SBML Model Report

Model name: "Hockin2002_BloodCoagulation"

May 5, 2016

1 General Overview

This is a document in SBML Level 2 Version 4 format. This model was created by the following two authors: Michael Schubert[1] and Vijayalakshmi Chelliah[2] at June first 2011 at 2:22 p. m. and last time modified at May 28th 2014 at 1:55 p. m. Table 1 shows an overview of the quantities of all components of this model.

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

Element	Quantity	Element	Quantity
compartment types	0	compartments	1
species types	0	species	34
events	0	constraints	0
reactions	31	function definitions	0
global parameters	43	unit definitions	0
rules	1	initial assignments	0

Model Notes

This model is from the article:
A model for the stoichiometric regulation of blood coagulation.
Hockin MF, Jones KC, Everse SJ, Mann KG. Journal of Biological ChemistryVolume 277, Issue 21, 24 May 2002, Pages 18322 -18333 11893748,

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Abstract:
We have developed a model of the extrinsic blood coagulation system that includes the stoichiometric anticoagulants. The model accounts for the formation, expression, and propagation of the vitamin K-dependent procoagulant complexes and extends our previous model by including: (a) the tissue factor pathway inhibitor (TFPI)-mediated inactivation of tissue factor (TF).VIIa and its product complexes; (b) the antithrombin-III (AT-III)-mediated inactivation of IIa, mIIa, factor VIIa, factor IXa, and factor Xa; (c) the initial activation of factor V and factor VIII by thrombin generated by factor Xa-membrane; (d) factor VIIIa dissociation/activity loss; (e) the binding competition and kinetic activation steps that exist between TF and factors VII and VIIa; and (f) the activation of factor VII by IIa, factor Xa, and factor IXa. These additions to our earlier model generate a model consisting of 34 differential equations with 42 rate constants that together describe the 27 independent equilibrium expressions, which describe the fates of 34 species. Simulations are initiated by „exposing„ picomolar concentrations of TF to an electronic milieu consisting of factors II, IX, X, VII, VIIa, V, and VIIII, and the anticoagulants TFPI and AT-III at concentrations found in normal plasma or associated with coagulation pathology. The reaction followed in terms of thrombin generation, proceeds through phases that can be operationally defined as initiation, propagation, and termination. The generation of thrombin displays a nonlinear dependence upon TF, AT-III, and TFPI and the combination of these latter inhibitors displays kinetic thresholds. At subthreshold TF, thrombin production/expression is suppressed by the combination of TFPI and AT-III; for concentrations above the TF threshold, the bolus of thrombin produced is quantitatively equivalent. A comparison of the model with empirical laboratory data illustrates that most experimentally observable parameters are captured, and the pathology that results in enhanced or deficient thrombin generation is accurately described.

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
`compartment_1`	compartment_1		3	1	litre	☑	

3.1 Compartment `compartment_1`

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

Name compartment_1

4 Species

This model contains 34 species. Section 8 provides further details and the derived rates of change of each species.

Table 3: Properties of each species.

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
TF	TF	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
TF_VII	TF_VII	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
VII	VII	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
TF_VIIa	TF_VIIa	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
VIIa	VIIa	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
Xa	Xa	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IIa	IIa	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
TF_VIIa_X	TF_VIIa_X	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
X	X	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
TF_VIIa_Xa	TF_VIIa_Xa	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IX	IX	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
TF_VIIa_IX	TF_VIIa_IX	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IXa	IXa	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
II	II	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
VIII	VIII	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
VIIIa	VIIIa	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IXa_VIIIa	IXa_VIIIa	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IXa_VIIIa_X	IXa_VIIIa_X	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
VIIIa1_L	VIIIa1_L	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
VIIIa2	VIIIa2	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
V	V	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
Va	Va	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
Xa_Va	Xa_Va	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
Xa_Va_II	Xa_Va_II	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
mIIa	mIIa	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
TFPI	TFPI	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
Xa_TFPI	Xa_TFPI	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
TF_VIIa_Xa_TFPI	TF_VIIa_Xa_TFPI	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
ATIII	ATIII	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
Xa_ATIII	Xa_ATIII	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
mIIa_ATIII	mIIa_ATIII	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IXa_ATIII	IXa_ATIII	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
IIa_ATIII	IIa_ATIII	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟
TF_VIIa_ATIII	TF_VIIa_ATIII	compartment_1	$\mathrm{mol} \cdot \mathrm{l}^{-1}$	⊟	⊟

5 Parameters

This model contains 43 global parameters.

Table 4: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1	0000038	0.003		☑
k2	k2	0000036	3200000.000		☑
k3	k3	0000038	0.003		☑
k4	k4	0000036	$2.3 \cdot 10^{7}$		☑
k5	k5	0000036	440000.000		☑
k6	k6	0000036	$1.3 \cdot 10^{7}$		☑
k7	k7	0000036	23000.000		☑
k8	k8	0000038	1.050		☑
k9	k9	0000036	$2.5 \cdot 10^{7}$		☑
k10	k10	0000035	6.000		☑
k11	k11	0000038	19.000		☑
k12	k12	0000036	$2.2 \cdot 10^{7}$		☑
k13	k13	0000038	2.400		☑
k14	k14	0000036	10^{7}		☑
k15	k15	0000035	1.800		☑
k16	k16	0000036	7500.000		☑
k17	k17	0000036	$2 \cdot 10^{7}$		☑
k18	k18	0000038	0.005		☑
k19	k19	0000036	10^{7}		☑
k20	k20	0000038	0.001		☑
k21	k21	0000036	10^{8}		☑
k22	k22	0000035	8.200		☑
k23	k23	0000039	22000.000		☑
k24	k24	0000035	0.006		☑
k25	k25	0000035	0.001		☑
k26	k26	0000036	$2 \cdot 10^{7}$		☑
k27	k27	0000038	0.200		☑
k28	k28	0000036	$4 \cdot 10^{8}$		☑
k29	k29	0000038	103.000		☑
k30	k30	0000036	10^{8}		☑
k31	k31	0000035	63.500		☑
k32	k32	0000036	$1.5 \cdot 10^{7}$		☑
k33	k33	0000038	$3.6 \cdot 10^{-4}$		☑
k34	k34	0000036	900000.000		☑
k35	k35	0000038	$1.1 \cdot 10^{-4}$		☑
k36	k36	0000036	$3.2 \cdot 10^{8}$		☑
k37	k37	0000036	$5 \cdot 10^{7}$		☑

Id	Name	SBO	Value	Unit	Constant
k38	k38	0000036	1500.000		☑
k39	k39	0000036	7100.000		☑
k40	k40	0000036	490.000		☑
k41	k41	0000036	7100.000		☑
k42	k42	0000036	230.000		☑
IIa_plus_1-_2mIIa	IIa+1.2mIIa		0.000		☐

6 Rule

This is an overview of one rule.

