\mathrm{DNA1010}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{124}$$

$$\mathrm{function\_4\_DNA17\_1}\,([\mathrm{DNA0010}], [\mathrm{DNA1010}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0010}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1010}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{125}$$

$$\mathrm{function\_4\_DNA17\_1}\,([\mathrm{DNA0010}], [\mathrm{DNA1010}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0010}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1010}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{126}$$

8.18 Reaction DNA18

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

Name DNA18

Reaction equation

$$\mathrm{DNA0011} + \mathrm{S1} \underset{}{\overset{\mathrm{DNA0011,\ DNA1011,\ S1}}{\rightleftharpoons}} \mathrm{DNA1011} \tag{127}$$

Reactants

Table 57: Properties of each reactant.

Id	Name	SBO
DNA0011	DNA0011	
S1	S1	

Modifiers

Table 58: Properties of each modifier.

Id	Name	SBO
DNA0011	DNA0011	
DNA1011	DNA1011	
S1	S1	

Product

Table 59: Properties of each product.

Id	Name	SBO
DNA1011	DNA1011	

Kinetic Law

Derived unit contains undeclared units

$$v_{18} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA18\_1}\,([\mathrm{DNA0011}], [\mathrm{DNA1011}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{128}$$

$$\mathrm{function\_4\_DNA18\_1}\,([\mathrm{DNA0011}], [\mathrm{DNA1011}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0011}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1011}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{129}$$

$$\mathrm{function\_4\_DNA18\_1}\,([\mathrm{DNA0011}], [\mathrm{DNA1011}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0011}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1011}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{130}$$

8.19 Reaction DNA19

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

Name DNA19

Reaction equation

$$\mathrm{DNA1001} + \mathrm{S1} \xrightleftharpoons{\mathrm{DNA1001,\ DNA1011,\ S1}} \mathrm{DNA1011} \tag{131}$$

Reactants

Table 60: Properties of each reactant.

Id	Name	SBO
DNA1001	DNA1001	
S1	S1	

Modifiers

Table 61: Properties of each modifier.

Id	Name	SBO
DNA1001	DNA1001	
DNA1011	DNA1011	
S1	S1	

Product

Table 62: Properties of each product.

Id	Name	SBO
DNA1011	DNA1011	

Kinetic Law

Derived unit contains undeclared units

$$v_{19} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA19\_1}\,([\mathrm{DNA1001}], [\mathrm{DNA1011}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{132}$$

$$\mathrm{function\_4\_DNA19\_1}\,([\mathrm{DNA1001}], [\mathrm{DNA1011}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA1001}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1011}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{133}$$

$$\mathrm{function\_4\_DNA19\_1}\,([\mathrm{DNA1001}], [\mathrm{DNA1011}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA1001}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1011}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{134}$$

8.20 Reaction DNA20

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

Name DNA20

Reaction equation

$$\mathrm{DNA1010} + \mathrm{S1} \xrightleftharpoons{\text{DNA1010, DNA1011, S1}} \mathrm{DNA1011} \tag{135}$$

Reactants

Table 63: Properties of each reactant.

Id	Name	SBO
DNA1010	DNA1010	
S1	S1	

Modifiers

Table 64: Properties of each modifier.

Id	Name	SBO
DNA1010	DNA1010	
DNA1011	DNA1011	
S1	S1	

Product

Table 65: Properties of each product.

Id	Name	SBO
DNA1011	DNA1011	

Kinetic Law

Derived unit contains undeclared units

$$v_{20} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA20\_1}\left(\left[\mathrm{DNA1010}\right], \left[\mathrm{DNA1011}\right], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{136}$$

$$\mathrm{function\_4\_DNA20\_1}\left(\left[\mathrm{DNA1010}\right], \left[\mathrm{DNA1011}\right], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_NG1} \cdot \left[\mathrm{DNA1010}\right] \cdot \left[\mathrm{S1}\right] - \mathrm{Koff\_NG1} \cdot \left[\mathrm{DNA1011}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{137}$$

$$\begin{aligned}\text{function\_4\_DNA20\_1}\left([\text{DNA1010}],[\text{DNA1011}],\text{Koff\_NG1},\text{Kon\_NG1},[\text{S1}],\right.\\ \left.\text{vol}\left(\text{nucleus}\right)\right) = \frac{\text{Kon\_NG1}\cdot[\text{DNA1010}]\cdot[\text{S1}]-\text{Koff\_NG1}\cdot[\text{DNA1011}]}{\text{vol}\left(\text{nucleus}\right)}\end{aligned} \tag{138}$$

8.21 Reaction DNA21

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

Name DNA21

Reaction equation

$$\text{DNA1000} + \text{S1} \underset{}{\overset{\text{DNA1000, DNA1100, S1}}{\rightleftharpoons}} \text{DNA1100} \tag{139}$$

Reactants

Table 66: Properties of each reactant.

Id	Name	SBO
DNA1000	DNA1000	
S1	S1	

Modifiers

Table 67: Properties of each modifier.

Id	Name	SBO
DNA1000	DNA1000	
DNA1100	DNA1100	
S1	S1	

Product

Table 68: Properties of each product.

Id	Name	SBO
DNA1100	DNA1100	

Kinetic Law

Derived unit contains undeclared units

$$v_{21} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA21\_1}\,([\mathrm{DNA1000}], [\mathrm{DNA1100}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{140}$$

$$\mathrm{function\_4\_DNA21\_1}\,([\mathrm{DNA1000}], [\mathrm{DNA1100}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_G1} \cdot [\mathrm{DNA1000}] \cdot [\mathrm{S1}] - \mathrm{Koff\_G1} \cdot [\mathrm{DNA1100}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{141}$$

$$\mathrm{function\_4\_DNA21\_1}\,([\mathrm{DNA1000}], [\mathrm{DNA1100}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_G1} \cdot [\mathrm{DNA1000}] \cdot [\mathrm{S1}] - \mathrm{Koff\_G1} \cdot [\mathrm{DNA1100}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{142}$$

8.22 Reaction DNA22

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

Name DNA22

Reaction equation

$$\mathrm{DNA0100} + \mathrm{S1} \underset{}{\overset{\text{DNA0100, DNA1100, S1}}{\rightleftharpoons}} \mathrm{DNA1100} \tag{143}$$

Reactants

Table 69: Properties of each reactant.

Id	Name	SBO
DNA0100	DNA0100	
S1	S1	

Modifiers

Table 70: Properties of each modifier.

Id	Name	SBO
DNA0100	DNA0100	
DNA1100	DNA1100	
S1	S1	

Product

Table 71: Properties of each product.

Id	Name	SBO
DNA1100	DNA1100	

Kinetic Law

Derived unit contains undeclared units

$$v_{22} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA22\_1}\,([\mathrm{DNA0100}], [\mathrm{DNA1100}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{144}$$

$$\mathrm{function\_4\_DNA22\_1}\,([\mathrm{DNA0100}], [\mathrm{DNA1100}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0100}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1100}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{145}$$

$$\mathrm{function\_4\_DNA22\_1}\,([\mathrm{DNA0100}], [\mathrm{DNA1100}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0100}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1100}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{146}$$

8.23 Reaction DNA23

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

Name DNA23

Reaction equation

$$\mathrm{DNA0101} + \mathrm{S1} \underset{\longleftarrow}{\overset{\mathrm{DNA0101,\ DNA1101,\ S1}}{\longrightarrow}} \mathrm{DNA1101} \tag{147}$$

Reactants

Table 72: Properties of each reactant.

Id	Name	SBO
DNA0101	DNA0101	
S1	S1	

Modifiers

Table 73: Properties of each modifier.

Id	Name	SBO
DNA0101	DNA0101	
DNA1101	DNA1101	
S1	S1	

Product

Table 74: Properties of each product.

Id	Name	SBO
DNA1101	DNA1101	

Kinetic Law

Derived unit contains undeclared units

$$v_{23} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA23\_1}\,([\mathrm{DNA0101}], [\mathrm{DNA1101}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{148}$$

$$\mathrm{function\_4\_DNA23\_1}\,([\mathrm{DNA0101}], [\mathrm{DNA1101}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0101}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1101}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{149}$$

$$\mathrm{function\_4\_DNA23\_1}\,([\mathrm{DNA0101}], [\mathrm{DNA1101}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0101}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1101}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{150}$$

8.24 Reaction DNA24

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

Name DNA24

Reaction equation

$$\mathrm{DNA1001} + \mathrm{S1} \xrightleftharpoons{\mathrm{DNA1001,\ DNA1101,\ S1}} \mathrm{DNA1101} \tag{151}$$

Reactants

Table 75: Properties of each reactant.

Id	Name	SBO
DNA1001	DNA1001	
S1	S1	

Modifiers

Table 76: Properties of each modifier.

Id	Name	SBO
DNA1001	DNA1001	
DNA1101	DNA1101	
S1	S1	

Product

Table 77: Properties of each product.

