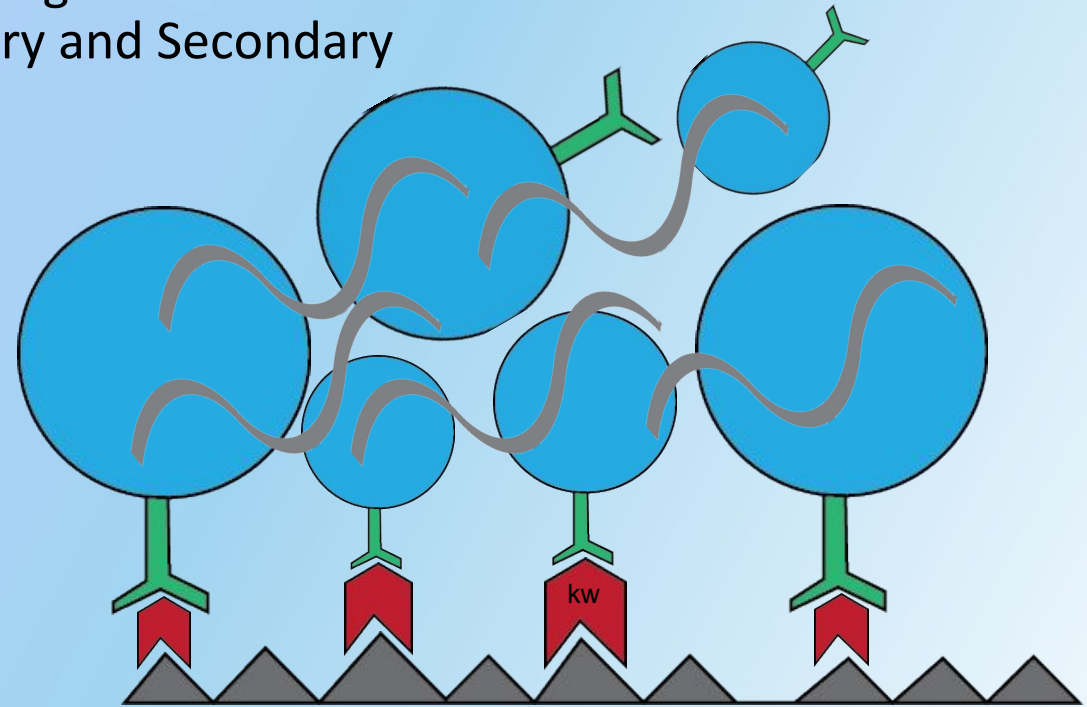
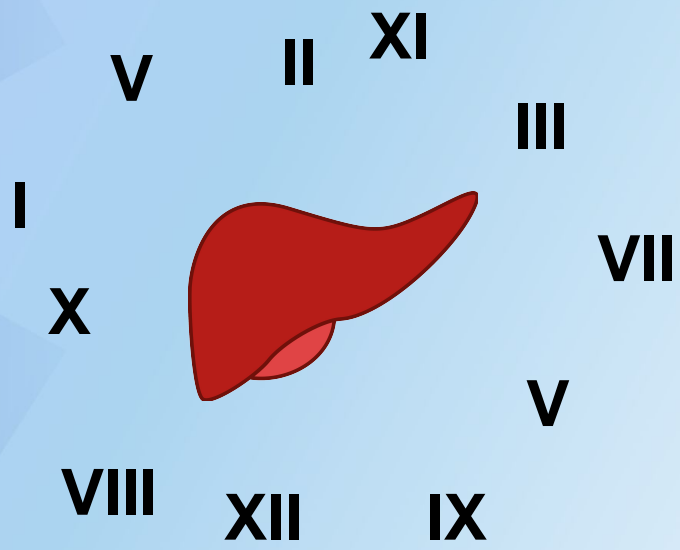
Coagulation Cascade and Blood