6.1 Rule IIa_plus_1_2mIIa

Rule IIa_plus_1_2mIIa is an assignment rule for parameter IIa_plus_1_2mIIa:

$$\text{IIa\_plus\_1\_2mIIa} = [\text{IIa}] + 1.2 \cdot [\text{mIIa}] \tag{1}$$

7 Reactions

This model contains 31 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	R1	R1	$TF + VII \rightleftharpoons TF\_VII$	
2	R2	R2	$TF + VIIa \rightleftharpoons TF\_VIIa$	
3	R3	R3	$TF\_VIIa + VII \longrightarrow TF\_VIIa + VIIa$	
4	R4	R4	$Xa + VII \longrightarrow Xa + VIIa$	
5	R5	R5	$IIa + VII \longrightarrow IIa + VIIa$	
6	R6	R6	$TF\_VIIa + X \rightleftharpoons TF\_VIIa\_X$	
7	R7	R7	$TF\_VIIa + Xa \rightleftharpoons TF\_VIIa\_Xa$	
8	R8	R8	$TF\_VIIa + IX \rightleftharpoons TF\_VIIa\_IX$	
9	R9	R9	$Xa + II \longrightarrow Xa + IIa$	
10	R10	R10	$IIa + VIII \longrightarrow IIa + VIIIa$	
11	R11	R11	$IXa + VIIIa \rightleftharpoons IXa\_VIIIa$	
12	R12	R12	$IXa\_VIIIa + X \rightleftharpoons IXa\_VIIIa\_X$	
13	R13	R13	$VIIIa \rightleftharpoons VIIIa1\_L + VIIIa2$	
14	R14	R14	$IXa\_VIIIa\_X \longrightarrow VIIIa1\_L + VIIIa2 + X + IXa$	
15	R15	R15	$IXa\_VIIIa \longrightarrow VIIIa1\_L + VIIIa2 + IXa$	
16	R16	R16	$IIa + V \longrightarrow IIa + Va$	
17	R17	R17	$Xa + Va \rightleftharpoons Xa\_Va$	
18	R18	R18	$Xa\_Va + II \rightleftharpoons Xa\_Va\_II$	
19	R19	R19	$mIIa + Xa\_Va \longrightarrow IIa + Xa\_Va$	
20	R20	R20	$Xa + TFPI \rightleftharpoons Xa\_TFPI$	
21	R21	R21	$TF\_VIIa\_Xa + TFPI \rightleftharpoons TF\_VIIa\_Xa\_TFPI$	
22	R22	R22	$TF\_VIIa + Xa\_TFPI \longrightarrow TF\_VIIa\_Xa\_TFPI$	
23	R23	R23	$Xa + ATIII \longrightarrow Xa\_ATIII$	

№	Id	Name	Reaction Equation	SBO
24	R24	R24	mIIa + ATIII ⟶ mIIa_ATIII	
25	R25	R25	IXa + ATIII ⟶ IXa_ATIII	
26	R26	R26	IIa + ATIII ⟶ IIa_ATIII	
27	R27	R27	TF_VIIa + ATIII ⟶ TF_VIIa_ATIII	
28	R6b	R6b	TF_VIIa_X ⟶ TF_VIIa_Xa	
29	R8b	R8b	TF_VIIa_IX ⟶ TF_VIIa + IXa	
30	R12b	R12b	IXa_VIIIa_X ⟶ IXa_VIIIa + Xa	
31	R18b	R18b	Xa_Va_II ⟶ Xa_Va + mIIa	

7.1 Reaction R1

This is a reversible reaction of two reactants forming one product.

Name R1

Reaction equation

$$\mathrm{TF} + \mathrm{VII} \rightleftharpoons \mathrm{TF\_VII} \tag{2}$$

Reactants

Table 6: Properties of each reactant.

Id	Name	SBO
TF	TF	0000010
VII	VII	0000010

Product

Table 7: Properties of each product.

Id	Name	SBO
TF_VII	TF_VII	0000011

Kinetic Law

SBO:0000101 mass action rate law for second order forward, first order reverse, reversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_1 = \mathrm{vol}\left(\mathrm{compartment\_1}\right) \cdot \left(\mathrm{k2} \cdot [\mathrm{TF}] \cdot [\mathrm{VII}] - \mathrm{k1} \cdot [\mathrm{TF\_VII}]\right) \tag{3}$$

7.2 Reaction R2

This is a reversible reaction of two reactants forming one product.

Name R2

Reaction equation

$$\mathrm{TF} + \mathrm{VIIa} \rightleftharpoons \mathrm{TF\_VIIa} \tag{4}$$

Reactants

Table 8: Properties of each reactant.

Id	Name	SBO
TF	TF	0000010
VIIa	VIIa	0000010

Product

Table 9: Properties of each product.

Id	Name	SBO
TF_VIIa	TF_VIIa	0000011

Kinetic Law

SBO:0000101 mass action rate law for second order forward, first order reverse, reversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_2 = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot (\mathrm{k4} \cdot [\mathrm{TF}] \cdot [\mathrm{VIIa}] - \mathrm{k3} \cdot [\mathrm{TF\_VIIa}]) \tag{5}$$

7.3 Reaction R3

This is an irreversible reaction of two reactants forming two products.

