

Thrombosis and COVID-19: Pathophysiology

D. TSAKIRIS

MEET THE HEMOSTASIS EXPERTS IV

12. NOVEMBER 2020

DIMITRIOS.TSAKIRIS@USB.CH

RM, *22.11.1961 M

24.3.20 Emergency USB, upper respiratory tract infection

- 24h later COVID-positiv

29.3.20 self referral with cough, dyspnea

- O₂ saturation 85% at 10L O₂
- ICU

Thorax Nativ 1.0 axial I50f LCAD
Se: 5
Im: 167

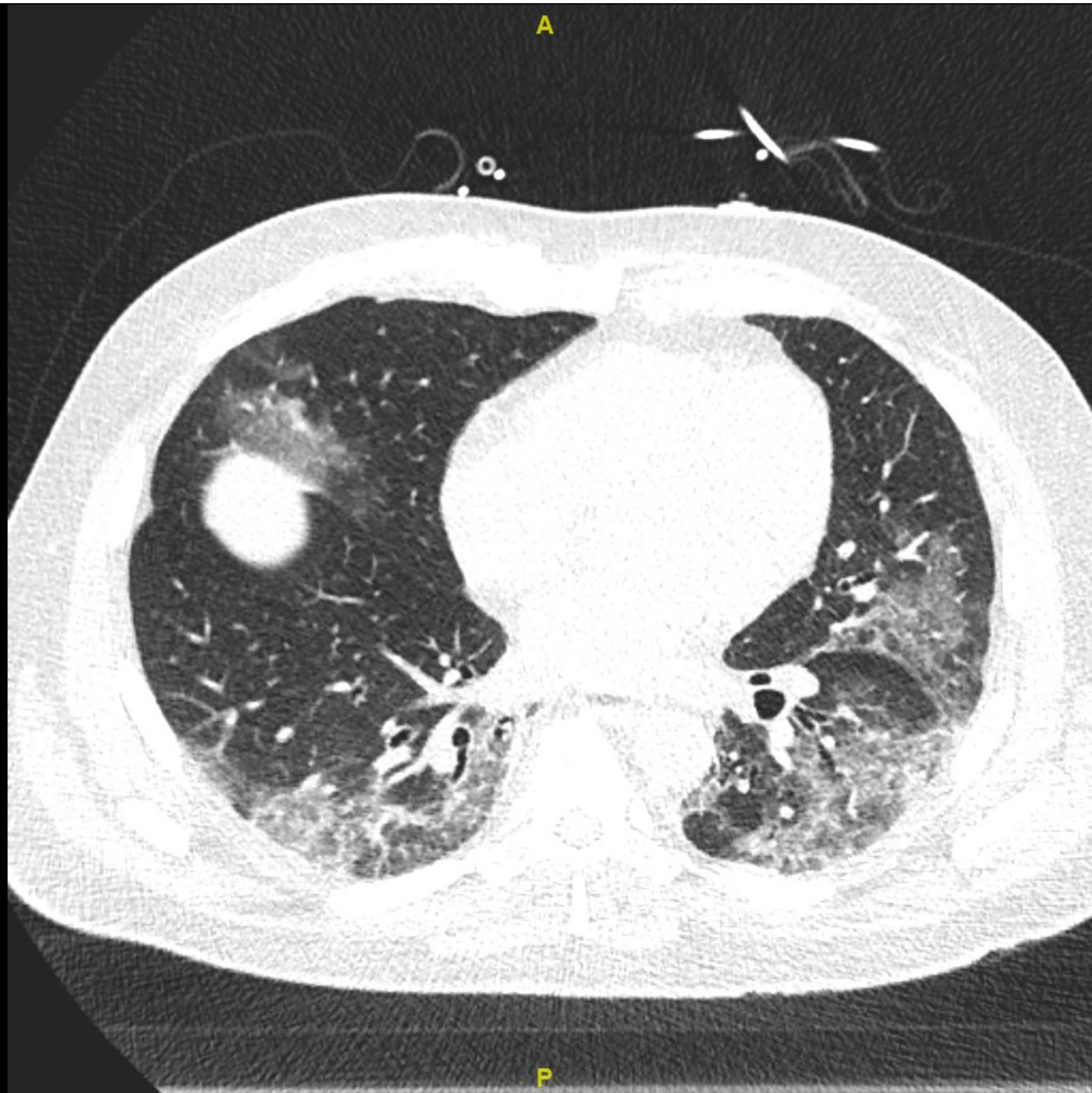
Primär
Universittsspital Basel
Study Date: 29.03.2020
Study Time: 16:46:34

R

A

L

P



ST: 1 mm

Q 1.74
nativ

WW:1200 - WL:-600

RM, *22.11.1961 M

Hämostase Routineanalytik										
Abteilung			4602		4602		4602		4800	
Probenentnahme			30.03.20 05:11		29.03.20 21:45		29.03.20 20:36		29.03.20 17:30	
Laboreingang	Einheit	Referenzbereich	30.03.20 05:19		29.03.20 22:27		29.03.20 20:45		29.03.20 17:43	
Auftragsnummer			42211906		42211881		42211824		42211766	
Hämostase Routine										
Quick	%	70 - 120	64	↓			68	↓	66	↓
Quick INR		<1.3	1.3				<u>1.2</u>		1.2	
aPTT	s	25-34	29				30			
Thrombinzeit 1	s	13-18	19	↑			17			
Fibrinogen	g/l	1.7-4.0	6.2	↑			<u>6.8</u>	↑		
Faktor II	%	70 - 120	68	↓			73			
Faktor V	%	70 - 120	114				>120	↑		
Faktor VII	%	70 - 120	57	↓			53	↓		
D-Dimere	µg/ml	0.19 - 0.5	5.65	↑	7.28	↑	<u>10.41</u>	↑		

