

Detailed mechanism-driven model of blood coagulation*Table S1. Initial values*

Parameter	Value
TF0	10^{-10} [mol/m ²]
VII0	10^{-5} [mol/m ³] × Dilution
VIIa0	10^{-7} [mol/m ³] × Dilution
X0	1.7×10^{-4} [mol/m ³] × Dilution
Xa0	0 [mol/m ³]
II0	1.4×10^{-3} [mol/m ³] × Dilution
IIa0	0 [mol/m ³]
Fg0	7.6×10^{-3} [mol/m ³] × Dilution
Fn0	0 [mol/m ³]
IXa0	0 [mol/m ³]
IX0	9×10^{-5} [mol/m ³] × Dilution
VIIIa0	0 [mol/m ³]
VIII0	7×10^{-7} [mol/m ³] × Dilution
Va0	0 [mol/m ³]
V0	2×10^{-5} [mol/m ³] × Dilution
XaTFPI0	0 [mol/m ³]
TFPI0	0.25×10^{-6} [mol/m ³] × Dilution
AT0	3.4×10^{-3} [mol/m ³] × Dilution
XIa0	0 [mol/m ³]
XI0	3×10^{-5} [mol/m ³] × Dilution
HC0	0 [mol/m ³]
C1I	1.7×10^{-3} [mol/m ³] × Dilution
a2M0	3×10^{-3} [mol/m ³]
a1AT	4×10^{-2} [mol/m ³] × Dilution
a2AP	1.1×10^{-3} [mol/m ³] × Dilution
PCI	8.8×10^{-5} [mol/m ³] × Dilution
S0	0.4 [mol/m ³]
TFden	0.8×10^{-10} [mol/m ²]
Dilution	0.67 – 1
PS0	1.31×10^{-4} [mol/m ³] × Dilution
PLi0	TF0 × PLi0_Coef
PLi0_Coef	5000
PLv0	0.2 [mol/m ³] × Dilution
PLe0	0 - 4×10^{-3} [mol/m ³]

Table S2. Constants of reactions on the TF surface

Constant	Value
ka_VIIa_TF	2.6×10^3 [m ³ /(s×mol)]
ka_VII_TF	8.6×10^2 [m ³ /(s×mol)]
kd_VIIaTF	2.3×10^{-4} [1/s]

Constant	Value
kd_VIITF	2.3×10^{-4} [1/s]
kcat_VIITF_Ila	6.1×10^{-2} [1/s]
Ka_X_VIIaTF	10^3 [m ³ /(s×mol)]
Kd_XVIIaTF	0.5 [1/s]
kAct_VII_VIIaTF	434 [m ³ /(s×mol)]
kAct_VIITF_Xa	935 [m ³ /(s×mol)]
kAct_VIITF_VIIaTF	7.5×10^6 [m ² /(s×mol)]
kAct_XVIIaTF	12 [1/s]
Ka_IX_VIIaTF	3×10^4 [m ³ /(s×mol)]
Kd_IXVIIaTF	0.45 [1/s]
Kact_IXVIIaTF	8.6 [1/s]
kAct_VIIa_VIITF	7.2 [m ³ /(s×mol)]

Table S3. Reactions on the TF surface

Reaction	Expression	Unit
sVII_flux	$-k_a_VII_TF \times VII \times TF +$ $kd_VIITF \times VIITF -$ $kAct_VII_VIIaTF \times VII \times VIIaTF$	mol/(m ² ×s)
sVIIa_flux	$-k_a_VIIa_TF \times VIIa \times TF +$ $kd_VIIaTF \times VIIaTF +$ $kAct_VII_VIIaTF \times VII \times VIIaTF$	mol/(m ² ×s)
sVIIaTF_flux	$k_a_VIIa_TF \times VIIa \times TF -$ $kd_VIIaTF \times VIIaTF +$ $kAct_VIITF_Xa \times VIITF \times Xa -$ $k_a_VIIaTF_XaTFPI \times VIIaTF \times XaTFPI$ $+ kd_VIIaTFXaTFPI \times XaTFPI \times VIIaTF -$ $Ka_X_VIIaTF \times X \times VIIaTF +$ $Kd_XVIIaTF \times XVIIaTF -$ $Ka_IX_VIIaTF \times IX \times VIIaTF +$ $Kd_IXVIIaTF \times IXVIIaTF -$ $Ki_VIIaTF_AT \times VIIaTF \times AT -$ $Ki_VIIaTF_HCAT \times VIIaTF \times ATHC +$ $kAct_VIIa_VIITF \times VIIa \times VIITF +$ $kAct_XVIIaTF \times XVIIaTF +$ $Kact_IXVIIaTF \times IXVIIaTF +$ $kAct_VIITF_VIIaTF \times VIIaTF \times VIITF$	mol/(m ² ×s)
sVIITF_flux	$k_a_VII_TF \times VII \times TF -$ $kd_VIITF \times VIITF -$ $kAct_VIITF_Xa \times VIITF \times Xa -$ $kAct_VIITF_VIIaTF \times VIIaTF \times VIITF -$ $kAct_VIIa_VIITF \times VIIa \times VIITF$	mol/(m ² ×s)
sX_flux	$-Ka_X_VIIaTF \times X \times VIIaTF +$ $Kd_XVIIaTF \times XVIIaTF$	mol/(m ² ×s)
sXa_flux	$kAct_XVIIaTF \times XVIIaTF$	mol/(m ² ×s)
sTF_flux	$-k_a_VIIa_TF \times VIIa \times TF +$ $kd_VIIaTF \times VIIaTF -$	mol/(m ² ×s)

Reaction	Expression	Unit
	$ka_VII_TF \times VII \times TF + kd_VIITF \times VIITF$	
sXVIIaTF_flux	$Ka_X_VIIaTF \times X \times VIIaTF - Kd_XVIIaTF \times XVIIaTF - kAct_XVIIaTF \times XVIIaTF$	mol/(m ² ×s)
sXaTFPI_flux	$-ka_VIIaTF_XaTFPI \times XaTFPI \times VIIaTF + kd_VIIaTFXaTFPI \times XaTFPIVIIaTF$	mol/(m ² ×s)
sXaTFPIVIIaTF_flux	$ka_VIIaTF_XaTFPI \times XaTFPI \times VIIaTF - kd_VIIaTFXaTFPI \times XaTFPIVIIaTF$	mol/(m ² ×s)
sIXVIIaTF_flux	$Ka_IX_VIIaTF \times IX \times VIIaTF - Kd_IXVIIaTF \times IXVIIaTF - Kact_IXVIIaTF \times IXVIIaTF$	mol/(m ² ×s)
sIX_flux	$-Ka_IX_VIIaTF \times IX \times VIIaTF + Kd_IXVIIaTF \times IXVIIaTF$	mol/(m ² ×s)
sIXa_flux	$Kact_IXVIIaTF \times IXVIIaTF$	mol/(m ² ×s)
sPL_flux	$ni \times (-ka_VII_TF \times VII \times TF + kd_VIITF \times VIITF - ka_VIIa_TF \times VIIa \times TF + kd_VIIaTF \times VIIaTF - Ka_X_VIIaTF \times X \times VIIaTF + Kd_XVIIaTF \times XVIIaTF + kAct_XVIIaTF \times XVIIaTF - ka_VIIaTF_XaTFPI \times XaTFPI \times VIIaTF + kd_VIIaTFXaTFPI \times XaTFPIVIIaTF - Ka_IX_VIIaTF \times IX \times VIIaTF + Kd_IXVIIaTF \times IXVIIaTF + Kact_IXVIIaTF \times IXVIIaTF)$	mol/(m ² ×s)

Table S4. Inhibition constants

Constant	Value
ka_VIIaTF_XaTFPI	3.8×10^5 [m ³ /(s×mol)]
ka_Xa_TFPI	9×10^4 [m ³ /(s×mol)]
kd_XaTFPI	3.6×10^{-3} [1/s]
ka_IXa_ATIII	0.22 [m ³ /(s×mol)]
ka_Xa_ATIII	2.5 [m ³ /(s×mol)]
ka_Xa_a2M	1.4 [m ³ /(s×mol)]
ka_Xa_a1AT	0.227 [m ³ /(s×mol)]
ka_Xa_PCI	20 [m ³ /(s×mol)]
ka_XaVaB_ATIII	0.14 [m ³ /(s×mol)]
ka_Ila_ATIII	5.6 [m ³ /(s×mol)]
ka_Ila_a2M	0.488 [m ³ /(s×mol)]
ka_Ila_a1AT	0.1085 [m ³ /(s×mol)]
ka_Ila_PCI	6.17 [m ³ /(s×mol)]
ka_Ila_HCII	1.05 [m ³ /(s×mol)]
ka_XIa_ATIII	8×10^{-3} [m ³ /(s×mol)]
ka_XIa_a2AP	0.011 [m ³ /(s×mol)]