Id	Name	SBO
DNA1101	DNA1101	

Kinetic Law

Derived unit contains undeclared units

$$v_{24} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA24\_1}\,([\mathrm{DNA1001}], [\mathrm{DNA1101}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{152}$$

$$\mathrm{function\_4\_DNA24\_1}\,([\mathrm{DNA1001}], [\mathrm{DNA1101}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_G1} \cdot [\mathrm{DNA1001}] \cdot [\mathrm{S1}] - \mathrm{Koff\_G1} \cdot [\mathrm{DNA1101}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{153}$$

$$\mathrm{function\_4\_DNA24\_1}\,([\mathrm{DNA1001}], [\mathrm{DNA1101}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_G1} \cdot [\mathrm{DNA1001}] \cdot [\mathrm{S1}] - \mathrm{Koff\_G1} \cdot [\mathrm{DNA1101}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{154}$$

8.25 Reaction DNA25

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

Name DNA25

Reaction equation

$$\mathrm{DNA1100} + \mathrm{S1} \xrightleftharpoons{\mathrm{DNA1100,\ DNA1101,\ S1}} \mathrm{DNA1101} \tag{155}$$

Reactants

Table 78: Properties of each reactant.

Id	Name	SBO
DNA1100	DNA1100	
S1	S1	

Modifiers

Table 79: Properties of each modifier.

Id	Name	SBO
DNA1100	DNA1100	
DNA1101	DNA1101	
S1	S1	

Product

Table 80: Properties of each product.

Id	Name	SBO
DNA1101	DNA1101	

Kinetic Law

Derived unit contains undeclared units

$$v_{25} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA25\_1}\left(\left[\mathrm{DNA1100}\right], \left[\mathrm{DNA1101}\right], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{156}$$

$$\mathrm{function\_4\_DNA25\_1}\left(\left[\mathrm{DNA1100}\right], \left[\mathrm{DNA1101}\right], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_NG1} \cdot \left[\mathrm{DNA1100}\right] \cdot \left[\mathrm{S1}\right] - \mathrm{Koff\_NG1} \cdot \left[\mathrm{DNA1101}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{157}$$

$$\begin{aligned}&\text{function\_4\_DNA25\_1}\left([\text{DNA1100}],[\text{DNA1101}],\text{Koff\_NG1},\text{Kon\_NG1},[\text{S1}],\right.\\&\left.\text{vol}\left(\text{nucleus}\right)\right)=\frac{\text{Kon\_NG1}\cdot[\text{DNA1100}]\cdot[\text{S1}]-\text{Koff\_NG1}\cdot[\text{DNA1101}]}{\text{vol}\left(\text{nucleus}\right)}\end{aligned}\tag{158}$$

8.26 Reaction DNA26

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

Name DNA26

Reaction equation

$$\text{DNA0110}+\text{S1}\overset{\text{DNA0110, DNA1110, S1}}{\rightleftharpoons}\text{DNA1110}\tag{159}$$

Reactants

Table 81: Properties of each reactant.

Id	Name	SBO
DNA0110	DNA0110	
S1	S1	

Modifiers

Table 82: Properties of each modifier.

Id	Name	SBO
DNA0110	DNA0110	
DNA1110	DNA1110	
S1	S1	

Product

Table 83: Properties of each product.

Id	Name	SBO
DNA1110	DNA1110	

Kinetic Law

Derived unit contains undeclared units

$$v_{26} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA26\_1}\,([\mathrm{DNA0110}], [\mathrm{DNA1110}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{160}$$

$$\mathrm{function\_4\_DNA26\_1}\,([\mathrm{DNA0110}], [\mathrm{DNA1110}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0110}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1110}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{161}$$

$$\mathrm{function\_4\_DNA26\_1}\,([\mathrm{DNA0110}], [\mathrm{DNA1110}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA0110}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1110}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{162}$$

8.27 Reaction DNA27

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

Name DNA27

Reaction equation

$$\mathrm{DNA1010} + \mathrm{S1} \underset{}{\overset{\mathrm{DNA1010,\ DNA1110,\ S1}}{\rightleftharpoons}} \mathrm{DNA1110} \tag{163}$$

Reactants

Table 84: Properties of each reactant.

Id	Name	SBO
DNA1010	DNA1010	
S1	S1	

Modifiers

Table 85: Properties of each modifier.

Id	Name	SBO
DNA1010	DNA1010	
DNA1110	DNA1110	
S1	S1	

Product

Table 86: Properties of each product.

Id	Name	SBO
DNA1110	DNA1110	

Kinetic Law

Derived unit contains undeclared units

$$v_{27} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA27\_1}\,([\mathrm{DNA1010}], [\mathrm{DNA1110}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{164}$$

$$\mathrm{function\_4\_DNA27\_1}\,([\mathrm{DNA1010}], [\mathrm{DNA1110}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_G1} \cdot [\mathrm{DNA1010}] \cdot [\mathrm{S1}] - \mathrm{Koff\_G1} \cdot [\mathrm{DNA1110}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{165}$$

$$\mathrm{function\_4\_DNA27\_1}\,([\mathrm{DNA1010}], [\mathrm{DNA1110}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_G1} \cdot [\mathrm{DNA1010}] \cdot [\mathrm{S1}] - \mathrm{Koff\_G1} \cdot [\mathrm{DNA1110}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{166}$$

8.28 Reaction DNA28

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

Name DNA28

Reaction equation

$$\mathrm{DNA1100} + \mathrm{S1} \xrightleftharpoons{\text{DNA1100, DNA1110, S1}} \mathrm{DNA1110} \tag{167}$$

Reactants

Table 87: Properties of each reactant.

Id	Name	SBO
DNA1100	DNA1100	
S1	S1	

Modifiers

Table 88: Properties of each modifier.

Id	Name	SBO
DNA1100	DNA1100	
DNA1110	DNA1110	
S1	S1	

Product

Table 89: Properties of each product.

Id	Name	SBO
DNA1110	DNA1110	

Kinetic Law

Derived unit contains undeclared units

$$v_{28} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA28\_1}\,([\mathrm{DNA1100}], [\mathrm{DNA1110}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{168}$$

$$\mathrm{function\_4\_DNA28\_1}\,([\mathrm{DNA1100}], [\mathrm{DNA1110}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA1100}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1110}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{169}$$

$$\mathrm{function\_4\_DNA28\_1}\,([\mathrm{DNA1100}], [\mathrm{DNA1110}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA1100}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1110}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{170}$$

8.29 Reaction DNA29

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

Name DNA29

Reaction equation

$$\mathrm{DNA0111} + \mathrm{S1} \xrightleftharpoons{\mathrm{DNA0111,\ DNA1111,\ S1}} \mathrm{DNA1111} \tag{171}$$

Reactants

Table 90: Properties of each reactant.

Id	Name	SBO
DNA0111	DNA0111	
S1	S1	

Modifiers

Table 91: Properties of each modifier.

Id	Name	SBO
DNA0111	DNA0111	
DNA1111	DNA1111	
S1	S1	

Product

Table 92: Properties of each product.

Id	Name	SBO
DNA1111	DNA1111	

Kinetic Law

Derived unit contains undeclared units

$$v_{29} = \text{vol}\,(\text{nucleus}) \cdot \text{function\_4\_DNA29\_1}\,([\text{DNA0111}], [\text{DNA1111}], \text{Koff\_NG1}, \text{Kon\_NG1}, [\text{S1}], \text{vol}\,(\text{nucleus})) \tag{172}$$

$$\text{function\_4\_DNA29\_1}\,([\text{DNA0111}], [\text{DNA1111}], \text{Koff\_NG1}, \text{Kon\_NG1}, [\text{S1}], \text{vol}\,(\text{nucleus})) = \frac{\text{Kon\_NG1} \cdot [\text{DNA0111}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1111}]}{\text{vol}\,(\text{nucleus})} \tag{173}$$

$$\text{function\_4\_DNA29\_1}\,([\text{DNA0111}], [\text{DNA1111}], \text{Koff\_NG1}, \text{Kon\_NG1}, [\text{S1}], \text{vol}\,(\text{nucleus})) = \frac{\text{Kon\_NG1} \cdot [\text{DNA0111}] \cdot [\text{S1}] - \text{Koff\_NG1} \cdot [\text{DNA1111}]}{\text{vol}\,(\text{nucleus})} \tag{174}$$

8.30 Reaction DNA30

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

Name DNA30

Reaction equation

$$\mathrm{DNA1011} + \mathrm{S1} \xrightleftharpoons{\mathrm{DNA1011,\ DNA1111,\ S1}} \mathrm{DNA1111} \tag{175}$$

Reactants

Table 93: Properties of each reactant.

Id	Name	SBO
DNA1011	DNA1011	
S1	S1	

Modifiers

Table 94: Properties of each modifier.

Id	Name	SBO
DNA1011	DNA1011	
DNA1111	DNA1111	
S1	S1	

Product

Table 95: Properties of each product.