DIC-Score according to ISTH

Platelet count

- >100 Giga/L = 0; <100 Giga/L = 1; <50 Giga/L = 2

D-dimers

- Fibrinmonomers or d-dimers
- normal = 0; high= 2; very high= 3

Prolonged PT/INR

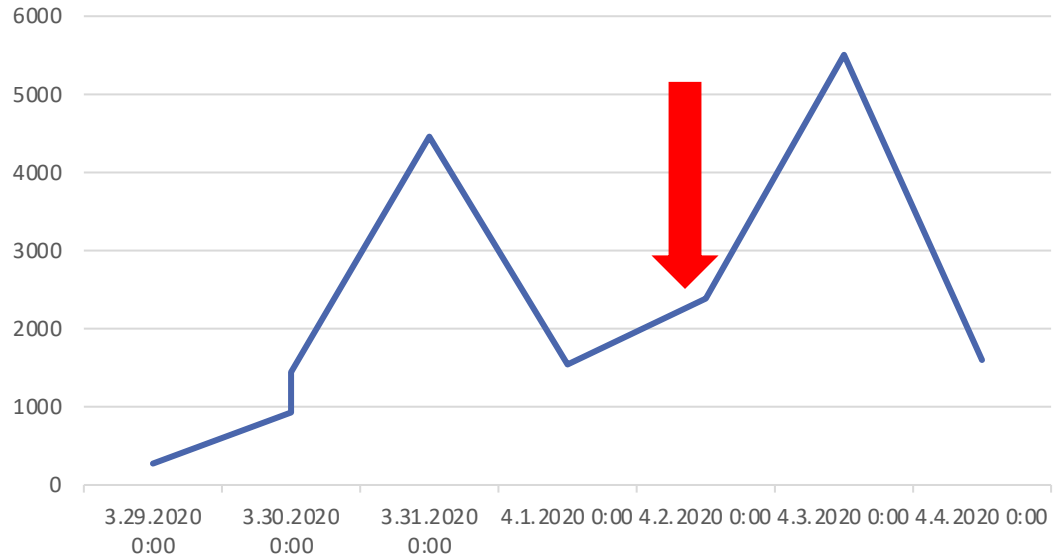
- <3 Sec. = 0; 3-6 Sec. = 1; >6 Sec. = 2
- INR <1.3 = 0, INR 1.3-1.6 = 1, INR >1.6 = 2

Fibrinogen

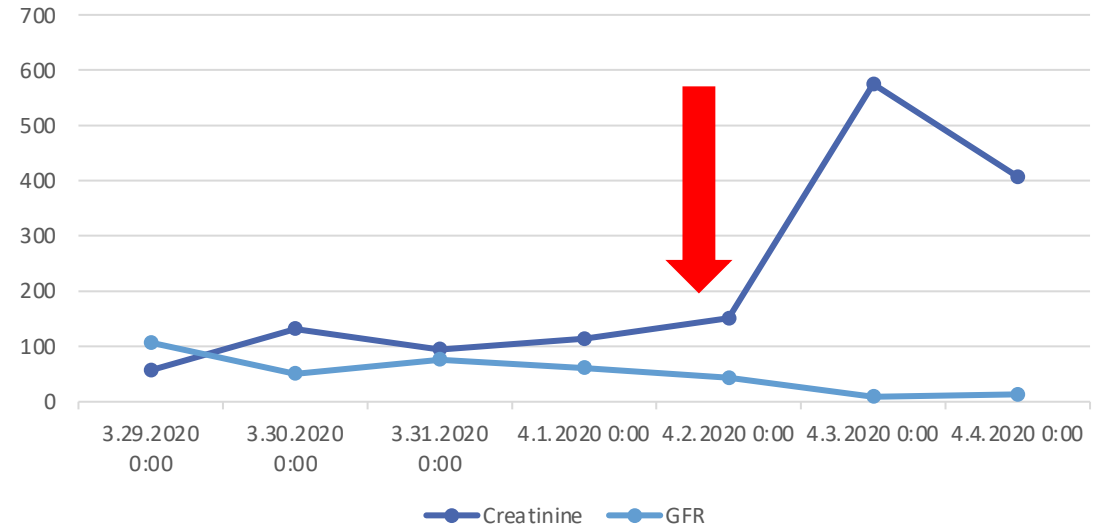
- >1.0 g/l = 0, <1.0 g/l = 1)