Constant	Value
ka_XIa_a1AT	$2.5 \times 10^{-3} \text{ [m}^3/(\text{s} \times \text{mol})]$
ka_XIa_PCI	$0.0225 \text{ [m}^3/(\text{s} \times \text{mol})]$
ka_XIa_C1I	$6 \times 10^{-3} \text{ [m}^3/(\text{s} \times \text{mol})]$
kd_VIIaTFXaTFPI	$1 \times 10^{-4} \text{ [1/s]}$
h_VIIIa	$5.83 \times 10^{-3} \text{ [1/s]}$
Ka_at3i	$10 \text{ [m}^3/(\text{s} \times \text{mol})]$
Ki_VIIa_HCAT	$0.17 \text{ [m}^3/(\text{s} \times \text{mol})]$
Ki_VIIaTF_AT	$0.45 \text{ [m}^3/(\text{s} \times \text{mol})]$
Ki_VIIaTF_HCAT	$5.6 \text{ [m}^3/(\text{s} \times \text{mol})]$
Kd_HCATweak	1.3 [1/s]
Ka_HC_ATweak	$30 \text{ [m}^3/(\text{s} \times \text{mol})]$
Kcat_HCAT	440 [1/s]
Kcat_HCATweak	1.3 [1/s]
h_IXaVIIIa	$1.7 \times 10^{-4} \text{ [1/s]}$
ka_XaVaBi_ATIII	$0.14 \text{ [m}^2/(\text{s} \times \text{mol})]$

Table S5. Constants of volume reactions

Constant	Value
Ka_Fg_Ila	$4 \times 10^4 \text{ [m}^3/(\text{s} \times \text{mol})]$
Ka_Fn_Ila	$2 \times 10^4 \text{ [m}^3/(\text{s} \times \text{mol})]$
Ka_S_Ila	$15 \text{ [m}^3/(\text{s} \times \text{mol})]$
Ka_S_IlaA2M	$6.1 \text{ [m}^3/(\text{s} \times \text{mol})]$
Ka_Xa_PS	$5.5 \times 10^2 \text{ [m}^3/(\text{s} \times \text{mol})]$
kAct_VII_Xa	$1.3 \times 10^4 \text{ [m}^3/(\text{s} \times \text{mol})]$
Kcat_FgIla	84 [1/s]
Kcat_S_Ila	1.83 [1/s]
Kcat_S_IlaA2M	0.89 [1/s]
Kcat_XI_Ila	$5 \times 10^{-6} \text{ [1/s]}$
Kd_FgIla	200 [1/s]
Kd_FnIla	200 [1/s]
Kd_IlaA2MS	1 [1/s]
Kd_IlaS	2 [1/s]
Kd_XaPS	0.1 [1/s]
Keff_II_Xa	$220 \text{ [m}^3/(\text{s} \times \text{mol})]$
Keff_IX_XIa	$1 \times 10^4 \text{ [m}^3/(\text{s} \times \text{mol})]$
Keff_VIII_Ila	$5 \times 10^3 \text{ [m}^3/(\text{s} \times \text{mol})]$
Keff_VIII_Xa	$1.1 \times 10^3 \text{ [m}^3/(\text{s} \times \text{mol})]$
Keff_X_IXa	$2.5 \text{ [m}^3/(\text{s} \times \text{mol})]$
Keff_XI_XIa	$20 \text{ [m}^3/(\text{s} \times \text{mol})]$
KM_XI_Ila	$5 \times 10^{-5} \text{ [m}^3/(\text{s} \times \text{mol})]$

Table S6. Volume reactions

Reaction	Expression	Unit
a2M_flux	$-(ka_Ila_a2M \times a2M \times Ila + ka_Xa_a2M \times a2M \times Xa)$	$\text{mol}/(\text{m}^3 \times \text{s})$

Reaction	Expression	Unit
AMC_flux	$K_{cat_S_IIa} \times IIaS + K_{cat_S_IIaA2M} \times IIaA2MS$	$\text{mol}/(\text{m}^3 \times \text{s})$
AT_flux	$-(k_{a_IXa_ATIII} \times IXa + k_{a_Xa_ATIII} \times Xa + k_{a_XaVaB_ATIII} \times XaVae + k_{a_XaVaB_ATIII} \times XaVav + k_{a_IIa_ATIII} \times IIa + k_{a_XIa_ATIII} \times XIa) \times AT - AT \times K_{a_at3i} \times (IIaFg + IIaFn) - K_{a_HC_ATweak} \times HC \times AT + K_{d_HCA} Tweak \times ATHCweak$	$\text{mol}/(\text{m}^3 \times \text{s})$
Fg_flux	$-K_{a_Fg_IIa} \times IIa \times Fg + K_{d_FgIIa} \times IIaFg + K_{a_at3i} \times AT \times IIaFg$	$\text{mol}/(\text{m}^3 \times \text{s})$
IIaFg_flux	$K_{a_Fg_IIa} \times IIa \times Fg - K_{d_FgIIa} \times IIaFg - K_{cat_FgIIa} \times IIaFg - K_{a_at3i} \times AT \times IIaFg$	$\text{mol}/(\text{m}^3 \times \text{s})$
Fn_flux	$-K_{a_Fn_IIa} \times IIa \times Fn + K_{d_FnIIa} \times IIaFn + K_{a_at3i} \times AT \times IIaFn$	$\text{mol}/(\text{m}^3 \times \text{s})$
IIaFn_flux	$K_{a_Fn_IIa} \times IIa \times Fn - K_{d_FnIIa} \times IIaFn - K_{a_at3i} \times AT \times IIaFn + K_{cat_FgIIa} \times IIaFg$	$\text{mol}/(\text{m}^3 \times \text{s})$
HC_flux	$-K_{a_HC_ATweak} \times HC \times AT + K_{d_HCA} Tweak \times ATHCweak$	$\text{mol}/(\text{m}^3 \times \text{s})$
ATHC_flux	$K_{cat_HCA} T \times ATHCweak - K_{cat_HCA} Tweak \times ATHC$	$\text{mol}/(\text{m}^3 \times \text{s})$
ATHCweak_flux	$K_{a_HC_ATweak} \times HC \times AT - K_{d_HCA} Tweak \times ATHCweak - K_{cat_HCA} T \times ATHCweak + K_{cat_HCA} Tweak \times ATHC$	$\text{mol}/(\text{m}^3 \times \text{s})$
II_flux	$-K_{eff_II_Xa} \times II \times Xa$	$\text{mol}/(\text{m}^3 \times \text{s})$
IIa_flux	$K_{eff_II_Xa} \times II \times Xa - (k_{a_IIa_ATIII} \times AT + k_{a_IIa_a2M} \times a2M + k_{a_IIa_a1AT} \times a1AT + k_{a_IIa_PCI} \times PCI) \times IIa - K_{a_Fg_IIa} \times IIa \times Fg + K_{d_FgIIa} \times IIaFg - K_{a_Fn_IIa} \times IIa \times Fn + K_{d_FnIIa} \times IIaFn - (K_{a_S_IIa} \times S \times IIa - K_{d_IIaS} \times IIaS - K_{cat_S_IIa} \times IIaS)$	$\text{mol}/(\text{m}^3 \times \text{s})$

Reaction	Expression	Unit
Ilaa2M_flux	$ka_Ila_a2M \times a2M \times Ila - Ka_S_IlaA2M \times S \times Ilaa2M + Kd_IlaA2MS \times Ilaa2MS + Kcat_S_IlaA2M \times Ilaa2MS$	mol/(m ³ ×s)
Ilaa2MS_flux	$Ka_S_IlaA2M \times S \times Ilaa2M - Kd_IlaA2MS \times Ilaa2MS - Kcat_S_IlaA2M \times Ilaa2MS$	mol/(m ³ ×s)
IlaS_flux	$Ka_S_Ila \times S \times Ila - Kd_IlaS \times IlaS - Kcat_S_Ila \times IlaS$	mol/(m ³ ×s)
IX_flux	$-Keff_IX_XIa \times IX \times XIa$	mol/(m ³ ×s)
IXa_flux	$Keff_IX_XIa \times IX \times XIa - ka_IXa_ATIII \times AT \times IXa$	mol/(m ³ ×s)
PS_flux	$-Ka_Xa_PS \times Xa \times PS + Kd_XaPS \times XaPS - Ka_Xa_PS \times X \times PS + Kd_XaPS \times XPS$	mol/(m ³ ×s)
S_flux	$-Ka_S_Ila \times S \times Ila + Kd_IlaS \times IlaS - Ka_S_IlaA2M \times S \times Ilaa2M + Kd_IlaA2MS \times Ilaa2MS$	mol/(m ³ ×s)
TFPI_flux	$-ka_Xa_TFPI \times Xa \times TFPI + kd_XaTFPI \times XaTFPI$	mol/(m ³ ×s)
V_flux	0	
Va_flux	0	
VII_flux	$-kAct_VII_Xa \times VII \times Xa$	mol/(m ³ ×s)
VIIa_flux	$kAct_VII_Xa \times VII \times Xa$	mol/(m ³ ×s)
VIII_flux	0	
VIIIa_flux	$-h_VIIIa \times VIIIa$	mol/(m ³ ×s)
X_flux	$-Keff_X_IXa \times X \times IXa - Ka_Xa_PS \times X \times PS + Kd_XaPS \times XPS$	mol/(m ³ ×s)
Xa_flux	$Keff_X_IXa \times X \times IXa - Ka_Xa_PS \times Xa \times PS + Kd_XaPS \times XaPS - (ka_Xa_ATIII \times AT + ka_Xa_a2M \times a2M + ka_Xa_a1AT \times a1AT + ka_Xa_PCI \times PCI) \times Xa - ka_Xa_TFPI \times Xa \times TFPI + kd_XaTFPI \times XaTFPI$	mol/(m ³ ×s)
XaPS_flux	$Ka_Xa_PS \times Xa \times PS - Kd_XaPS \times XaPS$	mol/(m ³ ×s)
XPS_flux	$Ka_Xa_PS \times X \times PS - Kd_XaPS \times XPS$	mol/(m ³ ×s)
XaTFPI_flux	$ka_Xa_TFPI \times Xa \times TFPI - kd_XaTFPI \times XaTFPI$	mol/(m ³ ×s)