Name R3

Reaction equation

$$\mathrm{TF\_VIIa} + \mathrm{VII} \longrightarrow \mathrm{TF\_VIIa} + \mathrm{VIIa} \tag{6}$$

Reactants

Table 10: Properties of each reactant.

Id	Name	SBO
TF_VIIa	TF_VIIa	0000461
VII	VII	0000010

Products

Table 11: Properties of each product.

Id	Name	SBO
TF_VIIa	TF_VIIa	0000461
VIIa	VIIa	0000011

Kinetic Law

SBO:0000045 mass action rate law for second order irreversible reactions

Derived unit contains undeclared units

$$v_3 = \mathrm{vol}\left(\mathrm{compartment\_1}\right) \cdot \mathrm{k5} \cdot [\mathrm{TF\_VIIa}] \cdot [\mathrm{VII}] \tag{7}$$

7.4 Reaction R4

This is an irreversible reaction of two reactants forming two products.

Name R4

Reaction equation

$$\mathrm{Xa} + \mathrm{VII} \longrightarrow \mathrm{Xa} + \mathrm{VIIa} \tag{8}$$

Reactants

Table 12: Properties of each reactant.

Id	Name	SBO
Xa	Xa	0000461
VII	VII	0000010

Products

Table 13: Properties of each product.

Id	Name	SBO
Xa	Xa	0000461
VIIa	VIIa	0000011

Kinetic Law

SBO:0000045 mass action rate law for second order irreversible reactions

Derived unit contains undeclared units

$$v_4 = \mathrm{vol}(\mathrm{compartment\_1}) \cdot \mathrm{k6} \cdot [\mathrm{Xa}] \cdot [\mathrm{VII}] \tag{9}$$

7.5 Reaction R5

This is an irreversible reaction of two reactants forming two products.

Name R5

Reaction equation

$$\mathrm{IIa} + \mathrm{VII} \longrightarrow \mathrm{IIa} + \mathrm{VIIa} \tag{10}$$

Reactants

Table 14: Properties of each reactant.

Id	Name	SBO
IIa	IIa	0000461
VII	VII	0000010

Products

Table 15: Properties of each product.

Id	Name	SBO
IIa	IIa	0000461
VIIa	VIIa	0000011

Kinetic Law

SBO:0000045 mass action rate law for second order irreversible reactions

Derived unit contains undeclared units

$$v_5 = \mathrm{vol}(\mathrm{compartment\_1}) \cdot \mathrm{k7} \cdot [\mathrm{IIa}] \cdot [\mathrm{VII}] \tag{11}$$

7.6 Reaction R6

This is a reversible reaction of two reactants forming one product.

Name R6

Reaction equation

$$\mathrm{TF\_VIIa} + \mathrm{X} \rightleftharpoons \mathrm{TF\_VIIa\_X} \tag{12}$$

Reactants

Table 16: Properties of each reactant.

Id	Name	SBO
TF_VIIa	TF_VIIa	0000010
X	X	0000010

Product

Table 17: Properties of each product.

Id	Name	SBO
TF_VIIa_X	TF_VIIa_X	0000011

Kinetic Law

SBO:0000101 mass action rate law for second order forward, first order reverse, reversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_6 = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot (\mathrm{k9} \cdot [\mathrm{TF\_VIIa}] \cdot [\mathrm{X}] - \mathrm{k8} \cdot [\mathrm{TF\_VIIa\_X}]) \tag{13}$$

7.7 Reaction R7

This is a reversible reaction of two reactants forming one product.

Name R7

Reaction equation

$$\mathrm{TF\_VIIa} + \mathrm{Xa} \rightleftharpoons \mathrm{TF\_VIIa\_Xa} \tag{14}$$

Reactants

Table 18: Properties of each reactant.

Id	Name	SBO
TF_VIIa	TF_VIIa	0000010
Xa	Xa	0000010

Product

Table 19: Properties of each product.

Id	Name	SBO
TF_VIIa_Xa	TF_VIIa_Xa	0000011

Kinetic Law

SBO:0000101 mass action rate law for second order forward, first order reverse, reversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_7 = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot (\mathrm{k12} \cdot [\mathrm{TF\_VIIa}] \cdot [\mathrm{Xa}] - \mathrm{k11} \cdot [\mathrm{TF\_VIIa\_Xa}]) \tag{15}$$

7.8 Reaction R8

This is a reversible reaction of two reactants forming one product.

Name R8

Reaction equation

$$\mathrm{TF\_VIIa} + \mathrm{IX} \rightleftharpoons \mathrm{TF\_VIIa\_IX} \tag{16}$$

Reactants

Table 20: Properties of each reactant.

Id	Name	SBO
TF_VIIa	TF_VIIa	0000010
IX	IX	0000010

Product

Table 21: Properties of each product.

Id	Name	SBO
TF_VIIa_IX	TF_VIIa_IX	0000011

Kinetic Law

SBO:0000101 mass action rate law for second order forward, first order reverse, reversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_8 = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot (\mathrm{k14} \cdot [\mathrm{TF\_VIIa}] \cdot [\mathrm{IX}] - \mathrm{k13} \cdot [\mathrm{TF\_VIIa\_IX}]) \tag{17}$$

7.9 Reaction R9

This is an irreversible reaction of two reactants forming two products.

Name R9

Reaction equation

$$\mathrm{Xa} + \mathrm{II} \longrightarrow \mathrm{Xa} + \mathrm{IIa} \tag{18}$$

Reactants

Table 22: Properties of each reactant.

Id	Name	SBO
Xa	Xa	0000461
II	II	0000010

Products

Table 23: Properties of each product.

Id	Name	SBO
Xa	Xa	0000461
IIa	IIa	0000011

Kinetic Law

SBO:0000045 mass action rate law for second order irreversible reactions

Derived unit contains undeclared units

$$v_9 = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot \mathrm{k16} \cdot [\mathrm{Xa}] \cdot [\mathrm{II}] \tag{19}$$

7.10 Reaction R10

This is an irreversible reaction of two reactants forming two products.