Id	Name	SBO
DNA1111	DNA1111	

Kinetic Law

Derived unit contains undeclared units

$$v_{30} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA30\_1}\left(\left[\mathrm{DNA1011}\right], \left[\mathrm{DNA1111}\right], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{176}$$

$$\begin{aligned} &\mathrm{function\_4\_DNA30\_1}\left(\left[\mathrm{DNA1011}\right], \left[\mathrm{DNA1111}\right], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, \left[\mathrm{S1}\right], \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \\ &= \frac{\mathrm{Kon\_G1} \cdot \left[\mathrm{DNA1011}\right] \cdot \left[\mathrm{S1}\right] - \mathrm{Koff\_G1} \cdot \left[\mathrm{DNA1111}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \end{aligned} \tag{177}$$

$$\begin{aligned}&\text{function\_4\_DNA30\_1}\left([\text{DNA1011}],[\text{DNA1111}],\text{Koff\_G1},\text{Kon\_G1},[\text{S1}],\text{vol}\left(\text{nucleus}\right)\right)\\&=\frac{\text{Kon\_G1}\cdot[\text{DNA1011}]\cdot[\text{S1}]-\text{Koff\_G1}\cdot[\text{DNA1111}]}{\text{vol}\left(\text{nucleus}\right)}\end{aligned}\tag{178}$$

8.31 Reaction DNA31

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

Name DNA31

Reaction equation

$$\text{DNA1101}+\text{S1}\overset{\text{DNA1101, DNA1111, S1}}{\rightleftharpoons}\text{DNA1111}\tag{179}$$

Reactants

Table 96: Properties of each reactant.

Id	Name	SBO
DNA1101	DNA1101	
S1	S1	

Modifiers

Table 97: Properties of each modifier.

Id	Name	SBO
DNA1101	DNA1101	
DNA1111	DNA1111	
S1	S1	

Product

Table 98: Properties of each product.

Id	Name	SBO
DNA1111	DNA1111	

Kinetic Law

Derived unit contains undeclared units

$$v_{31} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA31\_1}\,([\mathrm{DNA1101}], [\mathrm{DNA1111}], \mathrm{Koff\_G1}, \mathrm{Kon\_G1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{180}$$

$$\mathrm{function\_4\_DNA31\_1}\,([\mathrm{DNA1101}], [\mathrm{DNA1111}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA1101}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1111}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{181}$$

$$\mathrm{function\_4\_DNA31\_1}\,([\mathrm{DNA1101}], [\mathrm{DNA1111}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA1101}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1111}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{182}$$

8.32 Reaction DNA32

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

Name DNA32

Reaction equation

$$\mathrm{DNA1110} + \mathrm{S1} \underset{}{\overset{\mathrm{DNA1110,\ DNA1111,\ S1}}{\rightleftharpoons}} \mathrm{DNA1111} \tag{183}$$

Reactants

Table 99: Properties of each reactant.

Id	Name	SBO
DNA1110	DNA1110	
S1	S1	

Modifiers

Table 100: Properties of each modifier.

Id	Name	SBO
DNA1110	DNA1110	
DNA1111	DNA1111	
S1	S1	

Product

Table 101: Properties of each product.

Id	Name	SBO
DNA1111	DNA1111	

Kinetic Law

Derived unit contains undeclared units

$$v_{32} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA32\_1}\,([\mathrm{DNA1110}], [\mathrm{DNA1111}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) \tag{184}$$

$$\mathrm{function\_4\_DNA32\_1}\,([\mathrm{DNA1110}], [\mathrm{DNA1111}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA1110}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1111}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{185}$$

$$\mathrm{function\_4\_DNA32\_1}\,([\mathrm{DNA1110}], [\mathrm{DNA1111}], \mathrm{Koff\_NG1}, \mathrm{Kon\_NG1}, [\mathrm{S1}], \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_NG1} \cdot [\mathrm{DNA1110}] \cdot [\mathrm{S1}] - \mathrm{Koff\_NG1} \cdot [\mathrm{DNA1111}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{186}$$

8.33 Reaction DNA33

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

Name DNA33

Reaction equation

$$\mathrm{DNA0011} \underset{\text{DNA0011, DNA001\_1}}{\rightleftharpoons} \mathrm{DNA001\_1} \tag{187}$$

Reactant

Table 102: Properties of each reactant.

Id	Name	SBO
DNA0011	DNA0011	

Modifiers

Table 103: Properties of each modifier.

Id	Name	SBO
DNA0011	DNA0011	
DNA001_1	DNA001_1	

Product

Table 104: Properties of each product.

Id	Name	SBO
DNA001_1	DNA001_1	

Kinetic Law

Derived unit contains undeclared units

$$v_{33} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA33\_1}\left(\left[\mathrm{DNA0011}\right], \left[\mathrm{DNA001\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{188}$$

$$\mathrm{function\_4\_DNA33\_1}\left(\left[\mathrm{DNA0011}\right], \left[\mathrm{DNA001\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA0011}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA001\_1}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{189}$$

$$\mathrm{function\_4\_DNA33\_1}\left(\left[\mathrm{DNA0011}\right], \left[\mathrm{DNA001\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA0011}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA001\_1}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{190}$$

8.34 Reaction DNA34

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

Name DNA34

Reaction equation

$$\mathrm{DNA0110} \xrightleftharpoons{\mathrm{DNA0110,\ DNA01\_10}} \mathrm{DNA01\_10} \tag{191}$$

Reactant

Table 105: Properties of each reactant.

Id	Name	SBO
DNA0110	DNA0110	

Modifiers

Table 106: Properties of each modifier.

Id	Name	SBO
DNA0110	DNA0110	
DNA01_10	DNA01_10	

Product

Table 107: Properties of each product.

Id	Name	SBO
DNA01_10	DNA01_10	

Kinetic Law

Derived unit contains undeclared units

$$v_{34} = \text{vol}\left(\text{nucleus}\right) \cdot \text{function\_4\_DNA34\_1}\left(\left[\text{DNA0110}\right], \left[\text{DNA01\_10}\right], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}\left(\text{nucleus}\right)\right) \tag{192}$$

$$\text{function\_4\_DNA34\_1}\left(\left[\text{DNA0110}\right], \left[\text{DNA01\_10}\right], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}\left(\text{nucleus}\right)\right) = \frac{\text{Kon\_P1} \cdot \left[\text{DNA0110}\right] - \text{Koff\_P1} \cdot \left[\text{DNA01\_10}\right]}{\text{vol}\left(\text{nucleus}\right)} \tag{193}$$

$$\text{function\_4\_DNA34\_1}\left(\left[\text{DNA0110}\right], \left[\text{DNA01\_10}\right], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}\left(\text{nucleus}\right)\right) = \frac{\text{Kon\_P1} \cdot \left[\text{DNA0110}\right] - \text{Koff\_P1} \cdot \left[\text{DNA01\_10}\right]}{\text{vol}\left(\text{nucleus}\right)} \tag{194}$$

8.35 Reaction DNA35

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

Name DNA35

Reaction equation

$$\mathrm{DNA0111} \underset{}{\overset{\mathrm{DNA0111,\ DNA01\_11}}{\rightleftharpoons}} \mathrm{DNA01\_11} \tag{195}$$

Reactant

Table 108: Properties of each reactant.

Id	Name	SBO
DNA0111	DNA0111	

Modifiers

Table 109: Properties of each modifier.

Id	Name	SBO
DNA0111	DNA0111	
DNA01_11	DNA01_11	

Product

Table 110: Properties of each product.

Id	Name	SBO
DNA01_11	DNA01_11	

Kinetic Law

Derived unit contains undeclared units

$$v_{35} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA35\_1}\left(\left[\mathrm{DNA0111}\right], \left[\mathrm{DNA01\_11}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{196}$$

$$\mathrm{function\_4\_DNA35\_1}\left(\left[\mathrm{DNA0111}\right], \left[\mathrm{DNA01\_11}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA0111}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA01\_11}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{197}$$

$$\mathrm{function\_4\_DNA35\_1}\left(\left[\mathrm{DNA0111}\right], \left[\mathrm{DNA01\_11}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA0111}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA01\_11}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{198}$$

8.36 Reaction DNA36

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

Name DNA36

Reaction equation

$$\text{DNA0111} \xrightleftharpoons{\text{DNA0111, DNA011\_1}} \text{DNA011\_1} \tag{199}$$

Reactant

Table 111: Properties of each reactant.

Id	Name	SBO
DNA0111	DNA0111	

Modifiers

Table 112: Properties of each modifier.

Id	Name	SBO
DNA0111	DNA0111	
DNA011_1	DNA011_1	

Product

Table 113: Properties of each product.

Id	Name	SBO
DNA011_1	DNA011_1	

Kinetic Law

Derived unit contains undeclared units

$$v_{36} = \text{vol}(\text{nucleus}) \cdot \text{function\_4\_DNA36\_1}([\text{DNA0111}], [\text{DNA011\_1}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}(\text{nucleus})) \tag{200}$$

$$= \frac{\text{function\_4\_DNA36\_1}([\text{DNA0111}], [\text{DNA011\_1}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}(\text{nucleus}))}{\text{vol}(\text{nucleus})} = \text{Kon\_P1} \cdot [\text{DNA0111}] - \text{Koff\_P1} \cdot [\text{DNA011\_1}] \tag{201}$$

$$\begin{aligned}&\text{function\_4\_DNA36\_1}\left([\text{DNA0111}], [\text{DNA011\_1}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}\left(\text{nucleus}\right)\right)\\ &= \frac{\text{Kon\_P1} \cdot [\text{DNA0111}] - \text{Koff\_P1} \cdot [\text{DNA011\_1}]}{\text{vol}\left(\text{nucleus}\right)}\end{aligned} \tag{202}$$

8.37 Reaction DNA37

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

Name DNA37

Reaction equation

$$\text{DNA01\_11} \underset{}{\overset{\text{DNA01\_11, DNA01\_1\_1}}{\rightleftharpoons}} \text{DNA01\_1\_1} \tag{203}$$

Reactant

Table 114: Properties of each reactant.