Reaction	Expression	Unit
XI_flux	$-K_{cat_XI_IIa} \times XI \times (IIa) / (K_{M_XI_IIa} + XI) - K_{eff_XI_XIa} \times XI \times XIa$	mol/(m ³ ×s)
XIa_flux	$K_{cat_XI_IIa} \times XI \times (IIa) / (K_{M_XI_IIa} + XI) - (k_{a_XIa_ATIII} \times AT + k_{a_XIa_a2AP} \times a2AP + k_{a_XIa_a1AT} \times a1AT + k_{a_XIa_PCI} \times PCI + k_{a_XIa_C1I} \times C1I) \times XIa + K_{eff_XI_XIa} \times XI \times XIa$	mol/(m ³ ×s)

Table S7. Constants of reactions on the TF-containing lipids

Constant	Value
Ka_II_PLi	15 [m ³ /(s×mol)]
Ka_II_XaVai	4.1×10 ⁴ [m ³ /(s×mol)]
Ka_IXa_VIIIaBi	(1 + X0/1×10 ⁻⁵ [mol/m ³]) ×2.5×10 ⁴ [m ³ /(s×mol)]
Ka_PS_VaBi	1.3×10 ⁴ [m ³ /(s×mol)]
Ka_V_PLi	740 [m ³ /(s×mol)]
Ka_Va_PLi	740 [m ³ /(s×mol)]
Ka_VIII_PLi	630 [m ³ /(s×mol)]
Ka_VIIIa_PLi	780 [m ³ /(s×mol)]
Ka_X_IXaVIIIai	1.8×10 ⁵ [m ³ /(s×mol)]
Ka_Xa_VaBi	4440 [m ³ /(s×mol)]
Ka_XI_VaBi	35 [m ³ /(s×mol)]
Ka_XI_VBi	37.5 [m ³ /(s×mol)]
Kcat_IIaXaVai	108 [1/s]
Kcat_VBi_IIa	2.3 [1/s]
Kcat_VBi_Xa	4.3 [1/s]
Kcat_X_IXaVIIIai	5 [1/s]
Kd_IIBi	2×10 ⁻³ [1/s]
Kd_IIaXaVai	10 [1/s]
Kd_IXaVIIIai	2.2×10 ⁻³ [1/s]
Kd_PSVaBi	0.1 [1/s]
Kd_VaBi	2×10 ⁻³ [1/s]
Kd_VBi	5×10 ⁻³ [1/s]
Kd_VIIIaBi	2.8×10 ⁻⁴ [1/s]
Kd_VIIIBi	1.3×10 ⁻³ [1/s]
Kd_XaVai	2×10 ⁻³ [1/s]
Kd_XIVaBi	1.5×10 ⁻⁴ [1/s]
Kd_XIVBi	1.8×10 ⁻⁴ [1/s]
Kd_XIXaVIIIai	10 [1/s]
Keff_XIVBi_IIa	8 [m ³ /(s×mol)]
KM_VBi_IIa	7.17×10 ⁻⁵ [mol/m ³]
KM_VBi_Xa	1.04×10 ⁻⁵ [mol/m ³]

Constant	Value
ni	100
Ka_IIBi_XaVai	4.1×10^4 [m ² /(s×mol)]

Table S8. Reactions on the TF-containing lipids

Reaction	Expression	Unit
II_i_flux	$-K_{a_II_PLi} \times II \times PLi + K_{d_IIBi} \times IIBi - K_{a_II_XaVai} \times II \times XaVai + K_{d_IIXaVai} \times IIXaVai$	mol/(m ² ×s)
Ila_i_flux	$K_{cat_IIXaVai} \times IIXaVai$	mol/(m ² ×s)
IIBi_flux	$K_{a_II_PLi} \times II \times PLi - K_{d_IIBi} \times IIBi - K_{a_IIBi_XaVai} \times IIBi \times XaVai$	mol/(m ² ×s)
IXa_i_flux	$-K_{a_IXa_VIIIaBi} \times IXa \times VIIIaBi + K_{d_IXaVIIIai} \times IXaVIIIai + h_{IXaVIIIa} \times IXaVIIIai$	mol/(m ² ×s)
IXaVIIIai_flux	$K_{a_IXa_VIIIaBi} \times IXa \times VIIIaBi - K_{d_IXaVIIIai} \times IXaVIIIai - h_{IXaVIIIa} \times IXaVIIIai - K_{a_X_IXaVIIIai} \times X \times IXaVIIIai + K_{d_XIXaVIIIai} \times XIXaVIIIai$	mol/(m ² ×s)
PS_i_flux	$-K_{a_PS_VaBi} \times PS \times VaBi + K_{d_PSVaBi} \times PSVai$	mol/(m ² ×s)
PSVai_flux	$K_{a_PS_VaBi} \times PS \times VaBi - K_{d_PSVaBi} \times PSVai$	mol/(m ² ×s)
V_i_flux	$-K_{a_V_PLi} \times V \times PLi + K_{d_VBi} \times VBi$	mol/(m ² ×s)
Va_i_flux	$-K_{a_Va_PLi} \times Va \times PLi + K_{d_VaBi} \times VaBi$	mol/(m ² ×s)
VaBi_flux	$-K_{a_PS_VaBi} \times PS \times VaBi + K_{d_PSVaBi} \times PSVai + K_{a_Va_PLi} \times Va \times PLi - K_{d_VaBi} \times VaBi - K_{a_Xa_VaBi} \times Xa \times VaBi + K_{d_XaVai} \times XaVai + K_{cat_VBi_Xa} \times VBi \times Xa / (K_{M_VBi_Xa} + VBi \times 1[1/m]) + K_{cat_VBi_IIa} \times VBi \times (IIa) / (K_{M_VBi_IIa} + VBi \times 1[1/m]) - K_{a_XI_VaBi} \times XI \times VaBi + K_{d_XIVaBi} \times XIVaBi + K_{eff_XIVBi_IIa} \times XIVaBi \times IIa$	mol/(m ² ×s)
VBi_flux	$K_{a_V_PLi} \times V \times PLi - K_{d_VBi} \times VBi - K_{cat_VBi_Xa} \times VBi \times Xa / (K_{M_VBi_Xa} + VBi \times 1[1/m]) - K_{cat_VBi_IIa} \times VBi \times (IIa) / (K_{M_VBi_IIa} + VBi \times 1[1/m]) - K_{a_XI_VBi} \times XI \times VBi + K_{d_XIVBi} \times XIVBi + K_{eff_XIVBi_IIa} \times XIVBi \times IIa$	mol/(m ² ×s)
VIII_i_flux	$-K_{a_VIII_PLi} \times VIII \times PLi + K_{d_VIIIBi} \times VIIIBi$	mol/(m ² ×s)
VIIIa_i_flux	$-K_{a_VIIIa_PLi} \times VIIIa \times PLi + K_{d_VIIIaBi} \times VIIIaBi$	mol/(m ² ×s)