Name R10

Reaction equation

$$\mathrm{IIa} + \mathrm{VIII} \longrightarrow \mathrm{IIa} + \mathrm{VIIIa} \tag{20}$$

Reactants

Table 24: Properties of each reactant.

Id	Name	SBO
IIa	IIa	0000461
VIII	VIII	0000010

Products

Table 25: Properties of each product.

Id	Name	SBO
IIa	IIa	0000461
VIIIa	VIIIa	0000011

Kinetic Law

SBO:0000045 mass action rate law for second order irreversible reactions

Derived unit contains undeclared units

$$v_{10} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot \mathrm{k17} \cdot [\mathrm{IIa}] \cdot [\mathrm{VIII}] \tag{21}$$

7.11 Reaction R11

This is a reversible reaction of two reactants forming one product.

Name R11

Reaction equation

$$\mathrm{IXa} + \mathrm{VIIIa} \rightleftharpoons \mathrm{IXa\_VIIIa} \tag{22}$$

Reactants

Table 26: Properties of each reactant.

Id	Name	SBO
IXa	IXa	0000010
VIIIa	VIIIa	0000010

Product

Table 27: Properties of each product.

Id	Name	SBO
IXa_VIIIa	IXa_VIIIa	0000011

Kinetic Law

SBO:0000101 mass action rate law for second order forward, first order reverse, reversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_{11} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot (\mathrm{k19} \cdot [\mathrm{IXa}] \cdot [\mathrm{VIIIa}] - \mathrm{k18} \cdot [\mathrm{IXa\_VIIIa}]) \tag{23}$$

7.12 Reaction R12

This is a reversible reaction of two reactants forming one product.

Name R12

Reaction equation

$$\mathrm{IXa\_VIIIa} + \mathrm{X} \rightleftharpoons \mathrm{IXa\_VIIIa\_X} \tag{24}$$

Reactants

Table 28: Properties of each reactant.

Id	Name	SBO
IXa_VIIIa	IXa_VIIIa	0000010
X	X	0000010

Product

Table 29: Properties of each product.

Id	Name	SBO
IXa_VIIIa_X	IXa_VIIIa_X	0000011

Kinetic Law

SBO:0000101 mass action rate law for second order forward, first order reverse, reversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_{12} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot (\mathrm{k21} \cdot [\mathrm{IXa\_VIIIa}] \cdot [\mathrm{X}] - \mathrm{k20} \cdot [\mathrm{IXa\_VIIIa\_X}]) \tag{25}$$

7.13 Reaction R13

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

Name R13

Reaction equation

$$\mathrm{VIIIa} \rightleftharpoons \mathrm{VIIIa1\_L} + \mathrm{VIIIa2} \tag{26}$$

Reactant

Table 30: Properties of each reactant.

Id	Name	SBO
VIIIa	VIIIa	0000010

Products

Table 31: Properties of each product.

Id	Name	SBO
VIIIa1_L	VIIIa1_L	0000011
VIIIa2	VIIIa2	0000011

Kinetic Law

SBO:0000083 mass action rate law for first order forward, second order reverse, reversible reactions, two products, continuous scheme

Derived unit contains undeclared units

$$v_{13} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot (\mathrm{k24} \cdot [\mathrm{VIIIa}] - \mathrm{k23} \cdot [\mathrm{VIIIa1\_L}] \cdot [\mathrm{VIIIa2}]) \tag{27}$$

7.14 Reaction R14

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

Name R14

Reaction equation

$$\mathrm{IXa\_VIIIa\_X} \longrightarrow \mathrm{VIIIa1\_L} + \mathrm{VIIIa2} + \mathrm{X} + \mathrm{IXa} \tag{28}$$

Reactant

Table 32: Properties of each reactant.

Id	Name	SBO
IXa_VIIIa_X	IXa_VIIIa_X	0000010

Products

Table 33: Properties of each product.

Id	Name	SBO
VIIIa1_L	VIIIa1_L	0000011
VIIIa2	VIIIa2	0000011
X	X	0000011
IXa	IXa	0000011

Kinetic Law

SBO:0000049 mass action rate law for first order irreversible reactions, continuous scheme

Derived unit contains undeclared units

$$v_{14} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot \mathrm{k25} \cdot [\mathrm{IXa\_VIIIa\_X}] \tag{29}$$

7.15 Reaction R15

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

Name R15

Reaction equation

$$\mathrm{IXa\_VIIIa} \longrightarrow \mathrm{VIIIa1\_L} + \mathrm{VIIIa2} + \mathrm{IXa} \tag{30}$$

Reactant

Table 34: Properties of each reactant.

Id	Name	SBO
IXa_VIIIa	IXa_VIIIa	0000010

Products

Table 35: Properties of each product.

Id	Name	SBO
VIIIa1_L	VIIIa1_L	0000011
VIIIa2	VIIIa2	0000011
IXa	IXa	0000011

Kinetic Law

SBO:0000049 mass action rate law for first order irreversible reactions, continuous scheme

Derived unit contains undeclared units

$$v_{15} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot \mathrm{k25} \cdot [\mathrm{IXa\_VIIIa}] \tag{31}$$

7.16 Reaction R16

This is an irreversible reaction of two reactants forming two products.

Name R16

Reaction equation

$$\mathrm{IIa} + \mathrm{V} \longrightarrow \mathrm{IIa} + \mathrm{Va} \tag{32}$$

Reactants

Table 36: Properties of each reactant.

Id	Name	SBO
IIa	IIa	0000461
V	V	0000010

Products

Table 37: Properties of each product.

Id	Name	SBO
IIa	IIa	0000461
Va	Va	0000011

Kinetic Law

SBO:0000045 mass action rate law for second order irreversible reactions

Derived unit contains undeclared units

$$v_{16} = \mathrm{vol}\left(\mathrm{compartment\_1}\right) \cdot \mathrm{k26} \cdot [\mathrm{IIa}] \cdot [\mathrm{V}] \tag{33}$$

7.17 Reaction R17

This is a reversible reaction of two reactants forming one product.