Id	Name	SBO
DNA01_11	DNA01_11	

Modifiers

Table 115: Properties of each modifier.

Id	Name	SBO
DNA01_11	DNA01_11	
DNA01_1_1	DNA01_1_1	

Product

Table 116: Properties of each product.

Id	Name	SBO
DNA01_1_1	DNA01_1_1	

Kinetic Law

Derived unit contains undeclared units

$$v_{37} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA37\_1}\left(\left[\mathrm{DNA01\_11}\right], \left[\mathrm{DNA01\_1\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{204}$$

$$\mathrm{function\_4\_DNA37\_1}\left(\left[\mathrm{DNA01\_11}\right], \left[\mathrm{DNA01\_1\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA01\_11}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA01\_1\_1}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{205}$$

$$\mathrm{function\_4\_DNA37\_1}\left(\left[\mathrm{DNA01\_11}\right], \left[\mathrm{DNA01\_1\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA01\_11}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA01\_1\_1}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{206}$$

8.38 Reaction DNA38

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

Name DNA38

Reaction equation

$$\mathrm{DNA011\_1} \underset{}{\overset{\mathrm{DNA011\_1,\ DNA01\_1\_1}}{\rightleftharpoons}} \mathrm{DNA01\_1\_1} \tag{207}$$

Reactant

Table 117: Properties of each reactant.

Id	Name	SBO
DNA011_1	DNA011_1	

Modifiers

Table 118: Properties of each modifier.

Id	Name	SBO
DNA011_1	DNA011_1	
DNA01_1_1	DNA01_1_1	

Product

Table 119: Properties of each product.

Id	Name	SBO
DNA01_1_1	DNA01_1_1	

Kinetic Law

Derived unit contains undeclared units

$$v_{38} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA38\_1}\,([\mathrm{DNA011\_1}], [\mathrm{DNA01\_1\_1}], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\,(\mathrm{nucleus})) \tag{208}$$

$$\mathrm{function\_4\_DNA38\_1}\,([\mathrm{DNA011\_1}], [\mathrm{DNA01\_1\_1}], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_P1} \cdot [\mathrm{DNA011\_1}] - \mathrm{Koff\_P1} \cdot [\mathrm{DNA01\_1\_1}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{209}$$

$$\mathrm{function\_4\_DNA38\_1}\,([\mathrm{DNA011\_1}], [\mathrm{DNA01\_1\_1}], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_P1} \cdot [\mathrm{DNA011\_1}] - \mathrm{Koff\_P1} \cdot [\mathrm{DNA01\_1\_1}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{210}$$

8.39 Reaction DNA39

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

Name DNA39

Reaction equation

$$\mathrm{DNA1100} \xrightleftharpoons{\mathrm{DNA1100,\ DNA1\_100}} \mathrm{DNA1\_100} \tag{211}$$

Reactant

Table 120: Properties of each reactant.

Id	Name	SBO
DNA1100	DNA1100	

Modifiers

Table 121: Properties of each modifier.

Id	Name	SBO
DNA1100	DNA1100	
DNA1_100	DNA1_100	

Product

Table 122: Properties of each product.

Id	Name	SBO
DNA1_100	DNA1_100	

Kinetic Law

Derived unit contains undeclared units

$$v_{39} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA39\_1}\,([\mathrm{DNA1100}], [\mathrm{DNA1\_100}], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\,(\mathrm{nucleus})) \tag{212}$$

$$\mathrm{function\_4\_DNA39\_1}\,([\mathrm{DNA1100}], [\mathrm{DNA1\_100}], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_P1} \cdot [\mathrm{DNA1100}] - \mathrm{Koff\_P1} \cdot [\mathrm{DNA1\_100}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{213}$$

$$\mathrm{function\_4\_DNA39\_1}\,([\mathrm{DNA1100}], [\mathrm{DNA1\_100}], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\,(\mathrm{nucleus})) = \frac{\mathrm{Kon\_P1} \cdot [\mathrm{DNA1100}] - \mathrm{Koff\_P1} \cdot [\mathrm{DNA1\_100}]}{\mathrm{vol}\,(\mathrm{nucleus})} \tag{214}$$

8.40 Reaction DNA40

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

Name DNA40

Reaction equation

$$\mathrm{DNA1101} \underset{}{\overset{\mathrm{DNA1101,\ DNA1\_101}}{\rightleftharpoons}} \mathrm{DNA1\_101} \tag{215}$$

Reactant

Table 123: Properties of each reactant.

Id	Name	SBO
DNA1101	DNA1101	

Modifiers

Table 124: Properties of each modifier.

Id	Name	SBO
DNA1101	DNA1101	
DNA1_101	DNA1_101	

Product

Table 125: Properties of each product.

Id	Name	SBO
DNA1_101	DNA1_101	

Kinetic Law

Derived unit contains undeclared units

$$v_{40} = \text{vol}(\text{nucleus}) \cdot \text{function\_4\_DNA40\_1}([\text{DNA1101}], [\text{DNA1\_101}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}(\text{nucleus})) \tag{216}$$

$$\text{function\_4\_DNA40\_1}([\text{DNA1101}], [\text{DNA1\_101}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}(\text{nucleus})) = \frac{\text{Kon\_P1} \cdot [\text{DNA1101}] - \text{Koff\_P1} \cdot [\text{DNA1\_101}]}{\text{vol}(\text{nucleus})} \tag{217}$$

$$\text{function\_4\_DNA40\_1}([\text{DNA1101}], [\text{DNA1\_101}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}(\text{nucleus})) = \frac{\text{Kon\_P1} \cdot [\text{DNA1101}] - \text{Koff\_P1} \cdot [\text{DNA1\_101}]}{\text{vol}(\text{nucleus})} \tag{218}$$

8.41 Reaction DNA41

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

Name DNA41

Reaction equation

$$\mathrm{DNA1110} \xrightleftharpoons{\mathrm{DNA1110},\ \mathrm{DNA1\_110}} \mathrm{DNA1\_110} \tag{219}$$

Reactant

Table 126: Properties of each reactant.

Id	Name	SBO
DNA1110	DNA1110	

Modifiers

Table 127: Properties of each modifier.

Id	Name	SBO
DNA1110	DNA1110	
DNA1_110	DNA1_110	

Product

Table 128: Properties of each product.

Id	Name	SBO
DNA1_110	DNA1_110	

Kinetic Law

Derived unit contains undeclared units

$$v_{41} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA41\_1}\left(\left[\mathrm{DNA1110}\right], \left[\mathrm{DNA1\_110}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{220}$$

$$\mathrm{function\_4\_DNA41\_1}\left(\left[\mathrm{DNA1110}\right], \left[\mathrm{DNA1\_110}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA1110}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_110}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{221}$$

$$\mathrm{function\_4\_DNA41\_1}\left(\left[\mathrm{DNA1110}\right], \left[\mathrm{DNA1\_110}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA1110}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_110}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{222}$$

8.42 Reaction DNA42

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

Name DNA42

Reaction equation

$$\text{DNA1110} \xrightleftharpoons{\text{DNA1110, DNA11\_10}} \text{DNA11\_10} \tag{223}$$

Reactant

Table 129: Properties of each reactant.

Id	Name	SBO
DNA1110	DNA1110	

Modifiers

Table 130: Properties of each modifier.

Id	Name	SBO
DNA1110	DNA1110	
DNA11_10	DNA11_10	

Product

Table 131: Properties of each product.

Id	Name	SBO
DNA11_10	DNA11_10	

Kinetic Law

Derived unit contains undeclared units

$$v_{42} = \text{vol}(\text{nucleus}) \cdot \text{function\_4\_DNA42\_1}([\text{DNA1110}], [\text{DNA11\_10}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}(\text{nucleus})) \tag{224}$$

$$= \frac{\text{function\_4\_DNA42\_1}([\text{DNA1110}], [\text{DNA11\_10}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}(\text{nucleus}))}{\text{vol}(\text{nucleus})} = \text{Kon\_P1} \cdot [\text{DNA1110}] - \text{Koff\_P1} \cdot [\text{DNA11\_10}] \tag{225}$$

$$\begin{aligned}&\text{function\_4\_DNA42\_1}\left([\text{DNA1110}], [\text{DNA11\_10}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}\left(\text{nucleus}\right)\right)\\ &= \frac{\text{Kon\_P1} \cdot [\text{DNA1110}] - \text{Koff\_P1} \cdot [\text{DNA11\_10}]}{\text{vol}\left(\text{nucleus}\right)}\end{aligned} \tag{226}$$

8.43 Reaction DNA43

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

Name DNA43

Reaction equation

$$\text{DNA1\_110} \overset{\text{DNA1\_110, DNA1\_1\_10}}{\rightleftharpoons} \text{DNA1\_1\_10} \tag{227}$$

Reactant

Table 132: Properties of each reactant.