Reaction	Expression	Unit
VIIIaBi_flux	$Ka_VIIIa_PLi \times VIIIa \times PLi - Kd_VIIIaBi \times VIIIaBi - h_VIIIa \times VIIIaBi + Keff_VIII_IIa \times VIIIBi \times (IIa) + Keff_VIII_Xa \times VIIIBi \times (Xa) - Ka_IXa_VIIIaBi \times (IXa) \times VIIIaBi + Kd_IXaVIIlai \times IXaVIIlai$	mol/(m ² ×s)
VIIIBi_flux	$Ka_VIII_PLi \times VIII \times PLi - Kd_VIIIBi \times VIIIBi - Keff_VIII_IIa \times VIIIBi \times (IIa) - Keff_VIII_Xa \times VIIIBi \times (Xa)$	mol/(m ² ×s)
X_i_flux	$-Ka_X_IXaVIIlai \times X \times IXaVIIlai + Kd_XIXaVIIlai \times XIXaVIIlai$	mol/(m ² ×s)
Xa_i_flux	$-Ka_Xa_VaBi \times Xa \times VaBi + Kd_XaVai \times XaVai + Kcat_X_IXaVIIlai \times XIXaVIIlai$	mol/(m ² ×s)
XaVai_flux	$Ka_Xa_VaBi \times (Xa) \times VaBi - Kd_XaVai \times XaVai - ka_XaVaB_ATIII \times XaVai \times AT - Ka_II_XaVai \times II \times XaVai + Kd_IIXaVai \times IIXaVai + Kcat_IIXaVai \times IIXaVai$	mol/(m ² ×s)
XIVaBi_flux	$Ka_XI_VaBi \times XI \times VaBi - Kd_XIVaBi \times XIVaBi - Keff_XIVBi_IIa \times XIVaBi \times (IIa)$	mol/(m ² ×s)
XIVBi_flux	$Ka_XI_VBi \times XI \times VBi - Kd_XIVBi \times XIVBi - Keff_XIVBi_IIa \times XIVBi \times (IIa)$	mol/(m ² ×s)
XIXaVIIlai_flux	$Ka_X_IXaVIIlai \times (X) \times IXaVIIlai - Kd_XIXaVIIlai \times XIXaVIIlai - Kcat_X_IXaVIIlai \times XIXaVIIlai$	mol/(m ² ×s)
IIXaVai_flux	$Ka_II_XaVai \times II \times XaVai - Kd_IIXaVai \times IIXaVai - Kcat_IIXaVai \times IIXaVai$	mol/(m ² ×s)
PLi_flux	$ni \times (-Ka_II_PLi \times II \times PLi + Kd_IIBi \times IIBi - Ka_II_XaVai \times II \times XaVai + Kd_IIXaVai \times IIXaVai + Kcat_IIXaVai \times IIXaVai + h_IXaVIIIa \times IXaVIIlai - Ka_PS_VaBi \times PS \times VaBi + Kd_PSVaBi \times PSVai - Ka_V_PLi \times V \times PLi + Kd_VBi \times VBi - Ka_Va_PLi \times Va \times PLi + Kd_VaBi \times VaBi - Ka_Xa_VaBi \times Xa \times VaBi + Kd_XaVai \times XaVai + ka_XaVaB_ATIII \times XaVai \times AT - Ka_XI_VaBi \times XI \times VaBi + Kd_XIVaBi \times XIVaBi + Keff_XIVBi_IIa \times XIVaBi \times IIa -$	mol/(m ² ×s)

Reaction	Expression	Unit
	$Ka_XI_VBi \times XI \times VBi +$ $Kd_XIVBi \times XIVBi +$ $Keff_XIVBi_IIa \times XIVBi \times IIa -$ $Ka_VIII_PLi \times VIII \times PLi +$ $Kd_VIIIaBi \times VIIIaBi -$ $Ka_VIIIa_PLi \times VIIIa \times PLi +$ $Kd_VIIIaBi \times VIIIaBi + h_VIIIa \times VIIIaBi -$ $Ka_IXa_VIIIaBi \times (IXa) \times VIIIaBi +$ $Kd_IXaVIIIai \times IXaVIIIai -$ $Ka_X_IXaVIIIai \times X \times IXaVIIIai +$ $Kd_XIXaVIIIai \times XIXaVIIIai +$ $Kcat_X_IXaVIIIai \times XIXaVIIIai)$	
XI_i_flux	$-Ka_XI_VaBi \times XI \times VaBi +$ $Kd_XIVaBi \times XIVaBi -$ $Ka_XI_VaBi \times XI \times VaBi +$ $Kd_XIVaBi \times XIVaBi$	mol/(m ² ×s)
XIa_i_flux	$Keff_XIVBi_IIa \times XIVaBi \times (IIa) +$ $Keff_XIVBi_IIa \times XIVBi \times (IIa)$	mol/(m ² ×s)

Table S9. Constants of reactions on the exogenous lipids

Constant	Value
Ka_II_PLe	15 [m ³ /(s×mol)]
Ka_II_XaVae	4.1×10 ⁴ [m ³ /(s×mol)]
Ka_IXa_VIIIaBe	1*(1 + X0/1×10 ⁻⁵ [mol/m ³]) ×2.5×10 ⁴ [m ³ /(s×mol)]
Ka_PS_VaBe	1.3×10 ⁴ [m ³ /(s×mol)]
Ka_V_PLe	740 [m ³ /(s×mol)]
Ka_Va_PLe	740 [m ³ /(s×mol)]
Ka_VIII_PLe	630 [m ³ /(s×mol)]
Ka_VIIIa_PLe	780 [m ³ /(s×mol)]
Ka_X_IXaVIIIae	1.8×10 ⁵ [m ³ /(s×mol)]
Ka_Xa_VaBe	4440 [m ³ /(s×mol)]
Ka_XI_VaBe	35 [m ³ /(s×mol)]
Ka_XI_VBe	37.5 [m ³ /(s×mol)]
Kcat_IIaVae	54 [1/s]
Kcat_VBe_IIa	2.3 [1/s]
Kcat_VBe_Xa	4.3 [1/s]
Kcat_X_IXaVIIIae	5 [1/s]
Kd_IIaBe	2×10 ⁻³ [1/s]
Kd_IIaVae	10 [1/s]
Kd_IXaVIIIae	2.2×10 ⁻³ [1/s]
Kd_PSVaBe	0.1 [1/s]
Kd_VaBe	2×10 ⁻³ [1/s]
Kd_VBe	5×10 ⁻³ [1/s]
Kd_VIIIaBe	2.8×10 ⁻⁴ [1/s]
Kd_VIIIaBe	1.3×10 ⁻³ [1/s]
Kd_XaVae	2×10 ⁻³ [1/s]

Constant	Value
Kd_XIVaBe	1.5×10^{-4} [1/s]
Kd_XIVBe	1.8×10^{-4} [1/s]
Kd_XIXaVIIIae	1 [1/s]
Keff_XIVBe_Ila	8 [m ³ /(s×mol)]
KM_VBe_Ila	7.17×10^{-5} [mol/m ³]
KM_VBe_Xa	1.04×10^{-5} [mol/m ³]
ne	100

Table S10. Reactions on the exogenous lipids

Reaction	Expression	Unit
II_e_flux	$-K_{a_II_PLe} \times II \times PLe + K_{d_IIBe} \times IIBe - K_{a_I_I_XaVa} \times II \times XaVa + K_{d_IIXaVa} \times IIXaVa$	mol/(m ³ ×s)
Ila_e_flux	$K_{cat_IIXaVa} \times IIXaVa$	mol/(m ³ ×s)
IIBe_flux	$K_{a_II_PLe} \times II \times PLe - K_{d_IIBe} \times IIBe - K_{a_II_XaVa} \times IIBe \times XaVa$	mol/(m ³ ×s)
IXa_e_flux	$-K_{a_IXa_VIIIaBe} \times IXa \times VIIIaBe + K_{d_IXa_VIIIa} \times IXa \times VIIIa + h_{IXa_VIIIa} \times IXa \times VIIIa$	mol/(m ³ ×s)
IXaVIIIae_flux	$K_{a_IXa_VIIIaBe} \times IXa \times VIIIaBe - K_{d_IXa_VIIIa} \times IXa \times VIIIa - h_{IXa_VIIIa} \times IXa \times VIIIa - K_{a_X_IXa_VIIIa} \times X \times IXa \times VIIIa + K_{d_XIXa_VIIIa} \times XIXa \times VIIIa$	mol/(m ³ ×s)
PS_e_flux	$-K_{a_PS_VaBe} \times PS \times VaBe + K_{d_PSVaBe} \times PSVaBe$	mol/(m ³ ×s)
PSVaBe_flux	$K_{a_PS_VaBe} \times PS \times VaBe - K_{d_PSVaBe} \times PSVaBe$	mol/(m ³ ×s)
V_e_flux	$-K_{a_V_PLe} \times V \times PLe + K_{d_VBe} \times VBe$	mol/(m ³ ×s)
Va_e_flux	$-K_{a_Va_PLe} \times Va \times PLe + K_{d_VaBe} \times VaBe$	mol/(m ³ ×s)
VaBe_flux	$-K_{a_PS_VaBe} \times PS \times VaBe + K_{d_PSVaBe} \times PSVaBe + K_{a_Va_PLe} \times Va \times PLe - K_{d_VaBe} \times VaBe - K_{a_Xa_VaBe} \times Xa \times VaBe + K_{d_XaVa} \times XaVa + K_{cat_VBe_Xa} \times VBe \times (Xa) / (KM_VBe_Xa + VBe) + K_{cat_VBe_Ila} \times VBe \times (Ila) / (KM_VBe_Ila + VBe) - K_{a_XI_VaBe} \times XI \times VaBe + K_{d_XIVaBe} \times XI \times VaBe + K_{eff_XIVBe_Ila} \times XIVaBe \times Ila$	mol/(m ³ ×s)
VBe_flux	$K_{a_V_PLe} \times V \times PLe - K_{d_VBe} \times VBe - K_{cat_VBe_Xa} \times VBe \times Xa / (KM_VBe_Xa + VBe) - K_{cat_VBe_Ila} \times VBe \times (Ila) / (KM_VBe_Ila + VBe) - K_{a_XI_VBe} \times XI \times VBe + K_{d_XIVBe} \times XIVBe + K_{eff_XIVBe_Ila} \times XIVBe \times Ila$	mol/(m ³ ×s)
VIII_e_flux	$-K_{a_VIII_PLe} \times VIII \times PLe + K_{d_VIIIBe} \times VI \times IIBe$	mol/(m ³ ×s)