Name R17

Reaction equation

$$\mathrm{Xa} + \mathrm{Va} \rightleftharpoons \mathrm{Xa\_Va} \tag{34}$$

Reactants

Table 38: Properties of each reactant.

Id	Name	SBO
Xa	Xa	0000010
Va	Va	0000010

Product

Table 39: Properties of each product.

Id	Name	SBO
Xa_Va	Xa_Va	0000011

Kinetic Law

SBO:0000101 mass action rate law for second order forward, first order reverse, reversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_{17} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot (\mathrm{k28} \cdot [\mathrm{Xa}] \cdot [\mathrm{Va}] - \mathrm{k27} \cdot [\mathrm{Xa\_Va}]) \tag{35}$$

7.18 Reaction R18

This is a reversible reaction of two reactants forming one product.

Name R18

Reaction equation

$$\mathrm{Xa\_Va} + \mathrm{II} \rightleftharpoons \mathrm{Xa\_Va\_II} \tag{36}$$

Reactants

Table 40: Properties of each reactant.

Id	Name	SBO
Xa_Va	Xa_Va	0000010
II	II	0000010

Product

Table 41: Properties of each product.

Id	Name	SBO
Xa_Va_II	Xa_Va_II	0000011

Kinetic Law

SBO:0000101 mass action rate law for second order forward, first order reverse, reversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_{18} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot (\mathrm{k30} \cdot [\mathrm{Xa\_Va}] \cdot [\mathrm{II}] - \mathrm{k29} \cdot [\mathrm{Xa\_Va\_II}]) \tag{37}$$

7.19 Reaction R19

This is an irreversible reaction of two reactants forming two products.

Name R19

Reaction equation

$$\mathrm{mIIa} + \mathrm{Xa\_Va} \longrightarrow \mathrm{IIa} + \mathrm{Xa\_Va} \tag{38}$$

Reactants

Table 42: Properties of each reactant.

Id	Name	SBO
mIIa	mIIa	0000010
Xa_Va	Xa_Va	0000461

Products

Table 43: Properties of each product.

Id	Name	SBO
IIa	IIa	0000011
Xa_Va	Xa_Va	0000461

Kinetic Law

SBO:0000045 mass action rate law for second order irreversible reactions

Derived unit contains undeclared units

$$v_{19} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot \mathrm{k32} \cdot [\mathrm{mIIa}] \cdot [\mathrm{Xa\_Va}] \tag{39}$$

7.20 Reaction R20

This is a reversible reaction of two reactants forming one product.

Name R20

Reaction equation

$$\mathrm{Xa} + \mathrm{TFPI} \rightleftharpoons \mathrm{Xa\_TFPI} \tag{40}$$

Reactants

Table 44: Properties of each reactant.

Id	Name	SBO
Xa	Xa	0000010
TFPI	TFPI	0000010

Product

Table 45: Properties of each product.

Id	Name	SBO
Xa_TFPI	Xa_TFPI	0000011

Kinetic Law

SBO:0000101 mass action rate law for second order forward, first order reverse, reversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_{20} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot (\mathrm{k34} \cdot [\mathrm{Xa}] \cdot [\mathrm{TFPI}] - \mathrm{k33} \cdot [\mathrm{Xa\_TFPI}]) \tag{41}$$

7.21 Reaction R21

This is a reversible reaction of two reactants forming one product.

Name R21

Reaction equation

$$\mathrm{TF\_VIIa\_Xa} + \mathrm{TFPI} \rightleftharpoons \mathrm{TF\_VIIa\_Xa\_TFPI} \tag{42}$$

Reactants

Table 46: Properties of each reactant.

Id	Name	SBO
TF_VIIa_Xa	TF_VIIa_Xa	0000010
TFPI	TFPI	0000010

Product

Table 47: Properties of each product.

Id	Name	SBO
TF_VIIa_Xa_TFPI	TF_VIIa_Xa_TFPI	0000011

Kinetic Law

SBO:0000101 mass action rate law for second order forward, first order reverse, reversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_{21} = \mathrm{vol}(\mathrm{compartment\_1}) \cdot (\mathrm{k36} \cdot [\mathrm{TF\_VIIa\_Xa}] \cdot [\mathrm{TFPI}] - \mathrm{k35} \cdot [\mathrm{TF\_VIIa\_Xa\_TFPI}]) \tag{43}$$

7.22 Reaction R22

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

Name R22

Reaction equation

$$\mathrm{TF\_VIIa} + \mathrm{Xa\_TFPI} \longrightarrow \mathrm{TF\_VIIa\_Xa\_TFPI} \tag{44}$$

Reactants

Table 48: Properties of each reactant.

Id	Name	SBO
TF_VIIa	TF_VIIa	0000010
Xa_TFPI	Xa_TFPI	0000010

Product

Table 49: Properties of each product.

Id	Name	SBO
TF_VIIa_Xa_TFPI	TF_VIIa_Xa_TFPI	0000011

Kinetic Law

SBO:0000054 mass action rate law for second order irreversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_{22} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot \mathrm{k37} \cdot [\mathrm{TF\_VIIa}] \cdot [\mathrm{Xa\_TFPI}] \tag{45}$$

7.23 Reaction R23

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

Name R23

Reaction equation

$$\mathrm{Xa} + \mathrm{ATIII} \longrightarrow \mathrm{Xa\_ATIII} \tag{46}$$

Reactants

Table 50: Properties of each reactant.

Id	Name	SBO
Xa	Xa	0000010
ATIII	ATIII	0000010

Product

Table 51: Properties of each product.

Id	Name	SBO
Xa_ATIII	Xa_ATIII	0000011

Kinetic Law

SBO:0000054 mass action rate law for second order irreversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_{23} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot \mathrm{k38} \cdot [\mathrm{Xa}] \cdot [\mathrm{ATIII}] \tag{47}$$

7.24 Reaction R24

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

Name R24

Reaction equation

$$\mathrm{mIIa} + \mathrm{ATIII} \longrightarrow \mathrm{mIIa\_ATIII} \tag{48}$$

Reactants

Table 52: Properties of each reactant.