Id	Name	SBO
DNA1_110	DNA1_110	

Modifiers

Table 133: Properties of each modifier.

Id	Name	SBO
DNA1_110	DNA1_110	
DNA1_1_10	DNA1_1_10	

Product

Table 134: Properties of each product.

Id	Name	SBO
DNA1_1_10	DNA1_1_10	

Kinetic Law

Derived unit contains undeclared units

$$v_{43} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA43\_1}\left(\left[\mathrm{DNA1\_110}\right], \left[\mathrm{DNA1\_1\_10}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{228}$$

$$\mathrm{function\_4\_DNA43\_1}\left(\left[\mathrm{DNA1\_110}\right], \left[\mathrm{DNA1\_1\_10}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA1\_110}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_1\_10}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{229}$$

$$\mathrm{function\_4\_DNA43\_1}\left(\left[\mathrm{DNA1\_110}\right], \left[\mathrm{DNA1\_1\_10}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA1\_110}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_1\_10}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{230}$$

8.44 Reaction DNA44

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

Name DNA44

Reaction equation

$$\mathrm{DNA11\_10} \underset{\mathrm{DNA11\_10,\ DNA1\_1\_10}}{\rightleftharpoons} \mathrm{DNA1\_1\_10} \tag{231}$$

Reactant

Table 135: Properties of each reactant.

Id	Name	SBO
DNA11_10	DNA11_10	

Modifiers

Table 136: Properties of each modifier.

Id	Name	SBO
DNA11_10	DNA11_10	
DNA1_1_10	DNA1_1_10	

Product

Table 137: Properties of each product.

Id	Name	SBO
DNA1_1_10	DNA1_1_10	

Kinetic Law

Derived unit contains undeclared units

$$v_{44} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA44\_1}\left(\left[\mathrm{DNA11\_10}\right], \left[\mathrm{DNA1\_1\_10}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{232}$$

$$\mathrm{function\_4\_DNA44\_1}\left(\left[\mathrm{DNA11\_10}\right], \left[\mathrm{DNA1\_1\_10}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA11\_10}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_1\_10}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{233}$$

$$\mathrm{function\_4\_DNA44\_1}\left(\left[\mathrm{DNA11\_10}\right], \left[\mathrm{DNA1\_1\_10}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA11\_10}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_1\_10}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{234}$$

8.45 Reaction DNA45

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

Name DNA45

Reaction equation

$$\mathrm{DNA1111} \underset{\leftarrow}{\overset{\mathrm{DNA1111,\ DNA1\_111}}{\rightarrow}} \mathrm{DNA1\_111} \tag{235}$$

Reactant

Table 138: Properties of each reactant.

Id	Name	SBO
DNA1111	DNA1111	

Modifiers

Table 139: Properties of each modifier.

Id	Name	SBO
DNA1111	DNA1111	
DNA1_111	DNA1_111	

Product

Table 140: Properties of each product.

Id	Name	SBO
DNA1_111	DNA1_111	

Kinetic Law

Derived unit contains undeclared units

$$v_{45} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA45\_1}\left(\left[\mathrm{DNA1111}\right], \left[\mathrm{DNA1\_111}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{236}$$

$$\mathrm{function\_4\_DNA45\_1}\left(\left[\mathrm{DNA1111}\right], \left[\mathrm{DNA1\_111}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA1111}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_111}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{237}$$

$$\mathrm{function\_4\_DNA45\_1}\left(\left[\mathrm{DNA1111}\right], \left[\mathrm{DNA1\_111}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA1111}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_111}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{238}$$

8.46 Reaction DNA46

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

Name DNA46

Reaction equation

$$\mathrm{DNA1111} \xrightleftharpoons{\mathrm{DNA1111},\ \mathrm{DNA11\_11}} \mathrm{DNA11\_11} \tag{239}$$

Reactant

Table 141: Properties of each reactant.

Id	Name	SBO
DNA1111	DNA1111	

Modifiers

Table 142: Properties of each modifier.

Id	Name	SBO
DNA1111	DNA1111	
DNA11_11	DNA11_11	

Product

Table 143: Properties of each product.

Id	Name	SBO
DNA11_11	DNA11_11	

Kinetic Law

Derived unit contains undeclared units

$$v_{46} = \text{vol}\left(\text{nucleus}\right) \cdot \text{function\_4\_DNA46\_1}\left(\left[\text{DNA1111}\right], \left[\text{DNA11\_11}\right], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}\left(\text{nucleus}\right)\right) \tag{240}$$

$$\text{function\_4\_DNA46\_1}\left(\left[\text{DNA1111}\right], \left[\text{DNA11\_11}\right], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}\left(\text{nucleus}\right)\right) = \frac{\text{Kon\_P1} \cdot \left[\text{DNA1111}\right] - \text{Koff\_P1} \cdot \left[\text{DNA11\_11}\right]}{\text{vol}\left(\text{nucleus}\right)} \tag{241}$$

$$\text{function\_4\_DNA46\_1}\left(\left[\text{DNA1111}\right], \left[\text{DNA11\_11}\right], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}\left(\text{nucleus}\right)\right) = \frac{\text{Kon\_P1} \cdot \left[\text{DNA1111}\right] - \text{Koff\_P1} \cdot \left[\text{DNA11\_11}\right]}{\text{vol}\left(\text{nucleus}\right)} \tag{242}$$

8.47 Reaction DNA47

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

Name DNA47

Reaction equation

$$\text{DNA1111} \xrightleftharpoons{\text{DNA1111, DNA111\_1}} \text{DNA111\_1} \tag{243}$$

Reactant

Table 144: Properties of each reactant.

Id	Name	SBO
DNA1111	DNA1111	

Modifiers

Table 145: Properties of each modifier.

Id	Name	SBO
DNA1111	DNA1111	
DNA111_1	DNA111_1	

Product

Table 146: Properties of each product.

Id	Name	SBO
DNA111_1	DNA111_1	

Kinetic Law

Derived unit contains undeclared units

$$v_{47} = \text{vol}(\text{nucleus}) \cdot \text{function\_4\_DNA47\_1}([\text{DNA1111}], [\text{DNA111\_1}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}(\text{nucleus})) \tag{244}$$

$$\text{function\_4\_DNA47\_1}([\text{DNA1111}], [\text{DNA111\_1}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}(\text{nucleus})) = \frac{\text{Kon\_P1} \cdot [\text{DNA1111}] - \text{Koff\_P1} \cdot [\text{DNA111\_1}]}{\text{vol}(\text{nucleus})} \tag{245}$$

$$\text{function\_4\_DNA47\_1}([\text{DNA1111}], [\text{DNA111\_1}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}(\text{nucleus})) = \frac{\text{Kon\_P1} \cdot [\text{DNA1111}] - \text{Koff\_P1} \cdot [\text{DNA111\_1}]}{\text{vol}(\text{nucleus})} \tag{246}$$

8.48 Reaction DNA48

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

Name DNA48

Reaction equation

$$\mathrm{DNA1\_111} \xrightleftharpoons{\mathrm{DNA1\_111},\ \mathrm{DNA1\_11\_1}} \mathrm{DNA1\_11\_1} \tag{247}$$

Reactant

Table 147: Properties of each reactant.

Id	Name	SBO
DNA1_111	DNA1_111	

Modifiers

Table 148: Properties of each modifier.

Id	Name	SBO
DNA1_111	DNA1_111	
DNA1_11_1	DNA1_11_1	

Product

Table 149: Properties of each product.

Id	Name	SBO
DNA1_11_1	DNA1_11_1	

Kinetic Law

Derived unit contains undeclared units

$$v_{48} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA48\_1}\left(\left[\mathrm{DNA1\_111}\right], \left[\mathrm{DNA1\_11\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{248}$$

$$\begin{aligned} &\mathrm{function\_4\_DNA48\_1}\left(\left[\mathrm{DNA1\_111}\right], \left[\mathrm{DNA1\_11\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \\ &= \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA1\_111}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_11\_1}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \end{aligned} \tag{249}$$

$$\begin{aligned}&\text{function\_4\_DNA48\_1}\left([\text{DNA1\_111}], [\text{DNA1\_11\_1}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}\left(\text{nucleus}\right)\right)\\ &= \frac{\text{Kon\_P1} \cdot [\text{DNA1\_111}] - \text{Koff\_P1} \cdot [\text{DNA1\_11\_1}]}{\text{vol}\left(\text{nucleus}\right)}\end{aligned} \tag{250}$$

8.49 Reaction DNA49

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

Name DNA49

Reaction equation

$$\text{DNA111\_1} \xrightleftharpoons{\text{DNA111\_1, DNA1\_11\_1}} \text{DNA1\_11\_1} \tag{251}$$

Reactant

Table 150: Properties of each reactant.

Id	Name	SBO
DNA111_1	DNA111_1	

Modifiers

Table 151: Properties of each modifier.