Reaction	Expression	Unit
VIIIa_e_flux	$-K_{a_VIIIa_PLe} \times VIIIa \times PLe + K_{d_VIIIaBe} \times VIIIaBe$	$\text{mol}/(\text{m}^3 \times \text{s})$
VIIIaBe_flux	$K_{a_VIIIa_PLe} \times VIIIa \times PLe - K_{d_VIIIaBe} \times VIIIaBe - h_{VIIIa} \times VIIIaBe + K_{eff_VIII_IIa} \times VIIIBe \times (IIa) + K_{eff_VIII_Xa} \times VIIIBe \times (Xa) - K_{a_IXa_VIIIaBe} \times (IXa) \times VIIIaBe + K_{d_IXa_VIIIaBe} \times IXa \times VIIIaBe$	$\text{mol}/(\text{m}^3 \times \text{s})$
VIIIBe_flux	$K_{a_VIII_PLe} \times VIII \times PLe - K_{d_VIIIBe} \times VIIIBe - K_{eff_VIII_IIa} \times VIIIBe \times (IIa) - K_{eff_VIII_Xa} \times VIIIBe \times (Xa)$	$\text{mol}/(\text{m}^3 \times \text{s})$
X_e_flux	$-K_{a_X_IXa_VIIIaBe} \times X \times IXa \times VIIIaBe + K_{d_XI_Xa_VIIIaBe} \times XI \times Xa \times VIIIaBe$	$\text{mol}/(\text{m}^3 \times \text{s})$
Xa_e_flux	$-K_{a_Xa_VaBe} \times Xa \times VaBe + K_{d_XaVaBe} \times XaVaBe + K_{cat_X_IXa_VIIIaBe} \times XI \times Xa \times VIIIaBe$	$\text{mol}/(\text{m}^3 \times \text{s})$
XaVaBe_flux	$K_{a_Xa_VaBe} \times (Xa) \times VaBe - K_{d_XaVaBe} \times XaVaBe - k_{a_XaVaBe_ATIII} \times XaVaBe \times AT - K_{a_II_XaVaBe} \times II \times XaVaBe + K_{d_II_XaVaBe} \times II \times XaVaBe + K_{cat_II_XaVaBe} \times II \times XaVaBe$	$\text{mol}/(\text{m}^3 \times \text{s})$
XIVaBe_flux	$K_{a_XI_VaBe} \times XI \times VaBe - K_{d_XIVaBe} \times XI \times VaBe - K_{eff_XIVBe_IIa} \times XIVaBe \times (IIa)$	$\text{mol}/(\text{m}^3 \times \text{s})$
XIVBe_flux	$K_{a_XI_VBe} \times XI \times VBe - K_{d_XIVBe} \times XIVBe - K_{eff_XIVBe_IIa} \times XIVBe \times (IIa)$	$\text{mol}/(\text{m}^3 \times \text{s})$
XIXaVIIIaBe_flux	$K_{a_X_IXa_VIIIaBe} \times (X) \times IXa \times VIIIaBe - K_{d_XI_Xa_VIIIaBe} \times XI \times Xa \times VIIIaBe - K_{cat_X_IXa_VIIIaBe} \times XI \times Xa \times VIIIaBe$	$\text{mol}/(\text{m}^3 \times \text{s})$
IIaVaBe_flux	$K_{a_II_XaVaBe} \times II \times XaVaBe - K_{d_IIaVaBe} \times IIaVaBe - K_{cat_IIaVaBe} \times IIaVaBe$	$\text{mol}/(\text{m}^3 \times \text{s})$
PLe_flux	$ne \times (-K_{a_II_PLe} \times II \times PLe + K_{d_IIaBe} \times IIaBe - K_{a_II_XaVaBe} \times II \times XaVaBe + K_{d_IIaVaBe} \times IIaVaBe + K_{cat_IIaVaBe} \times IIaVaBe + h_{IXaVI} \times IXa \times VIIIaBe - K_{a_PS_VaBe} \times PS \times VaBe + K_{d_PSVaBe} \times PSVaBe - K_{a_V_PLe} \times V \times PLe + K_{d_VBe} \times VBe - K_{a_Va_PLe} \times Va \times PLe + K_{d_VaBe} \times VaBe - K_{a_Xa_VaBe} \times Xa \times VaBe + K_{d_XaVaBe} \times XaVaBe + k_{a_XaVaBe_ATIII} \times XaVaBe \times AT - K_{a_XI_VaBe} \times XI \times VaBe + K_{d_XIVaBe} \times XI \times VaBe + K_{eff_XIVBe_IIa} \times XIVaBe \times (IIa) - K_{a_XI_VBe} \times XI \times VBe + K_{d_XIVBe} \times XIVBe - K_{eff_XIVBe_IIa} \times XIVBe \times (IIa) - K_{a_VIII_PLe} \times VIII \times PLe + K_{d_VIIIBe} \times VIIIBe - K_{a_VIIIa_PLe} \times VIIIa \times PLe + K_{d_VIIIaBe} \times VIIIaBe + h_{VIIIa} \times VIIIaBe - K_{a_IXa_VIIIaBe} \times (IXa) \times VIIIaBe + K_{d_IXa_VIIIaBe} \times IXa \times VIIIaBe - K_{a_X_IXa_VIIIaBe} \times X \times IXa \times VIIIaBe +$	$\text{mol}/(\text{m}^3 \times \text{s})$

Reaction	Expression	Unit
	$Kd_XIXaVIIIae \times XIXaVIIIae + Kcat_X_IXaVIIIae \times XIXaVIIIae$	
XI_e_flux	$-Ka_XI_VaBe \times XI \times VaBe + Kd_XIVaBe \times XIVaBe - Ka_XI_VaBe \times XI \times VaBe + Kd_XIVaBe \times XIVaBe$	mol/(m ³ ×s)
XIa_e_flux	$Keff_XIVBe_IIa \times XIVaBe \times (IIa) + Keff_XIVBe_IIa \times XIVBe \times (IIa)$	mol/(m ³ ×s)

Table S11. Constants of reactions on the endogenous lipids

Constant	Value
Ka_II_PLv	$1.5 \times 10^{-3} \text{ [m}^3\text{/(s} \times \text{mol)]}$
Ka_II_XaVav	$4.1 \times 10^4 \text{ [m}^3\text{/(s} \times \text{mol)]}$
Ka_IXa_VIIIaBv	$(1 + X0/1 \times 10^{-5} \text{ [mol/m}^3]) \times 2.5 \times 10^3 \text{ [m}^3\text{/(s} \times \text{mol)]}$
Ka_PS_VaBv	$1.3 \times 10^4 \text{ [m}^3\text{/(s} \times \text{mol)]}$
Ka_V_PLv	$7.4 \times 10^{-2} \text{ [m}^3\text{/(s} \times \text{mol)]}$
Ka_Va_PLv	$7.4 \times 10^{-2} \text{ [m}^3\text{/(s} \times \text{mol)]}$
Ka_VIII_PLv	$6.3 \times 10^{-2} \text{ [m}^3\text{/(s} \times \text{mol)]}$
Ka_VIIIa_PLv	$7.8 \times 10^{-2} \text{ [m}^3\text{/(s} \times \text{mol)]}$
Ka_X_IXaVIIIav	$1.8 \times 10^5 \text{ [m}^3\text{/(s} \times \text{mol)]}$
Ka_Xa_VaBv	$444 \text{ [m}^3\text{/(s} \times \text{mol)]}$
Ka_XI_VaBv	$35 \text{ [m}^3\text{/(s} \times \text{mol)]}$
Ka_XI_VBv	$37.5 \text{ [m}^3\text{/(s} \times \text{mol)]}$
Kcat_IIaVav	10.8 [1/s]
Kcat_VBv_IIa	0.23 [1/s]
Kcat_VBv_Xa	0.043 [1/s]
Kcat_X_IXaVIIIav	5 [1/s]
Kd_IIBv	$2 \times 10^{-3} \text{ [1/s]}$
Kd_IIaVav	10 [1/s]
Kd_IXaVIIIav	$2.2 \times 10^{-3} \text{ [1/s]}$
Kd_PSVaBv	0.1 [1/s]
Kd_VaBv	$2 \times 10^{-3} \text{ [1/s]}$
Kd_VBv	$5 \times 10^{-3} \text{ [1/s]}$
Kd_VIIIaBv	$2.8 \times 10^{-4} \text{ [1/s]}$
Kd_VIIIBv	$1.3 \times 10^{-3} \text{ [1/s]}$
Kd_XaVav	$2 \times 10^{-3} \text{ [1/s]}$
Kd_XIVaBv	$1.5 \times 10^{-4} \text{ [1/s]}$
Kd_XIVBv	$1.8 \times 10^{-4} \text{ [1/s]}$
Kd_XIXaVIIIav	10 [1/s]
Keff_XIVBv_IIa	0
KM_VBv_IIa	$7.17 \times 10^{-5} \text{ [mol/m}^3\text{]}$
KM_VBv_Xa	$1.04 \times 10^{-5} \text{ [mol/m}^3\text{]}$
nv	100