Id	Name	SBO
mIIa	mIIa	0000010
ATIII	ATIII	0000010

Product

Table 53: Properties of each product.

Id	Name	SBO
mIIa_ATIII	mIIa_ATIII	0000011

Kinetic Law

SBO:0000054 mass action rate law for second order irreversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_{24} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot \mathrm{k39} \cdot [\mathrm{mIIa}] \cdot [\mathrm{ATIII}] \tag{49}$$

7.25 Reaction R25

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

Name R25

Reaction equation

$$\mathrm{IXa} + \mathrm{ATIII} \longrightarrow \mathrm{IXa\_ATIII} \tag{50}$$

Reactants

Table 54: Properties of each reactant.

Id	Name	SBO
IXa	IXa	0000010
ATIII	ATIII	0000010

Product

Table 55: Properties of each product.

Id	Name	SBO
IXa_ATIII	IXa_ATIII	0000011

Kinetic Law

SBO:0000054 mass action rate law for second order irreversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_{25} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot \mathrm{k40} \cdot [\mathrm{IXa}] \cdot [\mathrm{ATIII}] \tag{51}$$

7.26 Reaction R26

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

Name R26

Reaction equation

$$\mathrm{IIa} + \mathrm{ATIII} \longrightarrow \mathrm{IIa\_ATIII} \tag{52}$$

Reactants

Table 56: Properties of each reactant.

Id	Name	SBO
IIa	IIa	0000010
ATIII	ATIII	0000010

Product

Table 57: Properties of each product.

Id	Name	SBO
IIa_ATIII	IIa_ATIII	0000011

Kinetic Law

SBO:0000054 mass action rate law for second order irreversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_{26} = \mathrm{vol}\left(\mathrm{compartment\_1}\right) \cdot \mathrm{k41} \cdot [\mathrm{IIa}] \cdot [\mathrm{ATIII}] \tag{53}$$

7.27 Reaction R27

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

Name R27

Reaction equation

$$\mathrm{TF\_VIIa} + \mathrm{ATIII} \longrightarrow \mathrm{TF\_VIIa\_ATIII} \tag{54}$$

Reactants

Table 58: Properties of each reactant.

Id	Name	SBO
TF_VIIa	TF_VIIa	0000010
ATIII	ATIII	0000010

Product

Table 59: Properties of each product.

Id	Name	SBO
TF_VIIa_ATIII	TF_VIIa_ATIII	0000011

Kinetic Law

SBO:0000054 mass action rate law for second order irreversible reactions, two reactants, continuous scheme

Derived unit contains undeclared units

$$v_{27} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot \mathrm{k42} \cdot [\mathrm{TF\_VIIa}] \cdot [\mathrm{ATIII}] \tag{55}$$

7.28 Reaction R6b

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

Name R6b

Reaction equation

$$\mathrm{TF\_VIIa\_X} \longrightarrow \mathrm{TF\_VIIa\_Xa} \tag{56}$$

Reactant

Table 60: Properties of each reactant.

Id	Name	SBO
TF_VIIa_X	TF_VIIa_X	0000010

Product

Table 61: Properties of each product.

Id	Name	SBO
TF_VIIa_Xa	TF_VIIa_Xa	0000011

Kinetic Law

SBO:0000049 mass action rate law for first order irreversible reactions, continuous scheme

Derived unit contains undeclared units

$$v_{28} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot \mathrm{k10} \cdot [\mathrm{TF\_VIIa\_X}] \tag{57}$$

7.29 Reaction R8b

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

Name R8b

Reaction equation

$$\mathrm{TF\_VIIa\_IX} \longrightarrow \mathrm{TF\_VIIa} + \mathrm{IXa} \tag{58}$$

Reactant

Table 62: Properties of each reactant.

Id	Name	SBO
TF_VIIa_IX	TF_VIIa_IX	0000010

Products

Table 63: Properties of each product.

Id	Name	SBO
TF_VIIa	TF_VIIa	0000011
IXa	IXa	0000011

Kinetic Law

SBO:0000049 mass action rate law for first order irreversible reactions, continuous scheme

Derived unit contains undeclared units

$$v_{29} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot \mathrm{k15} \cdot [\mathrm{TF\_VIIa\_IX}] \tag{59}$$

7.30 Reaction R12b

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

Name R12b

Reaction equation

$$\mathrm{IXa\_VIIIa\_X} \longrightarrow \mathrm{IXa\_VIIIa} + \mathrm{Xa} \tag{60}$$

Reactant

Table 64: Properties of each reactant.

Id	Name	SBO
IXa_VIIIa_X	IXa_VIIIa_X	0000010

Products

Table 65: Properties of each product.

Id	Name	SBO
IXa_VIIIa	IXa_VIIIa	0000011
Xa	Xa	0000011

Kinetic Law

SBO:0000049 mass action rate law for first order irreversible reactions, continuous scheme

Derived unit contains undeclared units

$$v_{30} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot \mathrm{k22} \cdot [\mathrm{IXa\_VIIIa\_X}] \tag{61}$$

7.31 Reaction R18b

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

Name R18b

Reaction equation

$$\mathrm{Xa\_Va\_II} \longrightarrow \mathrm{Xa\_Va} + \mathrm{mIIa} \tag{62}$$

Reactant

Table 66: Properties of each reactant.

Id	Name	SBO
Xa_Va_II	Xa_Va_II	0000010

Products

Table 67: Properties of each product.

Id	Name	SBO
Xa_Va	Xa_Va	0000011
mIIa	mIIa	0000011

Kinetic Law

SBO:0000049 mass action rate law for first order irreversible reactions, continuous scheme

Derived unit contains undeclared units

$$v_{31} = \mathrm{vol}\,(\mathrm{compartment\_1}) \cdot \mathrm{k31} \cdot [\mathrm{Xa\_Va\_II}] \tag{63}$$

8 Derived Rate Equations

When interpreted as an ordinary differential equation framework, this model implies the following set of equations for the rates of change of each species.