Id	Name	SBO
DNA111_1	DNA111_1	
DNA1_11_1	DNA1_11_1	

Product

Table 152: Properties of each product.

Id	Name	SBO
DNA1_11_1	DNA1_11_1	

Kinetic Law

Derived unit contains undeclared units

$$v_{49} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA49\_1}\left(\left[\mathrm{DNA111\_1}\right], \left[\mathrm{DNA1\_11\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{252}$$

$$\mathrm{function\_4\_DNA49\_1}\left(\left[\mathrm{DNA111\_1}\right], \left[\mathrm{DNA1\_11\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA111\_1}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_11\_1}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{253}$$

$$\mathrm{function\_4\_DNA49\_1}\left(\left[\mathrm{DNA111\_1}\right], \left[\mathrm{DNA1\_11\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA111\_1}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_11\_1}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{254}$$

8.50 Reaction DNA50

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

Name DNA50

Reaction equation

$$\mathrm{DNA1\_111} \underset{}{\overset{\mathrm{DNA1\_111,\ DNA1\_1\_11}}{\rightleftharpoons}} \mathrm{DNA1\_1\_11} \tag{255}$$

Reactant

Table 153: Properties of each reactant.

Id	Name	SBO
DNA1_111	DNA1_111	

Modifiers

Table 154: Properties of each modifier.

Id	Name	SBO
DNA1_111	DNA1_111	
DNA1_1_11	DNA1_1_11	

Product

Table 155: Properties of each product.

Id	Name	SBO
DNA1_1_11	DNA1_1_11	

Kinetic Law

Derived unit contains undeclared units

$$v_{50} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA50\_1}\left(\left[\mathrm{DNA1\_111}\right], \left[\mathrm{DNA1\_1\_11}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{256}$$

$$\mathrm{function\_4\_DNA50\_1}\left(\left[\mathrm{DNA1\_111}\right], \left[\mathrm{DNA1\_1\_11}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA1\_111}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_1\_11}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{257}$$

$$\mathrm{function\_4\_DNA50\_1}\left(\left[\mathrm{DNA1\_111}\right], \left[\mathrm{DNA1\_1\_11}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA1\_111}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_1\_11}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{258}$$

8.51 Reaction DNA51

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

Name DNA51

Reaction equation

$$\mathrm{DNA11\_11} \underset{\leftarrow}{\overset{\mathrm{DNA11\_11,\ DNA1\_1\_11}}{\rightleftharpoons}} \mathrm{DNA1\_1\_11} \tag{259}$$

Reactant

Table 156: Properties of each reactant.

Id	Name	SBO
DNA11_11	DNA11_11	

Modifiers

Table 157: Properties of each modifier.

Id	Name	SBO
DNA11_11	DNA11_11	
DNA1_1_11	DNA1_1_11	

Product

Table 158: Properties of each product.

Id	Name	SBO
DNA1_1_11	DNA1_1_11	

Kinetic Law

Derived unit contains undeclared units

$$v_{51} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA51\_1}\left(\left[\mathrm{DNA11\_11}\right], \left[\mathrm{DNA1\_1\_11}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{260}$$

$$\mathrm{function\_4\_DNA51\_1}\left(\left[\mathrm{DNA11\_11}\right], \left[\mathrm{DNA1\_1\_11}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA11\_11}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_1\_11}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{261}$$

$$\mathrm{function\_4\_DNA51\_1}\left(\left[\mathrm{DNA11\_11}\right], \left[\mathrm{DNA1\_1\_11}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA11\_11}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_1\_11}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{262}$$

8.52 Reaction DNA52

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

Name DNA52

Reaction equation

$$\mathrm{DNA11\_11} \underset{}{\overset{\mathrm{DNA11\_11},\ \mathrm{DNA11\_1\_1}}{\rightleftharpoons}} \mathrm{DNA11\_1\_1} \tag{263}$$

Reactant

Table 159: Properties of each reactant.

Id	Name	SBO
DNA11_11	DNA11_11	

Modifiers

Table 160: Properties of each modifier.

Id	Name	SBO
DNA11_11	DNA11_11	
DNA11_1_1	DNA11_1_1	

Product

Table 161: Properties of each product.

Id	Name	SBO
DNA11_1_1	DNA11_1_1	

Kinetic Law

Derived unit contains undeclared units

$$v_{52} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA52\_1}\left(\left[\mathrm{DNA11\_11}\right], \left[\mathrm{DNA11\_1\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{264}$$

$$\mathrm{function\_4\_DNA52\_1}\left(\left[\mathrm{DNA11\_11}\right], \left[\mathrm{DNA11\_1\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA11\_11}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA11\_1\_1}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{265}$$

$$\mathrm{function\_4\_DNA52\_1}\left(\left[\mathrm{DNA11\_11}\right], \left[\mathrm{DNA11\_1\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA11\_11}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA11\_1\_1}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{266}$$

8.53 Reaction DNA53

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

Name DNA53

Reaction equation

$$\mathrm{DNA111\_1} \underset{}{\overset{\mathrm{DNA111\_1,\ DNA11\_1\_1}}{\rightleftharpoons}} \mathrm{DNA11\_1\_1} \tag{267}$$

Reactant

Table 162: Properties of each reactant.

Id	Name	SBO
DNA111_1	DNA111_1	

Modifiers

Table 163: Properties of each modifier.

Id	Name	SBO
DNA111_1	DNA111_1	
DNA11_1_1	DNA11_1_1	

Product

Table 164: Properties of each product.

Id	Name	SBO
DNA11_1_1	DNA11_1_1	

Kinetic Law

Derived unit contains undeclared units

$$v_{53} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA53\_1}\left(\left[\mathrm{DNA111\_1}\right], \left[\mathrm{DNA11\_1\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{268}$$

$$\mathrm{function\_4\_DNA53\_1}\left(\left[\mathrm{DNA111\_1}\right], \left[\mathrm{DNA11\_1\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA111\_1}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA11\_1\_1}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{269}$$

$$\mathrm{function\_4\_DNA53\_1}\left(\left[\mathrm{DNA111\_1}\right], \left[\mathrm{DNA11\_1\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA111\_1}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA11\_1\_1}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{270}$$

8.54 Reaction DNA54

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

Name DNA54

Reaction equation

$$\mathrm{DNA1\_1\_11} \underset{}{\overset{\mathrm{DNA1\_1\_11},\ \mathrm{DNA1\_1\_1\_1}}{\rightleftharpoons}} \mathrm{DNA1\_1\_1\_1} \tag{271}$$

Reactant

Table 165: Properties of each reactant.

Id	Name	SBO
DNA1_1_11	DNA1_1_11	

Modifiers

Table 166: Properties of each modifier.

Id	Name	SBO
DNA1_1_11	DNA1_1_11	
DNA1_1_1_1	DNA1_1_1_1	

Product

Table 167: Properties of each product.

Id	Name	SBO
DNA1_1_1_1	DNA1_1_1_1	

Kinetic Law

Derived unit contains undeclared units

$$v_{54} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA54\_1}\left(\left[\mathrm{DNA1\_1\_11}\right], \left[\mathrm{DNA1\_1\_1\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{272}$$

$$\mathrm{function\_4\_DNA54\_1}\left(\left[\mathrm{DNA1\_1\_11}\right], \left[\mathrm{DNA1\_1\_1\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA1\_1\_11}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_1\_1\_1}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{273}$$

$$\begin{aligned}&\text{function\_4\_DNA54\_1}\left(\left[\text{DNA1\_1\_11}\right],\left[\text{DNA1\_1\_1\_1}\right],\text{Koff\_P1},\text{Kon\_P1},\text{vol}\left(\text{nucleus}\right)\right)\\&=\frac{\text{Kon\_P1}\cdot\left[\text{DNA1\_1\_11}\right]-\text{Koff\_P1}\cdot\left[\text{DNA1\_1\_1\_1}\right]}{\text{vol}\left(\text{nucleus}\right)}\end{aligned}\tag{274}$$

8.55 Reaction DNA55

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

Name DNA55

Reaction equation

$$\text{DNA1\_11\_1}\xrightleftharpoons{\text{DNA1\_11\_1, DNA1\_1\_1\_1}}\text{DNA1\_1\_1\_1}\tag{275}$$

Reactant

Table 168: Properties of each reactant.

Id	Name	SBO
DNA1_11_1	DNA1_11_1	

Modifiers

Table 169: Properties of each modifier.

Id	Name	SBO
DNA1_11_1	DNA1_11_1	
DNA1_1_1_1	DNA1_1_1_1	

Product

Table 170: Properties of each product.