Table S12. Reactions on the endogenous lipids

Reaction	Expression	Unit
II_v_flux	$-K_a_{II_PLv} \times II \times PLv + K_d_{IIBv} \times IIBv - K_a_{II_XaVav} \times II \times XaVav + K_d_{IIXaVav} \times IIXaVav$	mol/(m ³ ×s)
Ila_v_flux	$K_{cat_IIXaVav} \times IIXaVav$	mol/(m ³ ×s)
IIBv_flux	$K_a_{II_PLv} \times II \times PLv - K_d_{IIBv} \times IIBv - K_a_{II_XaVav} \times IIBv \times XaVav$	mol/(m ³ ×s)
IXa_v_flux	$-K_a_{IXa_VIIIaBv} \times IXa \times VIIIaBv + K_d_{IXaVIIIav} \times IXaVIIIav + h_{IXaVIIIa} \times IXaVIIIav$	mol/(m ³ ×s)
IXaVIIIav_flux	$K_a_{IXa_VIIIaBv} \times IXa \times VIIIaBv - K_d_{IXaVIIIav} \times IXaVIIIav - h_{IXaVIIIa} \times IXaVIIIav - K_a_{X_IXaVIIIav} \times X \times IXaVIIIav + K_d_{XIXaVIIIav} \times XIXaVIIIav$	mol/(m ³ ×s)
PS_v_flux	$-K_a_{PS_VaBv} \times PS \times VaBv + K_d_{PSVaBv} \times PSVav$	mol/(m ³ ×s)
PSVav_flux	$K_a_{PS_VaBv} \times PS \times VaBv - K_d_{PSVaBv} \times PSVav$	mol/(m ³ ×s)
V_v_flux	$-K_a_{V_PLv} \times V \times PLv + K_d_{VBv} \times VBv$	mol/(m ³ ×s)
Va_v_flux	$-K_a_{Va_PLv} \times Va \times PLv + K_d_{VaBv} \times VaBv$	mol/(m ³ ×s)
VaBv_flux	$-K_a_{PS_VaBv} \times PS \times VaBv + K_d_{PSVaBv} \times PSVav + K_a_{Va_PLv} \times Va \times PLv - K_d_{VaBv} \times VaBv - K_a_{Xa_VaBv} \times Xa \times VaBv + K_d_{XaVav} \times XaVav + K_{cat_VBv_Xa} \times VBv \times (Xa) / (K_M_{VBv_Xa} + VBv) + K_{cat_VBv_Ila} \times VBv \times (Ila) / (K_M_{VBv_Ila} + VBv) - K_a_{XI_VaBv} \times XI \times VaBv + K_d_{XIVaBv} \times XIVaBv + K_{eff_XIVBv_Ila} \times XIVaBv \times Ila$	mol/(m ³ ×s)
VBv_flux	$K_a_{V_PLv} \times V \times PLv - K_d_{VBv} \times VBv - K_{cat_VBv_Xa} \times VBv \times Xa / (K_M_{VBv_Xa} + VBv) - K_{cat_VBv_Ila} \times VBv \times (Ila) / (K_M_{VBv_Ila} + VBv) - K_a_{XI_VBv} \times XI \times VBv + K_d_{XIVBv} \times XIVBv + K_{eff_XIVBv_Ila} \times XIVBv \times Ila$	mol/(m ³ ×s)
VIII_v_flux	$-K_a_{VIII_PLv} \times VIII \times PLv + K_d_{VIIIbV} \times VIIIbV$	mol/(m ³ ×s)
VIIIa_v_flux	$-K_a_{VIIIa_PLv} \times VIIIa \times PLv + K_d_{VIIIaBv} \times VIIIaBv$	mol/(m ³ ×s)
VIIIaBv_flux	$K_a_{VIIIa_PLv} \times VIIIa \times PLv - K_d_{VIIIaBv} \times VIIIaBv - h_{VIIIa} \times VIIIaBv + K_{eff_VIII_Ila} \times VIIIbV \times (Ila) +$	mol/(m ³ ×s)

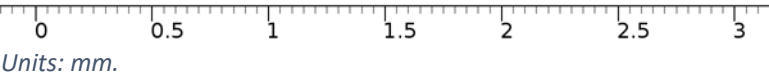
Reaction	Expression	Unit
	$K_{eff_VIII_Xa} \times VIII_{Bv} \times (Xa) - K_{a_IXa_VIIIaBv} \times (IXa) \times VIIIaBv + K_{d_IXaVIIIav} \times IXaVIIIav$	
VIIIBv_flux	$K_{a_VIII_PLv} \times VIII \times PLv - K_{d_VIIIBv} \times VIIIBv - K_{eff_VIII_IIa} \times VIIIBv \times (IIa) - K_{eff_VIII_Xa} \times VIIIBv \times (Xa)$	mol/(m ³ ×s)
X_v_flux	$-K_{a_X_IXaVIIIav} \times X \times IXaVIIIav + K_{d_XIXaVIIIav} \times XIXaVIIIav$	mol/(m ³ ×s)
Xa_v_flux	$-K_{a_Xa_VaBv} \times Xa \times VaBv + K_{d_XaVav} \times XaVav + K_{cat_X_IXaVIIIav} \times XIXaVIIIav$	mol/(m ³ ×s)
XaVav_flux	$K_{a_Xa_VaBv} \times (Xa) \times VaBv - K_{d_XaVav} \times XaVav - k_{a_XaVaB_ATIII} \times XaVav \times AT - K_{a_II_XaVav} \times II \times XaVav + K_{d_IIXaVav} \times IIXaVav + K_{cat_IIXaVav} \times IIXaVav$	mol/(m ³ ×s)
XIVaBv_flux	$K_{a_XI_VaBv} \times XI \times VaBv - K_{d_XIVaBv} \times XIVaBv - K_{eff_XIVBv_IIa} \times XIVaBv \times (IIa)$	mol/(m ³ ×s)
XIVBv_flux	$K_{a_XI_VBv} \times XI \times VBv - K_{d_XIVBv} \times XIVBv - K_{eff_XIVBv_IIa} \times XIVBv \times (IIa)$	mol/(m ³ ×s)
XIXaVIIIav_flux	$K_{a_X_IXaVIIIav} \times (X) \times IXaVIIIav - K_{d_XIXaVIIIav} \times XIXaVIIIav - K_{cat_X_IXaVIIIav} \times XIXaVIIIav$	mol/(m ³ ×s)
IIXaVav_flux	$K_{a_II_XaVav} \times II \times XaVav - K_{d_IIXaVav} \times IIXaVav - K_{cat_IIXaVav} \times IIXaVav$	mol/(m ³ ×s)
PLv_flux	$n_v \times (-K_{a_II_PLv} \times II \times PLv + K_{d_IIBv} \times IIBv - K_{a_II_XaVav} \times II \times XaVav + K_{d_IIXaVav} \times IIXaVav + K_{cat_IIXaVav} \times IIXaVav + h_{IXaVIIIa} \times IXaVIIIav - K_{a_PS_VaBv} \times PS \times VaBv + K_{d_PSVaBv} \times PSVav - K_{a_V_PLv} \times V \times PLv + K_{d_VBv} \times VBv - K_{a_Va_PLv} \times Va \times PLv + K_{d_VaBv} \times VaBv - K_{a_Xa_VaBv} \times Xa \times VaBv + K_{d_XaVav} \times XaVav + k_{a_XaVaB_ATIII} \times XaVav \times AT - K_{a_XI_VaBv} \times XI \times VaBv + K_{d_XIVaBv} \times XIVaBv + K_{eff_XIVBv_IIa} \times XIVaBv \times IIa - K_{a_XI_VBv} \times XI \times VBv + K_{d_XIVBv} \times XIVBv +$	mol/(m ³ ×s)