Identifiers for kinetic laws highlighted in gray cannot be verified to evaluate to units of SBML `substance` per `time`. As a result, some SBML interpreters may not be able to verify the consistency of the units on quantities in the model. Please check if

- parameters without an unit definition are involved or
- volume correction is necessary because the `hasOnlySubstanceUnits` flag may be set to `false` and `spacialDimensions`> 0 for certain species.

8.1 Species TF

Name TF

Initial concentration $2.5 \cdot 10^{-11}\ \mathrm{mol} \cdot \mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in R1, R2).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TF} = -\,v_1 - v_2 \tag{64}$$

8.2 Species TF_VII

Name TF_VII

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

This species takes part in one reaction (as a product in R1).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TF\_VII} = v_1 \tag{65}$$

8.3 Species VII

Name VII

Initial concentration $10^{-8}\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in four reactions (as a reactant in R1, R3, R4, R5).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{VII} = -v_1 - v_3 - v_4 - v_5 \tag{66}$$

8.4 Species TF_VIIa

Name TF_VIIa

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

This species takes part in nine reactions (as a reactant in R3, R6, R7, R8, R22, R27 and as a product in R2, R3, R8b).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TF\_VIIa} = v_2 + v_3 + v_{29} - v_3 - v_6 - v_7 - v_8 - v_{22} - v_{27} \tag{67}$$

8.5 Species VIIa

Name VIIa

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

This species takes part in four reactions (as a reactant in R2 and as a product in R3, R4, R5).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{VIIa} = v_3 + v_4 + v_5 - v_2 \tag{68}$$

8.6 Species Xa

Name Xa

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

This species takes part in nine reactions (as a reactant in R4, R7, R9, R17, R20, R23 and as a product in R4, R9, R12b).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Xa} = v_4 + v_9 + v_{30} - v_4 - v_7 - v_9 - v_{17} - v_{20} - v_{23} \tag{69}$$

8.7 Species IIa

Name IIa

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

This species takes part in nine reactions (as a reactant in R5, R10, R16, R26 and as a product in R5, R9, R10, R16, R19).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IIa} = v_5 + v_9 + v_{10} + v_{16} + v_{19} - v_5 - v_{10} - v_{16} - v_{26} \tag{70}$$

8.8 Species TF_VIIa_X

Name TF_VIIa_X

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

This species takes part in two reactions (as a reactant in R6b and as a product in R6).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TF\_VIIa\_X} = v_6 - v_{28} \tag{71}$$

8.9 Species X

Name X

Initial concentration $1.6\cdot 10^{-7}\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in three reactions (as a reactant in R6, R12 and as a product in R14).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{X} = v_{14} - v_6 - v_{12} \tag{72}$$

8.10 Species TF_VIIa_Xa

Name TF_VIIa_Xa

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

This species takes part in three reactions (as a reactant in R21 and as a product in R7, R6b).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TF\_VIIa\_Xa} = v_7 + v_{28} - v_{21} \tag{73}$$

8.11 Species IX

Name IX

Initial concentration $9\cdot 10^{-8}\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in one reaction (as a reactant in R8).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IX} = -v_8 \tag{74}$$

8.12 Species TF_VIIa_IX

Name TF_VIIa_IX

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

This species takes part in two reactions (as a reactant in R8b and as a product in R8).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TF\_VIIa\_IX} = v_8 - v_{29} \tag{75}$$

8.13 Species IXa

Name IXa

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

This species takes part in five reactions (as a reactant in R11, R25 and as a product in R14, R15, R8b).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IXa} = v_{14} + v_{15} + v_{29} - v_{11} - v_{25} \tag{76}$$

8.14 Species II

Name II

Initial concentration $1.4\cdot 10^{-6}\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in R9, R18).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{II} = -v_9 - v_{18} \tag{77}$$

8.15 Species VIII

Name VIII

Initial concentration $7 \cdot 10^{-10}\ \mathrm{mol} \cdot \mathrm{l}^{-1}$

This species takes part in one reaction (as a reactant in R10).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{VIII} = -v_{10} \tag{78}$$

8.16 Species VIIIa

Name VIIIa

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

This species takes part in three reactions (as a reactant in R11, R13 and as a product in R10).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{VIIIa} = v_{10} - v_{11} - v_{13} \tag{79}$$

8.17 Species IXa_VIIIa

Name IXa_VIIIa

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

This species takes part in four reactions (as a reactant in R12, R15 and as a product in R11, R12b).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IXa\_VIIIa} = v_{11} + v_{30} - v_{12} - v_{15} \tag{80}$$

8.18 Species IXa_VIIIa_X

Name IXa_VIIIa_X

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

This species takes part in three reactions (as a reactant in R14, R12b and as a product in R12).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IXa\_VIIIa\_X} = v_{12} - v_{14} - v_{30} \tag{81}$$

8.19 Species VIIIa1_L

Name VIIIa1_L

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

This species takes part in three reactions (as a product in R13, R14, R15).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{VIIIa1\_L} = v_{13} + v_{14} + v_{15} \tag{82}$$

8.20 Species VIIIa2

Name VIIIa2

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

This species takes part in three reactions (as a product in R13, R14, R15).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{VIIIa2} = v_{13} + v_{14} + v_{15} \tag{83}$$

8.21 Species V

Name V

Initial concentration $2\cdot 10^{-8}\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in one reaction (as a reactant in R16).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{V} = -v_{16} \tag{84}$$

8.22 Species Va

Name Va

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

This species takes part in two reactions (as a reactant in R17 and as a product in R16).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Va} = v_{16} - v_{17} \tag{85}$$

8.23 Species Xa_Va

Name Xa_Va

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

This species takes part in five reactions (as a reactant in R18, R19 and as a product in R17, R19, R18b).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Xa\_Va} = v_{17} + v_{19} + v_{31} - v_{18} - v_{19} \tag{86}$$