Score ≥ 5 : overt DIC

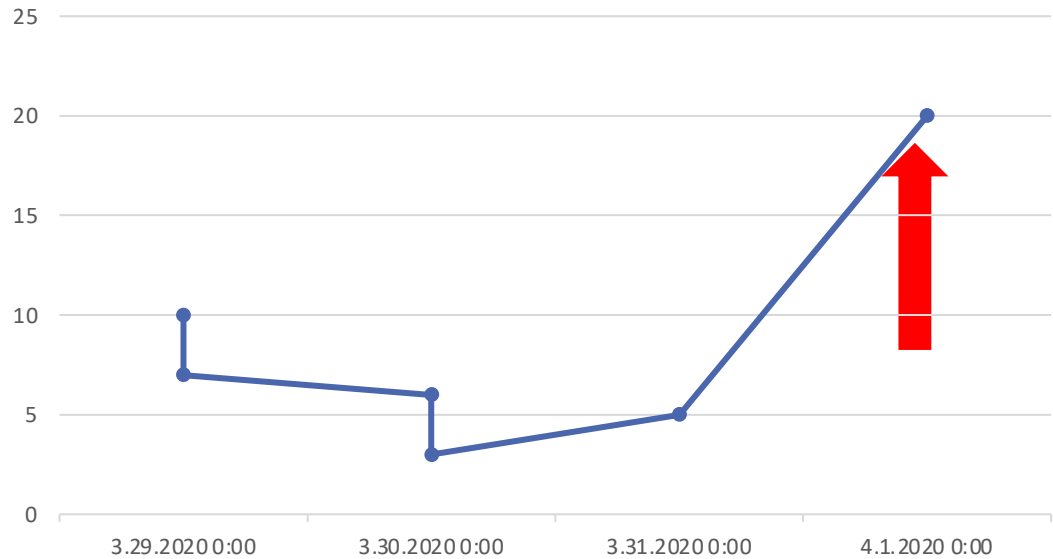
Interleukin-6



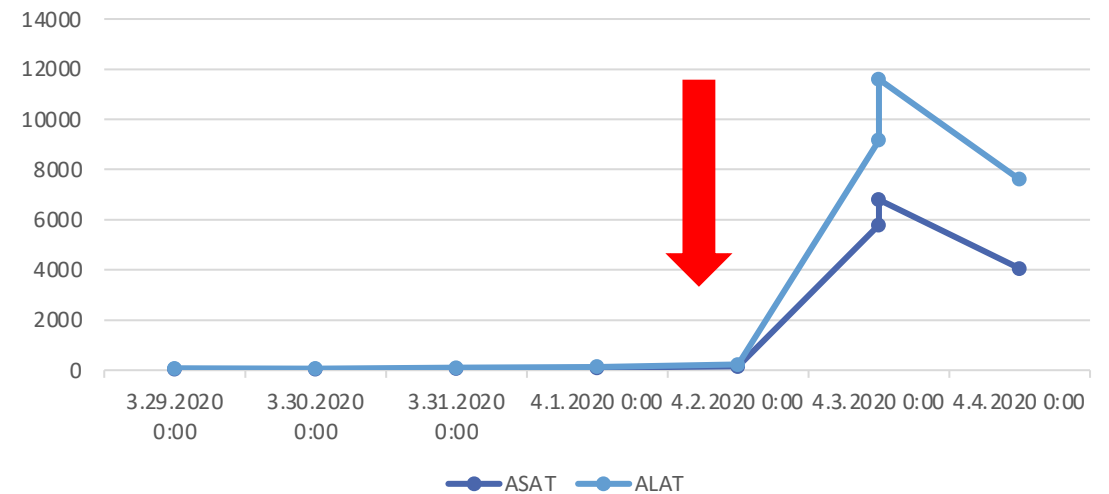
Creatinine and GFR



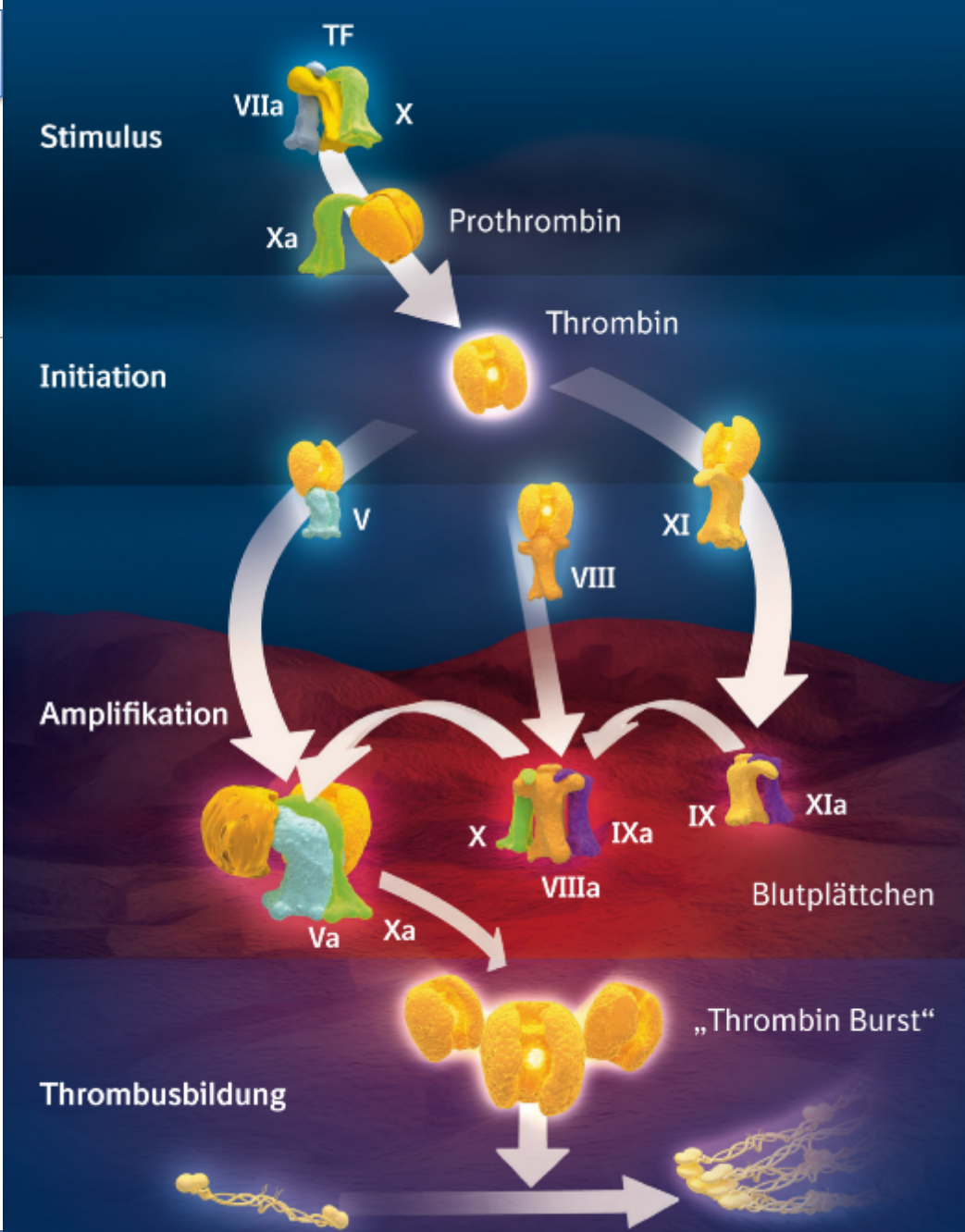
D-Dimere



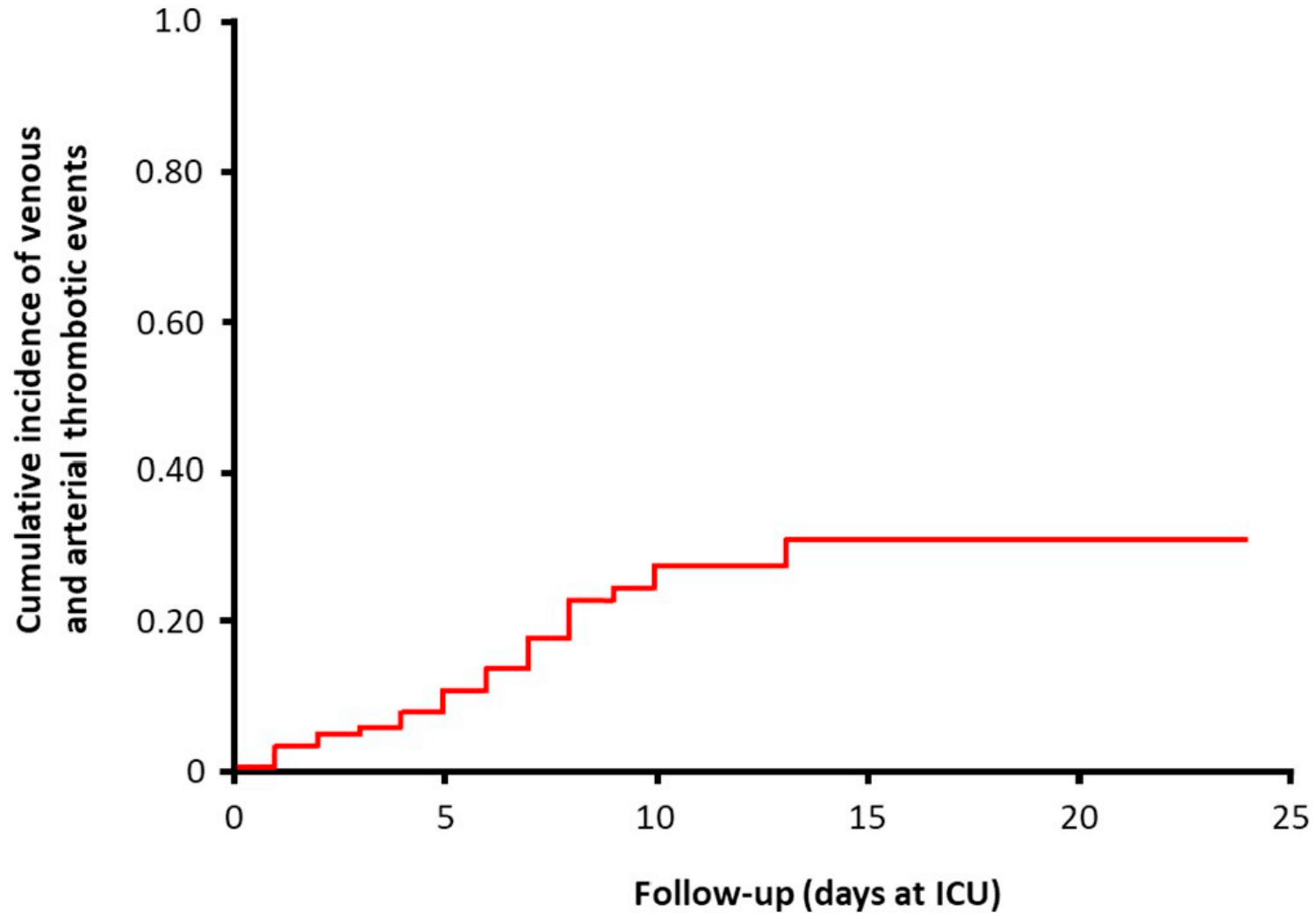
Liver enzymes



Cell based Hemostasis