Id	Name	SBO
DNA1_1_1_1	DNA1_1_1_1	

Kinetic Law

Derived unit contains undeclared units

$$v_{55} = \mathrm{vol}\left(\mathrm{nucleus}\right) \cdot \mathrm{function\_4\_DNA55\_1}\left(\left[\mathrm{DNA1\_11\_1}\right], \left[\mathrm{DNA1\_1\_1\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) \tag{276}$$

$$\mathrm{function\_4\_DNA55\_1}\left(\left[\mathrm{DNA1\_11\_1}\right], \left[\mathrm{DNA1\_1\_1\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA1\_11\_1}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_1\_1\_1}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{277}$$

$$\mathrm{function\_4\_DNA55\_1}\left(\left[\mathrm{DNA1\_11\_1}\right], \left[\mathrm{DNA1\_1\_1\_1}\right], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\left(\mathrm{nucleus}\right)\right) = \frac{\mathrm{Kon\_P1} \cdot \left[\mathrm{DNA1\_11\_1}\right] - \mathrm{Koff\_P1} \cdot \left[\mathrm{DNA1\_1\_1\_1}\right]}{\mathrm{vol}\left(\mathrm{nucleus}\right)} \tag{278}$$

8.56 Reaction DNA56

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

Name DNA56

Reaction equation

$$\mathrm{DNA11\_1\_1} \xrightleftharpoons{\mathrm{DNA11\_1\_1},\ \mathrm{DNA1\_1\_1\_1}} \mathrm{DNA1\_1\_1\_1} \tag{279}$$

Reactant

Table 171: Properties of each reactant.

Id	Name	SBO
DNA11_1_1	DNA11_1_1	

Modifiers

Table 172: Properties of each modifier.

Id	Name	SBO
DNA11_1_1	DNA11_1_1	
DNA1_1_1_1	DNA1_1_1_1	

Product

Table 173: Properties of each product.

Id	Name	SBO
DNA1_1_1_1	DNA1_1_1_1	

Kinetic Law

Derived unit contains undeclared units

$$v_{56} = \text{vol}(\text{nucleus}) \cdot \text{function\_4\_DNA56\_1}([\text{DNA11\_1\_1}], [\text{DNA1\_1\_1\_1}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}(\text{nucleus})) \tag{280}$$

$$\text{function\_4\_DNA56\_1}([\text{DNA11\_1\_1}], [\text{DNA1\_1\_1\_1}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}(\text{nucleus})) = \frac{\text{Kon\_P1} \cdot [\text{DNA11\_1\_1}] - \text{Koff\_P1} \cdot [\text{DNA1\_1\_1\_1}]}{\text{vol}(\text{nucleus})} \tag{281}$$

$$\text{function\_4\_DNA56\_1}([\text{DNA11\_1\_1}], [\text{DNA1\_1\_1\_1}], \text{Koff\_P1}, \text{Kon\_P1}, \text{vol}(\text{nucleus})) = \frac{\text{Kon\_P1} \cdot [\text{DNA11\_1\_1}] - \text{Koff\_P1} \cdot [\text{DNA1\_1\_1\_1}]}{\text{vol}(\text{nucleus})} \tag{282}$$

8.57 Reaction DNA57

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

Name DNA57

Reaction equation

$$\text{DNA1011} \xrightleftharpoons{\text{DNA1011, DNA101\_1}} \text{DNA101\_1} \tag{283}$$

Reactant

Table 174: Properties of each reactant.

Id	Name	SBO
DNA1011	DNA1011	

Modifiers

Table 175: Properties of each modifier.

Id	Name	SBO
DNA1011	DNA1011	
DNA101_1	DNA101_1	

Product

Table 176: Properties of each product.

Id	Name	SBO
DNA101_1	DNA101_1	

Kinetic Law

Derived unit contains undeclared units

$$v_{57} = \mathrm{vol}\,(\mathrm{nucleus}) \cdot \mathrm{function\_4\_DNA57}\,([\mathrm{DNA1011}], [\mathrm{DNA101\_1}], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\,(\mathrm{nucleus})) \tag{284}$$

$$\begin{aligned} &\mathrm{function\_4\_DNA57}\,([\mathrm{DNA1011}], [\mathrm{DNA101\_1}], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\,(\mathrm{nucleus})) \\ &= \frac{\mathrm{Kon\_P1} \cdot [\mathrm{DNA1011}] - \mathrm{Koff\_P1} \cdot [\mathrm{DNA101\_1}]}{\mathrm{vol}\,(\mathrm{nucleus})} \end{aligned} \tag{285}$$

$$\begin{aligned} &\mathrm{function\_4\_DNA57}\,([\mathrm{DNA1011}], [\mathrm{DNA101\_1}], \mathrm{Koff\_P1}, \mathrm{Kon\_P1}, \mathrm{vol}\,(\mathrm{nucleus})) \\ &= \frac{\mathrm{Kon\_P1} \cdot [\mathrm{DNA1011}] - \mathrm{Koff\_P1} \cdot [\mathrm{DNA101\_1}]}{\mathrm{vol}\,(\mathrm{nucleus})} \end{aligned} \tag{286}$$

9 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.

9.1 Species S1

Name S1

SBO:0000608 homodimer

Initial concentration $1.09648 \cdot 10^{-11}\ \mathrm{mol} \cdot \mathrm{l}^{-1}$

This species takes part in 64 reactions (as a reactant in DNA1, DNA2, DNA3, DNA4, DNA5, DNA6, DNA7, DNA8, DNA9, DNA10, DNA11, DNA12, DNA13, DNA14, DNA15, DNA16, DNA17, DNA18, DNA19, DNA20, DNA21, DNA22, DNA23, DNA24, DNA25, DNA26, DNA27, DNA28, DNA29, DNA30, DNA31, DNA32 and as a modifier in DNA1, DNA2, DNA3, DNA4, DNA5, DNA6, DNA7, DNA8, DNA9, DNA10, DNA11, DNA12, DNA13, DNA14, DNA15, DNA16, DNA17, DNA18, DNA19, DNA20, DNA21, DNA22, DNA23, DNA24, DNA25, DNA26, DNA27, DNA28, DNA29, DNA30, DNA31, DNA32).

$$\begin{aligned}\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{S1} = &- v_1 - v_2 - v_3 - v_4 - v_5 - v_6 - v_7 - v_8 - v_9 - v_{10} - v_{11} - v_{12} \\ &- v_{13} - v_{14} - v_{15} - v_{16} - v_{17} - v_{18} - v_{19} - v_{20} - v_{21} - v_{22} \\ &- v_{23} - v_{24} - v_{25} - v_{26} - v_{27} - v_{28} - v_{29} - v_{30} - v_{31} - v_{32}\end{aligned} \tag{287}$$

9.2 Species DNA0000

Name DNA0000

SBO:0000354 informational molecule segment

Initial concentration $10^{-10}\ \mathrm{mol} \cdot \mathrm{l}^{-1}$

This species takes part in eight reactions (as a reactant in DNA1, DNA2, DNA5, DNA13 and as a modifier in DNA1, DNA2, DNA5, DNA13).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA0000} = - v_1 - v_2 - v_5 - v_{13} \tag{288}$$

9.3 Species DNA0001

Name DNA0001

SBO:0000354 informational molecule segment

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

This species takes part in eight reactions (as a reactant in DNA3, DNA7, DNA14 and as a product in DNA1 and as a modifier in DNA1, DNA3, DNA7, DNA14).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA0001} = v_1 - v_3 - v_7 - v_{14} \tag{289}$$

9.4 Species DNA0010

Name DNA0010

SBO:0000354 informational molecule segment

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

This species takes part in eight reactions (as a reactant in DNA4, DNA8, DNA17 and as a product in DNA2 and as a modifier in DNA2, DNA4, DNA8, DNA17).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA0010} = v_2 - v_4 - v_8 - v_{17} \tag{290}$$

9.5 Species DNA0100

Name DNA0100

SBO:0000354 informational molecule segment

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

This species takes part in eight reactions (as a reactant in DNA6, DNA9, DNA22 and as a product in DNA5 and as a modifier in DNA5, DNA6, DNA9, DNA22).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA0100} = v_5 - v_6 - v_9 - v_{22} \tag{291}$$

9.6 Species DNA1000

Name DNA1000

SBO:0000354 informational molecule segment

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

This species takes part in eight reactions (as a reactant in DNA15, DNA16, DNA21 and as a product in DNA13 and as a modifier in DNA13, DNA15, DNA16, DNA21).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1000} = v_{13} - v_{15} - v_{16} - v_{21} \tag{292}$$

9.7 Species DNA1100

Name DNA1100

SBO:0000354 informational molecule segment

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

This species takes part in ten reactions (as a reactant in DNA25, DNA28, DNA39 and as a product in DNA21, DNA22 and as a modifier in DNA21, DNA22, DNA25, DNA28, DNA39).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1100} = v_{21} + v_{22} - v_{25} - v_{28} - v_{39} \tag{293}$$

9.8 Species DNA1010

Name DNA1010

SBO:0000354 informational molecule segment

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

This species takes part in eight reactions (as a reactant in DNA20, DNA27 and as a product in DNA16, DNA17 and as a modifier in DNA16, DNA17, DNA20, DNA27).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1010} = v_{16} + v_{17} - v_{20} - v_{27} \tag{294}$$

9.9 Species DNA1001

Name DNA1001

SBO:0000354 informational molecule segment

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

This species takes part in eight reactions (as a reactant in DNA19, DNA24 and as a product in DNA14, DNA15 and as a modifier in DNA14, DNA15, DNA19, DNA24).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1001} = v_{14} + v_{15} - v_{19} - v_{24} \tag{295}$$