8.24 Species Xa_Va_II

Name Xa_Va_II

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

This species takes part in two reactions (as a reactant in R18b and as a product in R18).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Xa\_Va\_II} = v_{18} - v_{31} \tag{87}$$

8.25 Species mIIa

Name mIIa

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

This species takes part in three reactions (as a reactant in R19, R24 and as a product in R18b).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{mIIa} = v_{31} - v_{19} - v_{24} \tag{88}$$

8.26 Species TFPI

Name TFPI

Initial concentration $2.5\cdot 10^{-9}\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in two reactions (as a reactant in R20, R21).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TFPI} = -v_{20} - v_{21} \tag{89}$$

8.27 Species Xa_TFPI

Name Xa_TFPI

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

This species takes part in two reactions (as a reactant in R22 and as a product in R20).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Xa\_TFPI} = v_{20} - v_{22} \tag{90}$$

8.28 Species TF_VIIa_Xa_TFPI

Name TF_VIIa_Xa_TFPI

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

This species takes part in two reactions (as a product in R21, R22).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TF\_VIIa\_Xa\_TFPI} = v_{21} + v_{22} \tag{91}$$

8.29 Species ATIII

Name ATIII

Initial concentration $3.4\cdot 10^{-6}\ \mathrm{mol}\cdot\mathrm{l}^{-1}$

This species takes part in five reactions (as a reactant in R23, R24, R25, R26, R27).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{ATIII} = -v_{23} - v_{24} - v_{25} - v_{26} - v_{27} \tag{92}$$

8.30 Species Xa_ATIII

Name Xa_ATIII

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

This species takes part in one reaction (as a product in R23).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Xa\_ATIII} = v_{23} \tag{93}$$

8.31 Species mIIa_ATIII

Name mIIa_ATIII

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

This species takes part in one reaction (as a product in R24).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{mIIa\_ATIII} = v_{24} \tag{94}$$

8.32 Species IXa_ATIII

Name IXa_ATIII

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

This species takes part in one reaction (as a product in R25).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IXa\_ATIII} = v_{25} \tag{95}$$

8.33 Species IIa_ATIII

Name IIa_ATIII

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

This species takes part in one reaction (as a product in R26).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{IIa\_ATIII} = v_{26} \tag{96}$$

8.34 Species TF_VIIa_ATIII

Name TF_VIIa_ATIII

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

This species takes part in one reaction (as a product in R27).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{TF\_VIIa\_ATIII} = v_{27} \tag{97}$$

A Glossary of Systems Biology Ontology Terms

SBO:0000010 reactant: Substance consumed by a chemical reaction. Reactants react with each other to form the products of a chemical reaction. In a chemical equation the Reactants are the elements or compounds on the left hand side of the reaction equation. A reactant can be consumed and produced by the same reaction, its global quantity remaining unchanged

SBO:0000011 product: Substance that is produced in a reaction. In a chemical equation the Products are the elements or compounds on the right hand side of the reaction equation. A product can be produced and consumed by the same reaction, its global quantity remaining unchanged

SBO:0000035 forward unimolecular rate constant, continuous case: Numerical parameter that quantifies the forward velocity of a chemical reaction involving only one reactant. This parameter encompasses all the contributions to the velocity except the quantity of the reactant. It is to be used in a reaction modelled using a continuous framework

SBO:0000036 forward bimolecular rate constant, continuous case: Numerical parameter that quantifies the forward velocity of a chemical reaction involving two reactants. This parameter encompasses all the contributions to the velocity except the quantity of the reactants. It is to be used in a reaction modelled using a continuous framework

SBO:0000038 reverse unimolecular rate constant, continuous case: Numerical parameter that quantifies the reverse velocity of a chemical reaction involving only one product. This parameter encompasses all the contributions to the velocity except the quantity of the product. It is to be used in a reaction modelled using a continuous framework

SBO:0000039 reverse bimolecular rate constant, continuous case: Numerical parameter that quantifies the reverse velocity of a chemical reaction involving only one product. This parameter encompasses all the contributions to the velocity except the quantity of the product. It is to be used in a reaction modelled using a continuous framework

SBO:0000045 mass action rate law for second order irreversible reactions: Reaction scheme where the products are created from the reactants and the change of a product quantity is proportional to the product of reactant activities. The reaction scheme does not include any reverse process that creates the reactants from the products. The change of a product quantity is proportional to two reactant quantity

SBO:0000049 mass action rate law for first order irreversible reactions, continuous scheme: Reaction scheme where the products are created from the reactants and the change of a product quantity is proportional to the product of reactant activities. The reaction scheme does not include any reverse process that creates the reactants from the products. The change of a product quantity is proportional to the quantity of one reactant. It is to be used in a reaction modelled using a continuous framework.

SBO:0000054 mass action rate law for second order irreversible reactions, two reactants, continuous scheme: Reaction scheme where the products are created from the reactants and the change of a product quantity is proportional to the product of reactant activities. The reaction scheme does not include any reverse process that creates the reactants from the products. The change of a product quantity is proportional to the product of two reactant quantities. It is to be used in a reaction modelled using a continuous framework.

SBO:0000083 mass action rate law for first order forward, second order reverse, reversible reactions, two products, continuous scheme: Reaction scheme where the products are created from the reactants and the change of a product quantity is proportional to the product of reactant activities. The reaction scheme does include a reverse process that creates the reactants from the products. The rate of the forward process is proportional to the quantity of one reactant. The rate of the reverse process is proportional to the product of two product quantities. It is to be used in a reaction modelled using a continuous framework.

SBO:0000101 mass action rate law for second order forward, first order reverse, reversible reactions, two reactants, continuous scheme: Reaction scheme where the products are created from the reactants and the change of a product quantity is proportional to the product of reactant activities. The reaction scheme does include a reverse process that creates the reactants from the products. The rate of the forward process is proportional to the product of two reactant quantities. The rate of the reverse process is proportional to the quantity of one product. It is to be used in a reaction modelled using a continuous framework.

SBO:0000461 essential activator: A substance that is absolutely required for occurrence and stimulation of a reaction

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