Thrombosis is frequent in COVID-19



Pathophysiological changes in COVID-19 cause small- and large-vessel thrombosis

Local inflammation

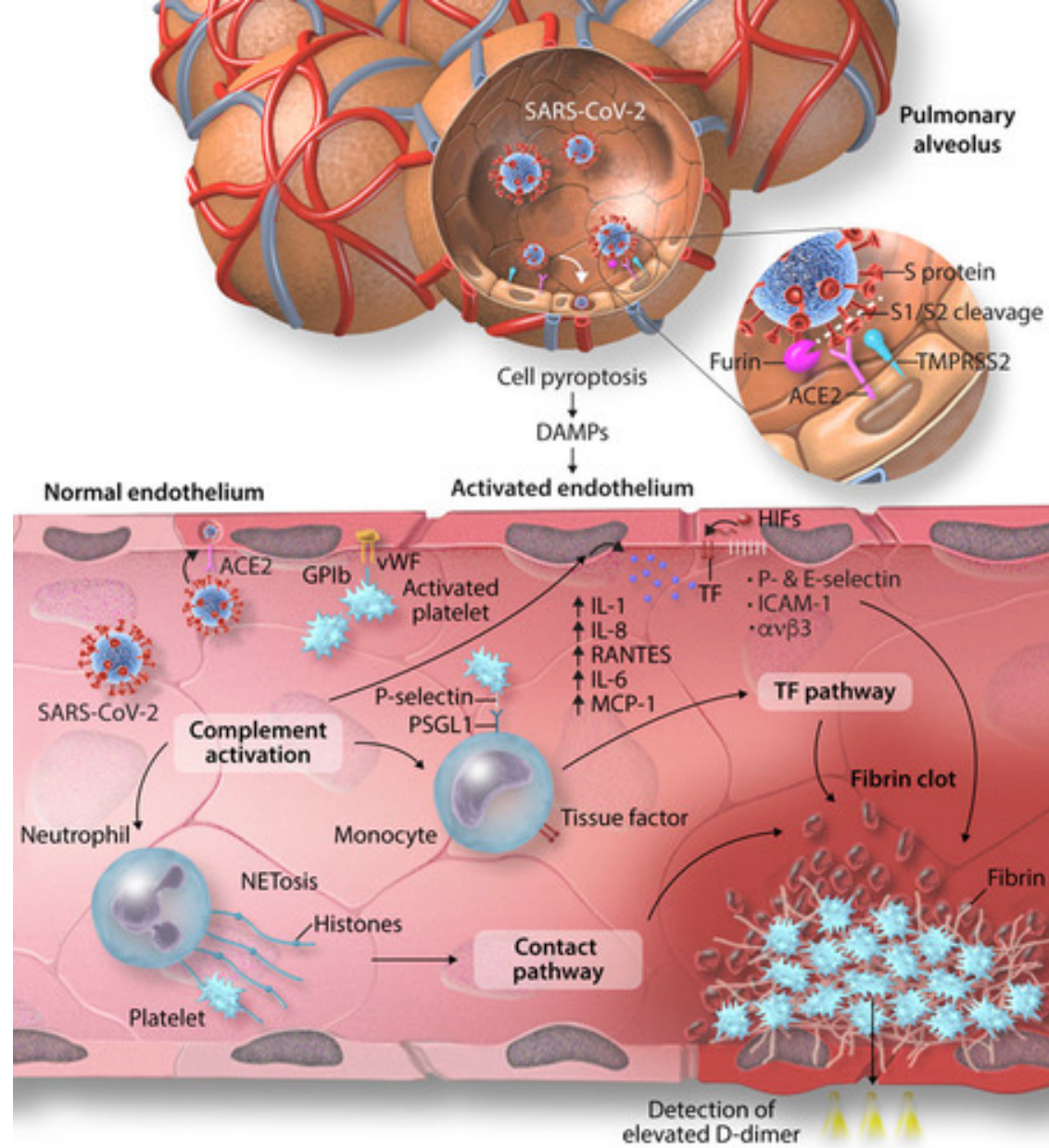
- Local viral damage

Systemic inflammation

- Cytokines
- Viremia

Endotheliopathy

- Local
- Remote