9.10 Species DNA0110

Name DNA0110

SBO:0000354 informational molecule segment

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

This species takes part in ten reactions (as a reactant in DNA12, DNA26, DNA34 and as a product in DNA8, DNA9 and as a modifier in DNA8, DNA9, DNA12, DNA26, DNA34).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA0110} = v_{8} + v_{9} - v_{12} - v_{26} - v_{34} \tag{296}$$

9.11 Species DNA0101

Name DNA0101

SBO:0000354 informational molecule segment

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

This species takes part in eight reactions (as a reactant in DNA11, DNA23 and as a product in DNA6, DNA7 and as a modifier in DNA6, DNA7, DNA11, DNA23).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA0101} = v_{6} + v_{7} - v_{11} - v_{23} \tag{297}$$

9.12 Species DNA0011

Name DNA0011

SBO:0000354 informational molecule segment

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

This species takes part in ten reactions (as a reactant in DNA10, DNA18, DNA33 and as a product in DNA3, DNA4 and as a modifier in DNA3, DNA4, DNA10, DNA18, DNA33).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA0011} = v_3 + v_4 - v_{10} - v_{18} - v_{33} \tag{298}$$

9.13 Species DNA1110

Name DNA1110

SBO:0000354 informational molecule segment

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

This species takes part in twelve reactions (as a reactant in DNA32, DNA41, DNA42 and as a product in DNA26, DNA27, DNA28 and as a modifier in DNA26, DNA27, DNA28, DNA32, DNA41, DNA42).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1110} = v_{26} + v_{27} + v_{28} - v_{32} - v_{41} - v_{42} \tag{299}$$

9.14 Species DNA1011

Name DNA1011

SBO:0000354 informational molecule segment

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

This species takes part in ten reactions (as a reactant in DNA30, DNA57 and as a product in DNA18, DNA19, DNA20 and as a modifier in DNA18, DNA19, DNA20, DNA30, DNA57).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1011} = v_{18} + v_{19} + v_{20} - v_{30} - v_{57} \tag{300}$$

9.15 Species DNA1101

Name DNA1101

SBO:0000354 informational molecule segment

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

This species takes part in ten reactions (as a reactant in DNA31, DNA40 and as a product in DNA23, DNA24, DNA25 and as a modifier in DNA23, DNA24, DNA25, DNA31, DNA40).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1101} = v_{23} + v_{24} + v_{25} - v_{31} - v_{40} \tag{301}$$

9.16 Species DNA0111

Name DNA0111

SBO:0000354 informational molecule segment

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

This species takes part in twelve reactions (as a reactant in DNA29, DNA35, DNA36 and as a product in DNA10, DNA11, DNA12 and as a modifier in DNA10, DNA11, DNA12, DNA29, DNA35, DNA36).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA0111} = v_{10} + v_{11} + v_{12} - v_{29} - v_{35} - v_{36} \tag{302}$$

9.17 Species DNA1111

Name DNA1111

SBO:0000354 informational molecule segment

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

This species takes part in 14 reactions (as a reactant in DNA45, DNA46, DNA47 and as a product in DNA29, DNA30, DNA31, DNA32 and as a modifier in DNA29, DNA30, DNA31, DNA32, DNA45, DNA46, DNA47).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1111} = v_{29} + v_{30} + v_{31} + v_{32} - v_{45} - v_{46} - v_{47} \tag{303}$$

9.18 Species DNA001_1

Name DNA001_1

SBO:0000354 informational molecule segment

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

This species takes part in two reactions (as a product in DNA33 and as a modifier in DNA33).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA001\_1} = v_{33} \tag{304}$$

9.19 Species DNA01_10

Name DNA01_10

SBO:0000354 informational molecule segment

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

This species takes part in two reactions (as a product in DNA34 and as a modifier in DNA34).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA01\_10} = v_{34} \tag{305}$$

9.20 Species DNA01_11

Name DNA01_11

SBO:0000354 informational molecule segment

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

This species takes part in four reactions (as a reactant in DNA37 and as a product in DNA35 and as a modifier in DNA35, DNA37).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA01\_11} = v_{35} - v_{37} \tag{306}$$

9.21 Species DNA011_1

Name DNA011_1

SBO:0000354 informational molecule segment

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

This species takes part in four reactions (as a reactant in DNA38 and as a product in DNA36 and as a modifier in DNA36, DNA38).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA011\_1} = v_{36} - v_{38} \tag{307}$$

9.22 Species DNA01_1_1

Name DNA01_1_1

SBO:0000354 informational molecule segment

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

This species takes part in four reactions (as a product in DNA37, DNA38 and as a modifier in DNA37, DNA38).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA01\_1\_1} = v_{37} + v_{38} \tag{308}$$

9.23 Species DNA101_1

Name DNA101_1

SBO:0000354 informational molecule segment

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

This species takes part in two reactions (as a product in DNA57 and as a modifier in DNA57).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA101\_1} = v_{57} \tag{309}$$

9.24 Species DNA1_100

Name DNA1_100

SBO:0000354 informational molecule segment

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

This species takes part in two reactions (as a product in DNA39 and as a modifier in DNA39).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1\_100} = v_{39} \tag{310}$$

9.25 Species DNA1_101

Name DNA1_101

SBO:0000354 informational molecule segment

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

This species takes part in two reactions (as a product in DNA40 and as a modifier in DNA40).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1\_101} = v_{40} \tag{311}$$

9.26 Species DNA1_110

Name DNA1_110

SBO:0000354 informational molecule segment

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

This species takes part in four reactions (as a reactant in DNA43 and as a product in DNA41 and as a modifier in DNA41, DNA43).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1\_110} = v_{41} - v_{43} \tag{312}$$

9.27 Species DNA11_10

Name DNA11_10

SBO:0000354 informational molecule segment

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

This species takes part in four reactions (as a reactant in DNA44 and as a product in DNA42 and as a modifier in DNA42, DNA44).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA11\_10} = v_{42} - v_{44} \tag{313}$$

9.28 Species DNA1_1_10

Name DNA1_1_10

SBO:0000354 informational molecule segment

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

This species takes part in four reactions (as a product in DNA43, DNA44 and as a modifier in DNA43, DNA44).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1\_1\_10} = v_{43} + v_{44} \tag{314}$$

9.29 Species DNA1_111

Name DNA1_111

SBO:0000354 informational molecule segment

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

This species takes part in six reactions (as a reactant in DNA48, DNA50 and as a product in DNA45 and as a modifier in DNA45, DNA48, DNA50).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1\_111} = v_{45} - v_{48} - v_{50} \tag{315}$$

9.30 Species DNA11_11

Name DNA11_11

SBO:0000354 informational molecule segment

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

This species takes part in six reactions (as a reactant in DNA51, DNA52 and as a product in DNA46 and as a modifier in DNA46, DNA51, DNA52).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA11\_11} = v_{46} - v_{51} - v_{52} \tag{316}$$

9.31 Species DNA111_1

Name DNA111_1

SBO:0000354 informational molecule segment

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

This species takes part in six reactions (as a reactant in DNA49, DNA53 and as a product in DNA47 and as a modifier in DNA47, DNA49, DNA53).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA111\_1} = v_{47} - v_{49} - v_{53} \tag{317}$$

9.32 Species DNA1_1_11

Name DNA1_1_11

SBO:0000354 informational molecule segment

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

This species takes part in six reactions (as a reactant in DNA54 and as a product in DNA50, DNA51 and as a modifier in DNA50, DNA51, DNA54).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1\_1\_11} = v_{50} + v_{51} - v_{54} \tag{318}$$

9.33 Species DNA1_11_1

Name DNA1_11_1

SBO:0000354 informational molecule segment

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

This species takes part in six reactions (as a reactant in DNA55 and as a product in DNA48, DNA49 and as a modifier in DNA48, DNA49, DNA55).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1\_11\_1} = v_{48} + v_{49} - v_{55} \tag{319}$$

9.34 Species DNA11_1_1

Name DNA11_1_1

SBO:0000354 informational molecule segment

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

This species takes part in six reactions (as a reactant in DNA56 and as a product in DNA52, DNA53 and as a modifier in DNA52, DNA53, DNA56).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA11\_1\_1} = v_{52} + v_{53} - v_{56} \tag{320}$$

9.35 Species DNA1_1_1_1

Name DNA1_1_1_1

SBO:0000354 informational molecule segment

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

This species takes part in six reactions (as a product in DNA54, DNA55, DNA56 and as a modifier in DNA54, DNA55, DNA56).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{DNA1\_1\_1\_1} = v_{54} + v_{55} + v_{56} \tag{321}$$

A Glossary of Systems Biology Ontology Terms

SBO:0000338 dissociation rate constant: Rate with which a complex dissociates into its components

SBO:0000341 association rate constant: Rate with which components associate into a complex

SBO:0000354 informational molecule segment: Fragment of a macromolecule that carries genetic information

SBO:0000540 fraction of an entity pool: A ratio that represents the quantity of a defined constituent entity over the total number of all constituent entities present.

SBO:0000608 homodimer: A macromolecular complex composed of precisely two identical monomeric units, which are usually non-covalently bound

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