Reaction	Expression	Unit
	$\begin{aligned} & \text{Keff_XIVBv_IIa} \times \text{XIVBv} \times \text{IIa} - \\ & \text{Ka_VIII_PLv} \times \text{VIII} \times \text{PLv} + \\ & \text{Kd_VIIIbv} \times \text{VIIIbv} - \\ & \text{Ka_VIIIa_PLv} \times \text{VIIIa} \times \text{PLv} + \\ & \text{Kd_VIIIabv} \times \text{VIIIabv} + \text{h_VIIIa} \times \text{VIIIa} \text{bv} \\ & - \text{Ka_IXa_VIIIabv} \times (\text{IXa}) \times \text{VIIIabv} + \\ & \text{Kd_IXaVIIIav} \times \text{IXaVIIIav} - \\ & \text{Ka_X_IXaVIIIav} \times \text{X} \times \text{IXaVIIIav} + \\ & \text{Kd_XIXaVIIIav} \times \text{XIXaVIIIav} + \\ & \text{Kcat_X_IXaVIIIav} \times \text{XIXaVIIIav} \end{aligned}$	
XI_v_flux	$\begin{aligned} & -\text{Ka_XI_VaBv} \times \text{XI} \times \text{VaBv} + \\ & \text{Kd_XIVaBv} \times \text{XIVaBv} - \\ & \text{Ka_XI_VaBv} \times \text{XI} \times \text{VaBv} + \\ & \text{Kd_XIVaBv} \times \text{XIVaBv} \end{aligned}$	mol/(m ³ ×s)
XIa_v_flux	$\begin{aligned} & \text{Keff_XIVBv_IIa} \times \text{XIVaBv} \times (\text{IIa}) + \\ & \text{Keff_XIVBv_IIa} \times \text{XIVBv} \times (\text{IIa}) \end{aligned}$	mol/(m ³ ×s)

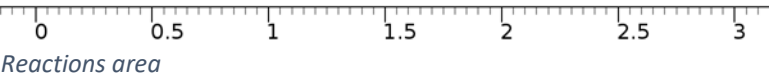
Table S13. Diffusion constants

Constant	Value
D_AMC	3.5×10 ⁻¹⁰ [m ² /s]
D_AT	5.5×10 ⁻¹¹ [m ² /s]
D_Fg	2×10 ⁻¹¹ [m ² /s]
D_Fn	0 [m ² /s]
D_HC	8.8×10 ⁻¹¹ [m ² /s]
D_ATHC	5×10 ⁻¹¹ [m ² /s]
D_II	5×10 ⁻¹¹ [m ² /s]
D_IIa	6.67×10 ⁻¹¹ [m ² /s]
D_IX	5.5×10 ⁻¹¹ [m ² /s]
D_IXa	6.17×10 ⁻¹¹ [m ² /s]
D_PS	5×10 ⁻¹¹ [m ² /s]
D_TFPI	6.5×10 ⁻¹¹ [m ² /s]
D_V	2.67×10 ⁻¹¹ [m ² /s]
D_Va	3.67×10 ⁻¹¹ [m ² /s]
D_VII	5.83×10 ⁻¹¹ [m ² /s]
D_VIIa	5.83×10 ⁻¹¹ [m ² /s]
D_VIII	0 [m ² /s]
D_VIIIa	3.5×10 ⁻¹¹ [m ² /s]
D_X	5.5×10 ⁻¹¹ [m ² /s]
D_Xa	6.17×10 ⁻¹¹ [m ² /s]
D_XaPS	4.2×10 ⁻¹¹ [m ² /s]
D_XaTFPI	4.5×10 ⁻¹¹ [m ² /s]
D_XI	3.5×10 ⁻¹¹ [m ² /s]
D_XIa	3.5×10 ⁻¹¹ [m ² /s]
D_a2M	1×10 ⁻¹¹ [m ² /s]

Geometry of simulation area



Reactions



Equatiuons

$$\frac{\partial c_i}{\partial t} + \nabla \cdot (-D_i \nabla c_i) + \mathbf{u} \cdot \nabla c_i = R_i$$

Table S14. Reactions settings

Variable	Reaction R _i
VII	VII_flux
VIIa	VIIa_flux

Variable	Reaction R _i
V	V_flux + V_e_flux + V_v_flux
Va	Va_flux + Va_e_flux + Va_v_flux
VBe	VBe_flux
VBv	VBv_flux
VaBe	VaBe_flux
VaBv	VaBv_flux
VIII	VIII_flux + VIII_e_flux + VIII_v_flux
VIIIa	VIIIa_flux + VIIIa_e_flux + VIIIa_v_flux
VIIIBe	VIIIBe_flux
VIIIBv	VIIIBv_flux
VIIIaBe	VIIIaBe_flux
VIIIaBv	VIIIaBv_flux
X	X_flux + X_e_flux + X_v_flux
Xa	Xa_flux + Xa_e_flux + Xa_v_flux
IX	IX_flux
IXa	IXa_flux + IXa_e_flux + IXa_v_flux
IXaVIIIae	IXaVIIIae_flux
IXaVIIIav	IXaVIIIav_flux
XIXaVIIIae	XIXaVIIIae_flux
XIXaVIIIav	XIXaVIIIav_flux
PLe	PLe_flux
PLv	PLv_flux
TFPI	TFPI_flux
XaTFPI	XaTFPI_flux
II	II_flux + II_e_flux + II_v_flux
Ila	Ila_flux + Ila_e_flux + Ila_v_flux
IIBe	IIBe_flux
IIBv	IIBv_flux
XaVae	XaVae_flux
XaVav	XaVav_flux
PSVae	PSVae_flux
PSVav	PSVav_flux
IIXaVae	IIXaVae_flux
IIXaVav	IIXaVav_flux
Fg	Fg_flux
Fn	Fn_flux
IlaFg	IlaFg_flux
IlaFn	IlaFn_flux
AT	AT_flux
HC	HC_flux
ATHC	ATHC_flux
ATHCweak	ATHCweak_flux
XI	XI_flux + XI_e_flux + XI_v_flux
XIa	XIa_flux + XIa_e_flux + XIa_v_flux
PS	PS_flux + PS_e_flux + PS_v_flux
a2M	a2M_flux

Variable	Reaction R_i
S	S_flux
IlaS	IlaS_flux
AMC	AMC_flux
Ilaa2M	Ilaa2M_flux
Ilaa2MS	Ilaa2MS_flux
XaPS	XaPS_flux
XPS	XPS_flux
XIVBe	XIVBe_flux
XIVBv	XIVBv_flux
XIVaBe	XIVaBe_flux
XIVaBv	XIVaBv_flux

Diffusional transport

Equations

$$\frac{\partial c_i}{\partial t} + \nabla \cdot (-D_i \nabla c_i) + \mathbf{u} \cdot \nabla c_i = R_i$$

$$\mathbf{N}_i = -D_i \nabla c_i + \mathbf{u} c_i$$

Table S15. Diffusion settings

Variable	Diffusion coefficient D_i
VII	D_VII
VIIa	D_VIIa
V	D_V
Va	D_Va
VBe	0
VBv	0
VaBe	0
VaBv	0
VIII	D_VIII
VIIIa	D_VIIIa
VIIIBe	0
VIIIBv	0
VIIIaBe	0
VIIIaBv	0
X	D_X
Xa	D_Xa
IX	D_IX
IXa	D_IXa
IXaVIIIAe	0
IXaVIIIAv	0
XIXaVIIIAe	0
XIXaVIIIAv	0
PLe	0
PLv	0
TFPI	D_TFPI
XaTFPI	D_XaTFPI

Variable	Diffusion coefficient D_i
II	D_{II}
Ila	D_{Ila}
IIBe	0
IIBv	0
XaVae	0
XaVav	0
PSVae	0
PSVav	0
IIXaVae	0
IIXaVav	0
Fg	D_{Fg}
Fn	0
IlaFg	D_{Fg}
IlaFn	0
AT	D_{AT}
HC	D_{HC}
ATHC	D_{ATHC}
ATHCweak	D_{ATHC}
XI	D_{XI}
XIa	D_{XIa}
PS	D_{Xa}
a2M	D_{a2M}
S	$1e-9[m^2/s]$
IlaS	D_{Ila}
AMC	$1e-9[m^2/s]$
Ilaa2M	D_{a2M}
Ilaa2MS	D_{a2M}
XaPS	D_{XaPS}
XPS	D_{XaPS}
XIVBe	0
XIVBv	0
XIVaBe	0
XIVaBv	0

Influx from the boundary (from TF surface)



Equations

$$-n \cdot \mathbf{N}_i = N_{0i}$$

Table S16. Boundary settings

Variable	Value N_{0i}
VII	sVII_flux
VIIa	sVIIa_flux
V	V_i_flux
Va	Va_i_flux
VBe	0
VBv	0
VaBe	0
VaBv	0
VIII	VIII_i_flux
VIIIa	VIIIa_i_flux
VIIIBe	0
VIIIBv	0
VIIIaBe	0
VIIIaBv	0
X	sX_flux + X_i_flux
Xa	sXa_flux + Xa_i_flux
IX	sIX_flux
IXa	sIXa_flux
IXaVIIIae	0
IXaVIIIav	0
XIXaVIIIae	0
XIXaVIIIav	0
PLe	0
PLv	0
TFPI	0