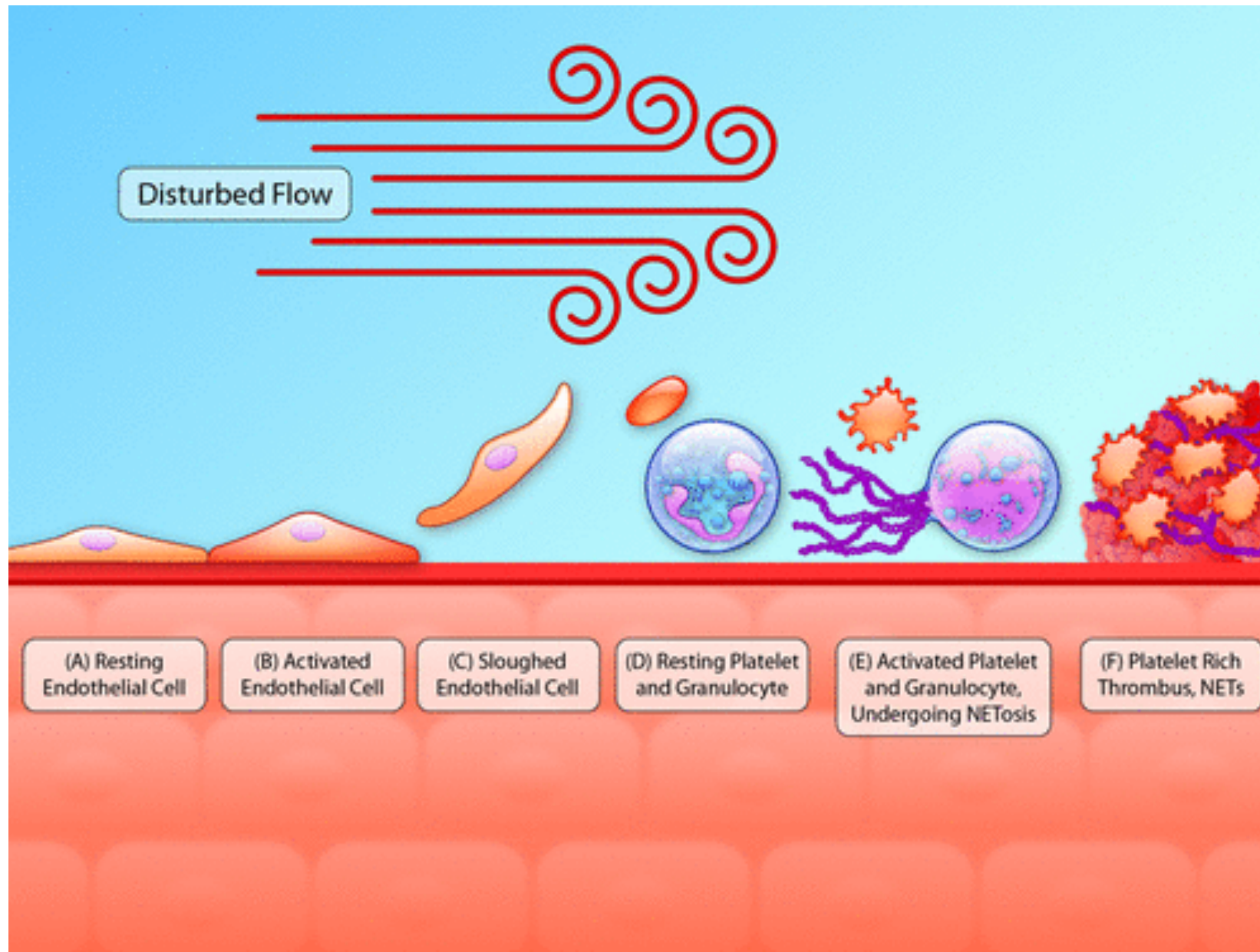


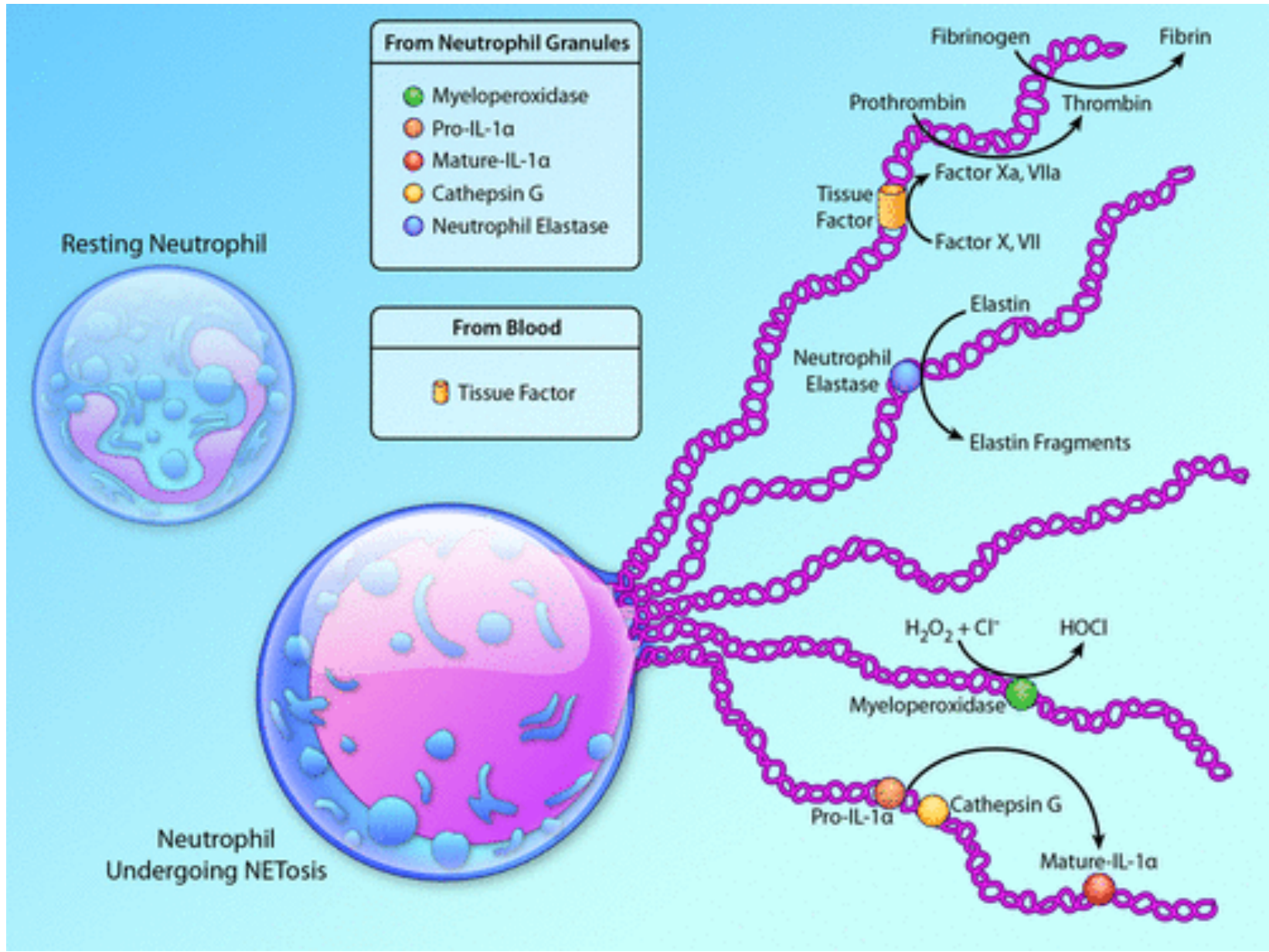
James D. McFadyen. *Circulation Research*. The Emerging Threat of (Micro)Thrombosis in COVID-19 and Its Therapeutic Implications, Volume: 127, Issue: 4, Pages: 571-587, DOI: (10.1161/CIRCRESAHA.120.317447)

Pathophysiological changes in COVID-19

Local inflammation

- Pyroptosis of lung epithelium
 - Local damage
 - ARDS
- Alveolar fibrin depositions
 - High d-dimers without evident thrombosis
- Endothelial stimulation
 - High fibrinolytic capacity
 - High d-dimers without evident thrombosis
 - High procoagulant fibrinogen, VWF, other





Pathophysiological changes in COVID-19

Systemic inflammation

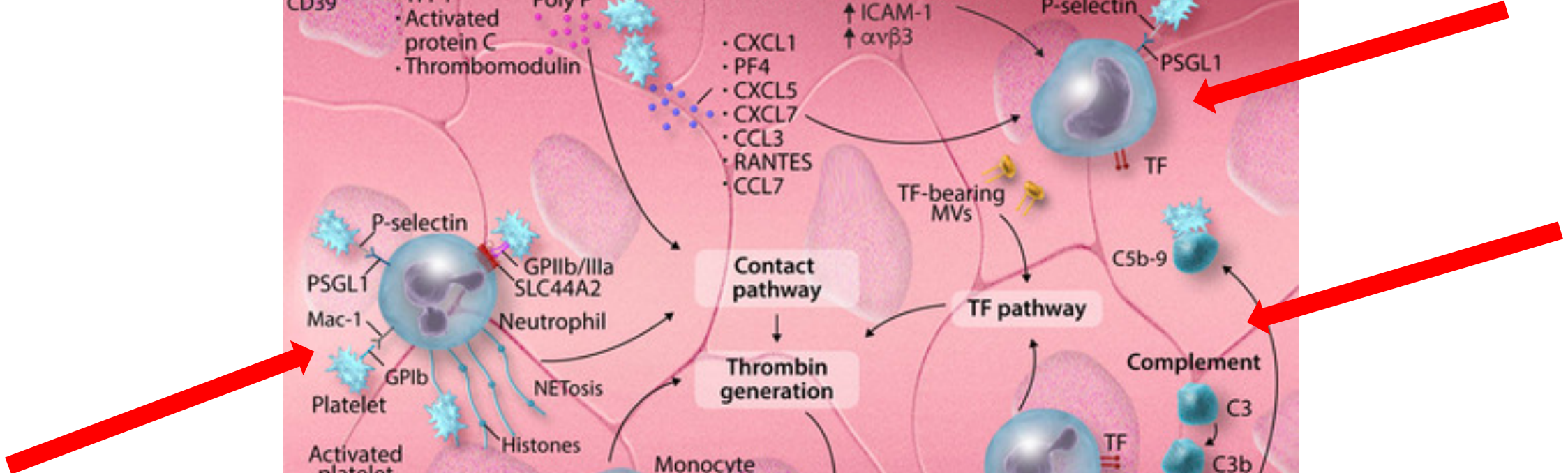
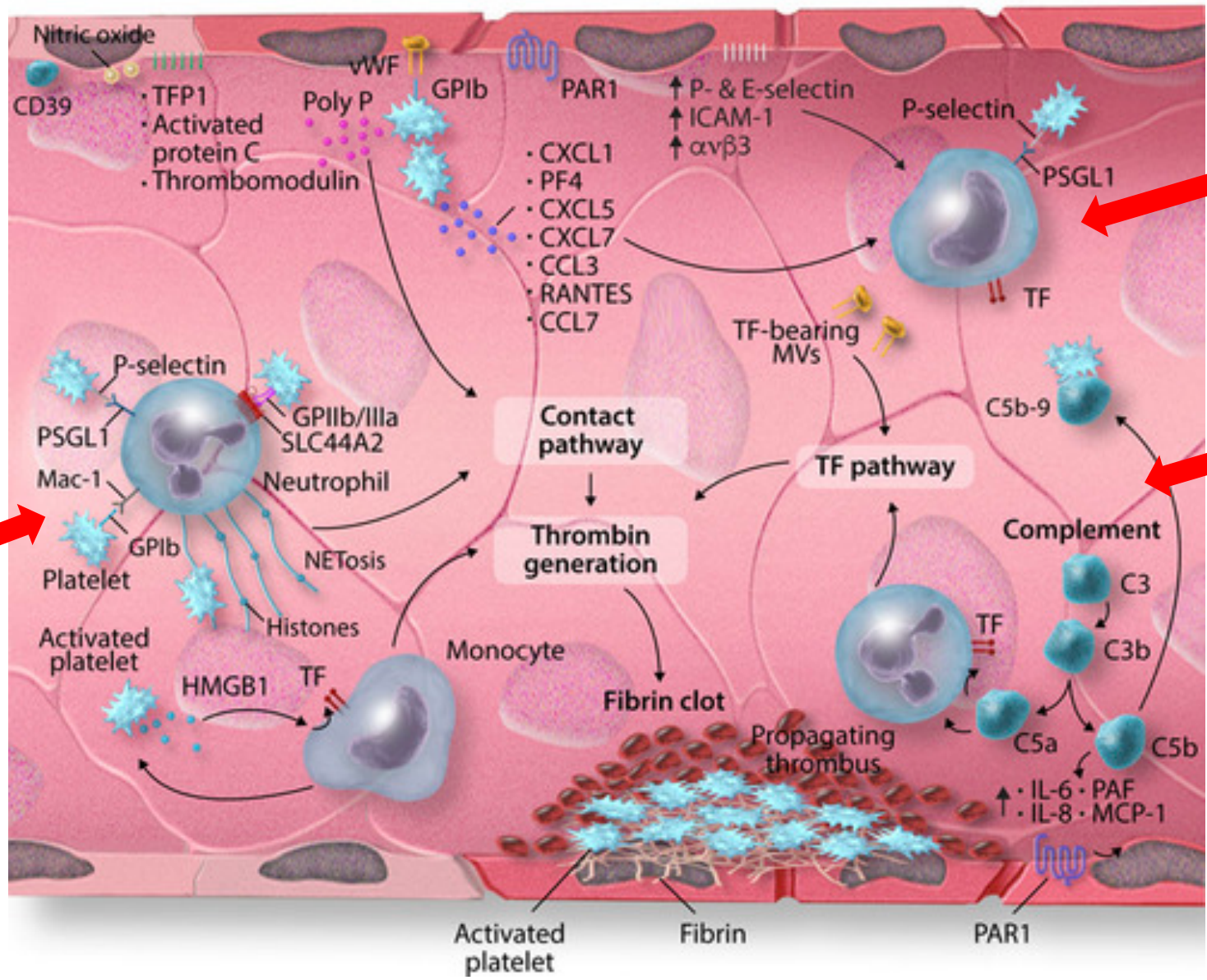
- Viremia
- Macrophage activation
- Ferritin, Cytokine storm, IL-6