Variable	Value N_{0i}
XaTFPI	sXaTFPI_flux
II	II_i_flux
Ila	Ila_i_flux
IIBe	0
IIBv	0
XaVae	0
XaVav	0
PSVae	0
PSVav	0
IIXaVae	0
IIXaVav	0
Fg	0
Fn	0
IlaFg	0
IlaFn	0
AT	0
HC	0
ATHC	0
ATHCweak	0
XI	XI_i_flux
XIa	XIa_i_flux
PS	PS_i_flux
a2M	0
S	0
IlaS	0
AMC	0
Ilaa2M	0
Ilaa2MS	0
XaPS	0
XPS	0
XIVBe	0
XIVBv	0
XIVaBe	0
XIVaBv	0

Surface reactions

Reaction area



Equations

$\frac{\partial c_{sj}}{\partial t} = R_{sj}$

Table S17. Boundary reactions settings

Variable	Value R _{si}
TF	sTF_flux
VIIaTF	sVIIaTF_flux
VIITF	sVIITF_flux
PLi	sPL_flux
XVIIaTF	sXVIIaTF_flux
IXVIIaTF	sIXVIIaTF_flux
XaTFPIVIIaTF	sXaTFPIVIIaTF_flux
VBi	VBi_flux
VaBi	VaBi_flux
VIIIBi	VIIIBi_flux
VIIIaBi	VIIIaBi_flux
IXaVIIIai	IXaVIIIai_flux
XIXaVIIIai	XIXaVIIIai_flux
IIBi	IIBi_flux
XaVai	XaVai_flux
IIXaVai	IIXaVai_flux
XIVBi	XIVBi_flux
XIVaBi	XIVaBi_flux
PSVai	PSVai_flux

Table S18. APTT, PT, anti-Xa activity, antithrombin level, parameters of thrombodynamics-4d 3 hours after LMWH administration (point 1).

Patient	APTT (s)	PT (s)	anti-Xa IU/ml	AT (%)	Tlag (min)	Vi (µm/min)	Vst (µm/min)	A (nM)
1	37.4	12.9	0.375	56	0.9	71.2	30.7	48.3
2	38.2	14.1	0.34694	49	1.2	64.9	27.6	52.2
3	35.1	13.9	0.50909	55	0.9	64.9	27.3	33.7
4	30.6	12.1	0.34677	124	1.3	64.3	28.4	23.7
5	38.7	11.9	0.33019	106	1.1	65.4	24.9	19.6
6	44.7	24.2	1.5102	49	1	48.1	5.5	9.4
7	31.4	15.4	0.18182	66	1.1	73.7	34.5	43.4
8	27.8	12.6	0.23077	52	0.9	83.8	45.6	190.7
9	30.1	18.1	0.27273	44	1.2	67.9	29.1	30.7
10	30.6	14.4	0.5641	78	1.2	60.9	23.3	17.9
11	53.9	13.3	1.28205	78	1	37	5.6	8.8
12	34.1	12.8	0.42697	89	0.9	66.5	26.2	14.3

Table S19. APTT, PT, anti-Xa activity, antithrombin level, parameters of thrombodynamics-4d 6 hours after LMWH administration (point 2)

Patient	APTT (s)	PT (s)	anti-Xa IU/ml	AT (%)	Tlag (min)	Vi (µm/min)	Vst (µm/min)	A (nM)
1	35.9	13.1	0.23636	55	0.9	81.6	42.6	149.7
2	38	14	0.25	52	1.1	64.4	28.7	50.4
3	22.6	11.4	0.29213	89	1.1	66.4	29.9	25.1
4	30.8	12.9	0.2844	109	1.1	67.6	27.7	20.1
5	35.6	11.8	0.19469	113	1.3	66.8	29.7	24.7
6	45.1	25.7	1.44	50	1.4	47.5	5.2	11.9
7	28.7	14.8	0.07042	71	0.8	81.9	78.5	280.5
8	26.4	12.4	0.09434	53	0.9	92.7	84.7	360
9	29.6	16.5	0.15254	59	1.1	69.9	31.3	47.8
10	28.8	13.3	0.41975	81	1.1	68	28.3	39.5
11	53.8	13.9	1.18293	82	1.1	36.7	7.5	8.2

12	35.6	12.9	0.43023	86	0.9	62.8	19.4	52.5
----	------	------	---------	----	-----	------	------	------

Table S20. APTT, PT, anti-Xa activity, antithrombin level, parameters of thrombodynamics-4d 12 hours after LMWH administration (point 3)

Patient	APTT (s)	PT (s)	anti-Xa IU/ml	AT (%)	Tlag (min)	Vi (µm/min)	Vst (µm/min)	A (nM)
1	29.9	12.3	0.08621	58	0.9	81.2	49.4	254.2
2	34.8	13.9	0.07273	55	1.5	67.2	35.6	134
3	36.6	13	0.22105	95	1	68.8	32.3	23.9
4	34.9	13.7	0.2521	119	1.1	70.1	28.6	13
5	30.6	12.3	0.08824	102	1.1	73.7	42.1	122.3
6	--	--	--	--	--	--	--	--
7	22.6	14.6	0.01493	67	1	81.1	79	263.6
8	23.1	11.9	0.03448	58	0.7	90.3	87.4	473.3
9	34	16.4	0	63	1.3	70.6	39.1	134.5
10	27.7	12.9	0.15068	73	1.1	77.7	40	79.5
11	36.2	13.1	0.55696	79	1.3	57.2	15.5	31.2
12	--	--	--	--	--	--	--	--

Equations of the PK model of LMWH

$$\frac{dC_i}{dt} = -K_{in} \cdot C_i + \frac{V_b}{V_{int}} \cdot K_{out} \cdot C_{b1} \quad (\text{eq1})$$

$$\frac{dC_{b1}}{dt} = K_{in} \cdot \frac{V_{int}}{V_b} \cdot C_i - K_{out} \cdot C_{b1} - K_{elim} \cdot C_{b1} - K_a \cdot C_{b1} + K_d \cdot C_{b2} \quad (\text{eq2})$$

$$\frac{dC_{b2}}{dt} = K_a \cdot C_{b1} - K_d \cdot C_{b2} \quad (\text{eq3})$$

C_i is the concentration of LMWH in the interstitial space

C_{b1} is the concentration of the free LMWH in the blood

C_{b2} is the concentration of the bound LMWH in the blood

Table S21. Constant values

Kin	0.0002[1/s]
Kout	0.0001[1/s]

Vb	$1.4 \cdot W \cdot 0.075 \cdot (1 - HC) [l]^*$
Vint	$\frac{W}{80} \cdot 6 [l]$
Kelim	$\left(1 + \frac{33}{Creat}\right) \cdot 3.85 \cdot 10^{-5} [1/s]^{\P}$
Ka	$Chol \cdot 0.15 \cdot 10^{-5} [1/s]\Delta$
Kd	$1e-6 [1/s]$

* for male; for female $Vb = 1.4 \cdot W \cdot 0.065 \cdot (1 - HC)$; here W is the body weight (kg), HC is the hematocrit (%).

$\P$ Creat is the creatinine level ($\mu\text{mol/l}$)

Δ Chol is the total cholesterol level (mmol/l)

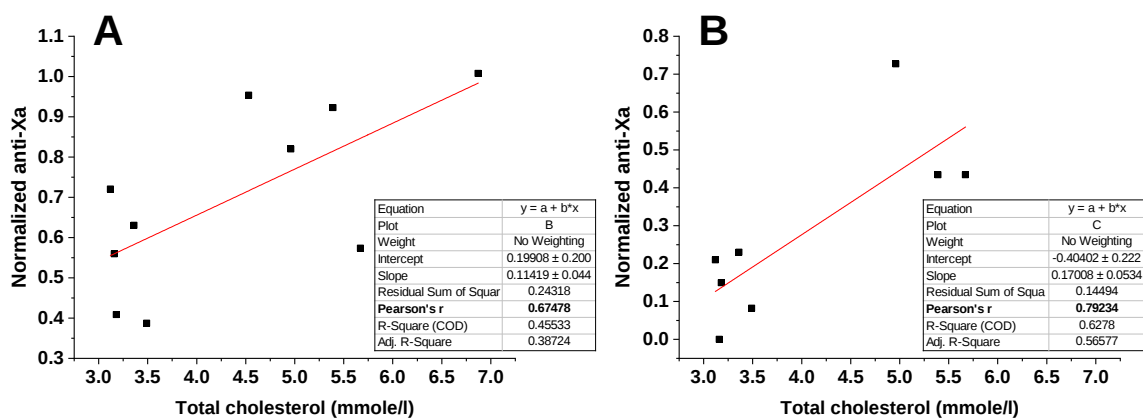


Fig.S1. Correlation of normalized anti-Xa activity and total cholesterol level in the group of patients. A – anti-Xa activity was measured at time point 2 (6 hours after LMWH administration). B - anti-Xa activity was measured at time point 3 (12 hours after LMWH administration).