Pathophysiological changes in COVID-19

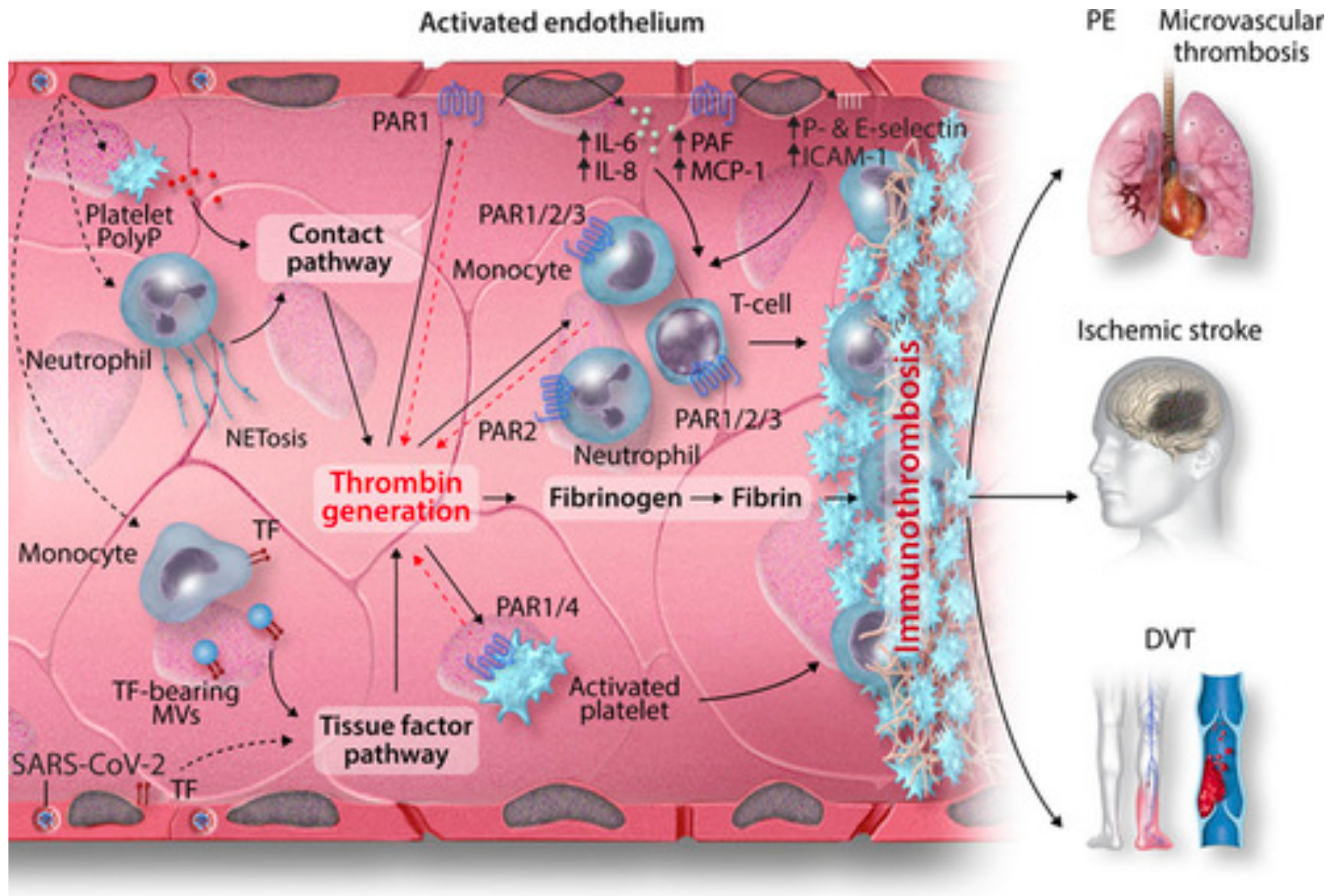
Endotheliopathy

- Viral inclusions
- Macrophage and neutrophil infiltration
 - Tissue factor release
 - NETs
 - Complement activation
- Endothelial cell apoptosis
 - Microvascular thrombosis
 - Large vessel thrombosis

Normal endothelium **Activated endothelium**



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FORUM

jth

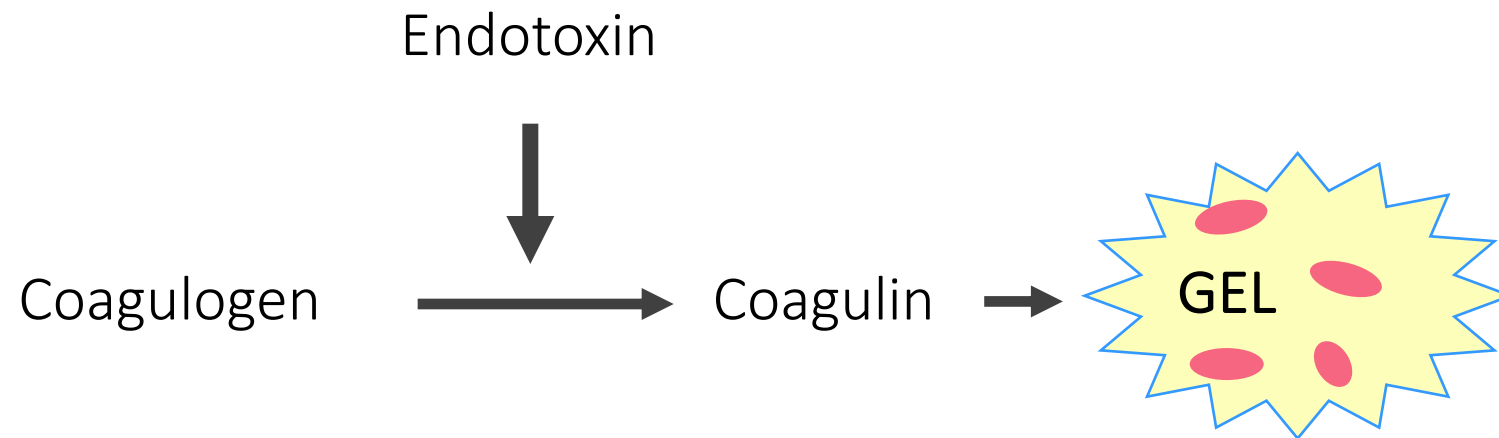
The protective rather than prothrombotic fibrinogen in COVID-19 and other inflammatory states

Jecko Thachil

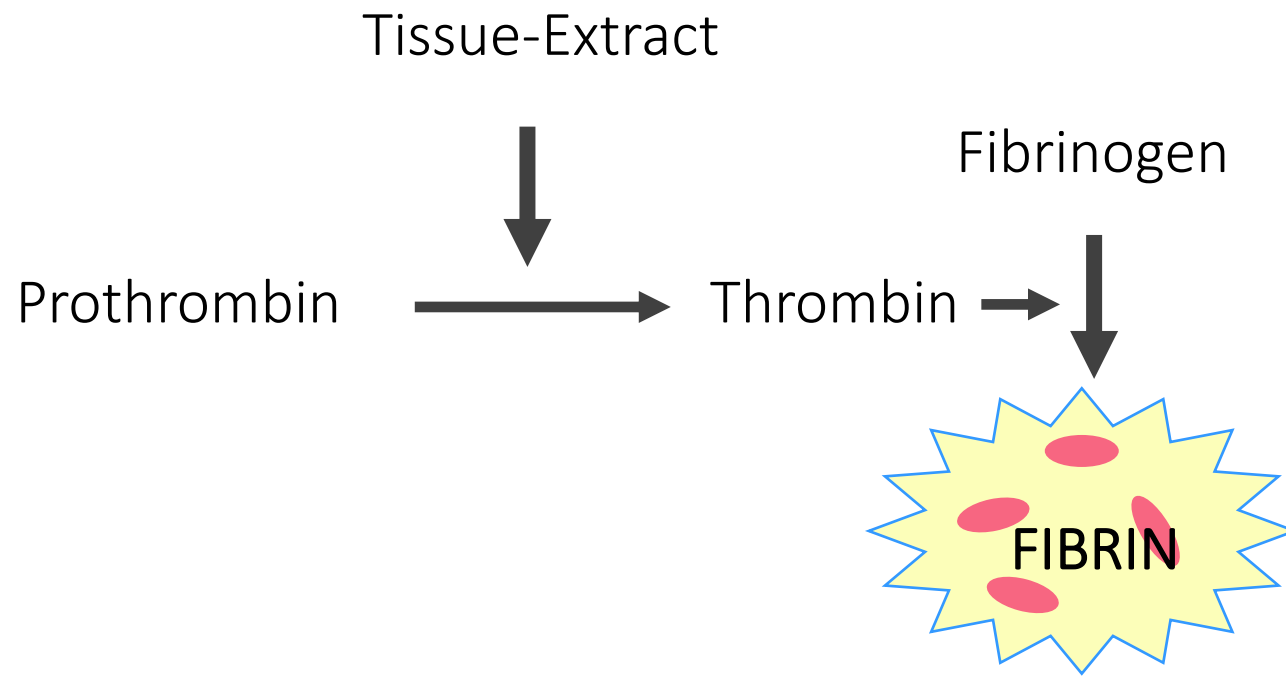
Limulus polyphemus

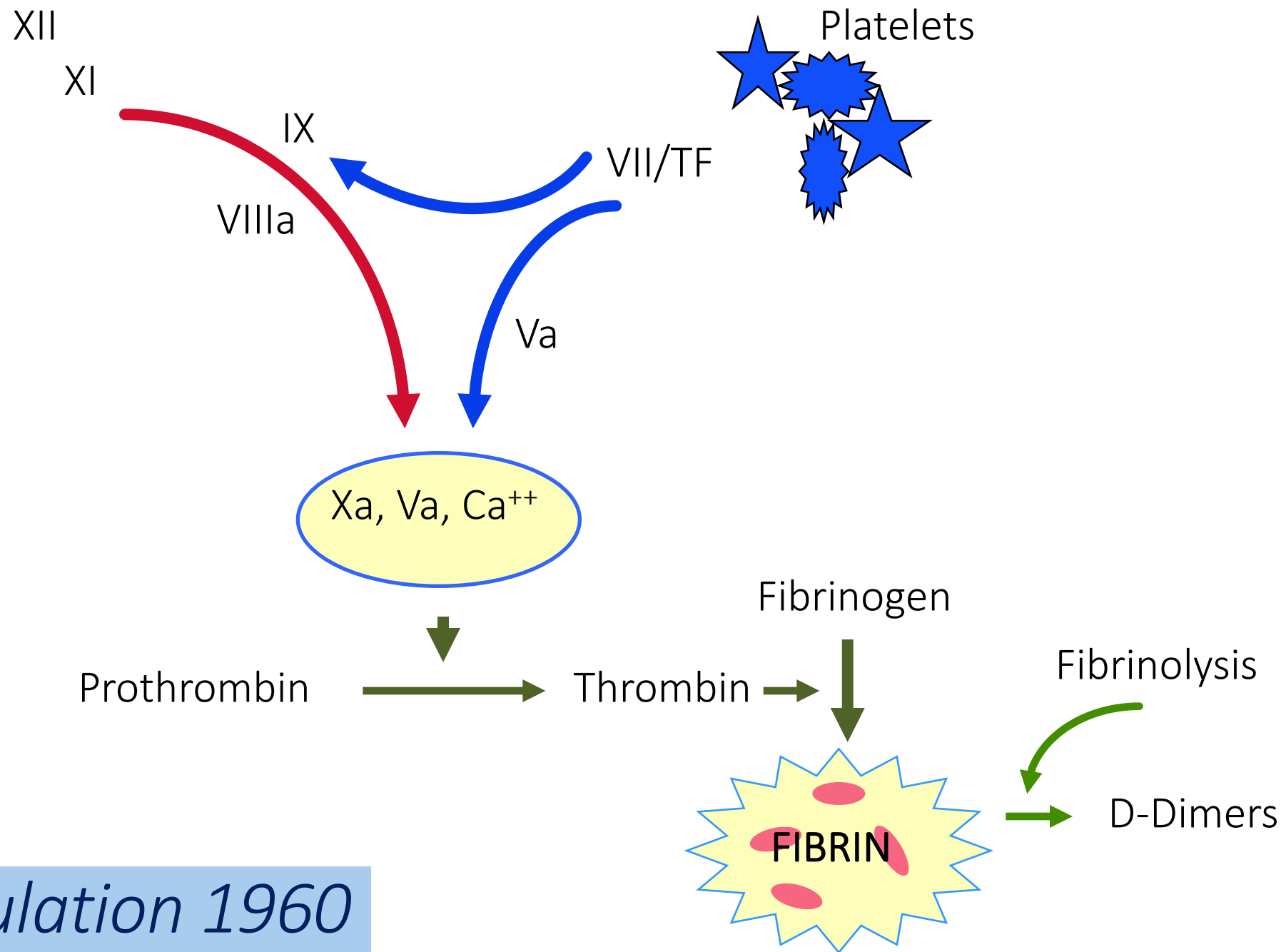


Limulus test 1964



Human coagulation theory 1904





Human coagulation 1960

Pathophysiological changes in COVID-19 cause small- and large-vessel thrombosis

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Systemic inflammation

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Endotheliopathy

- Local
- Remote

Thank you !