Hemostasis

- Stopping of flow of blood
- Primary and Secondary



Let’s Talk Coagulation Cascade

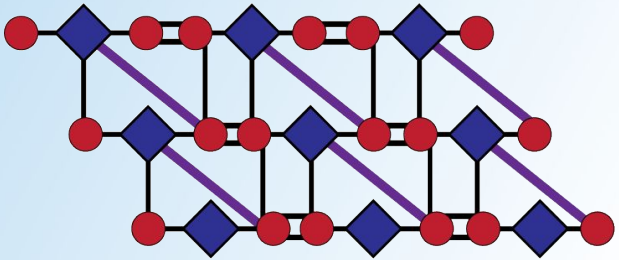


So about Those **Factors...**

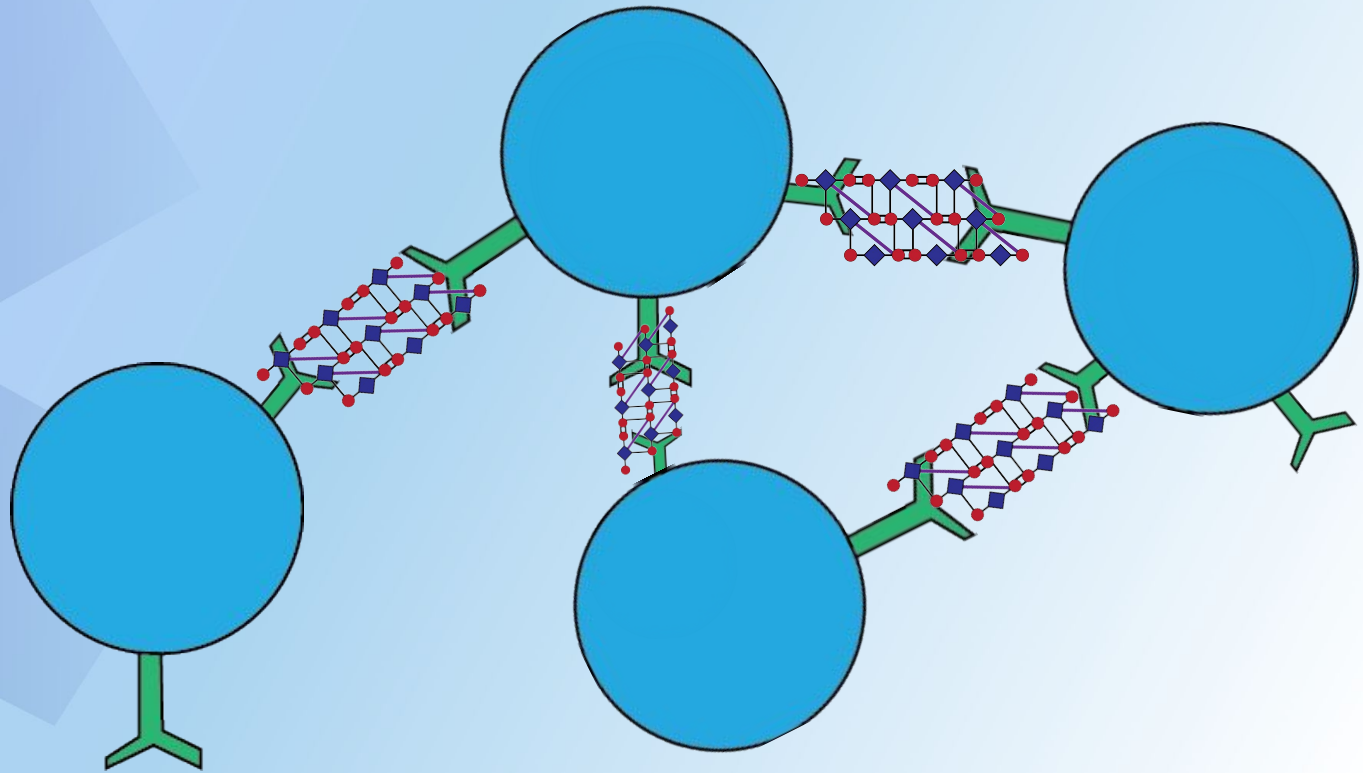
I	Fibrinogen	Substrate
II	Prothrombin	Proenzyme
III	Tissue Factor	Activator
IV	Calcium	Cofactor
V	Proaccelerin	Cofactor
VII	Proconvertin	Proenzyme
VIII	Antihemophilic	Cofactor
IX	Christmas	Proenzyme
X	Stuart-Prower	Proenzyme
XI	PTA	Proenzyme
XII	Hageman	Proenzyme
XIII	Protransglutaminase	Proenzyme

What's the Goal?

Fibrinogen

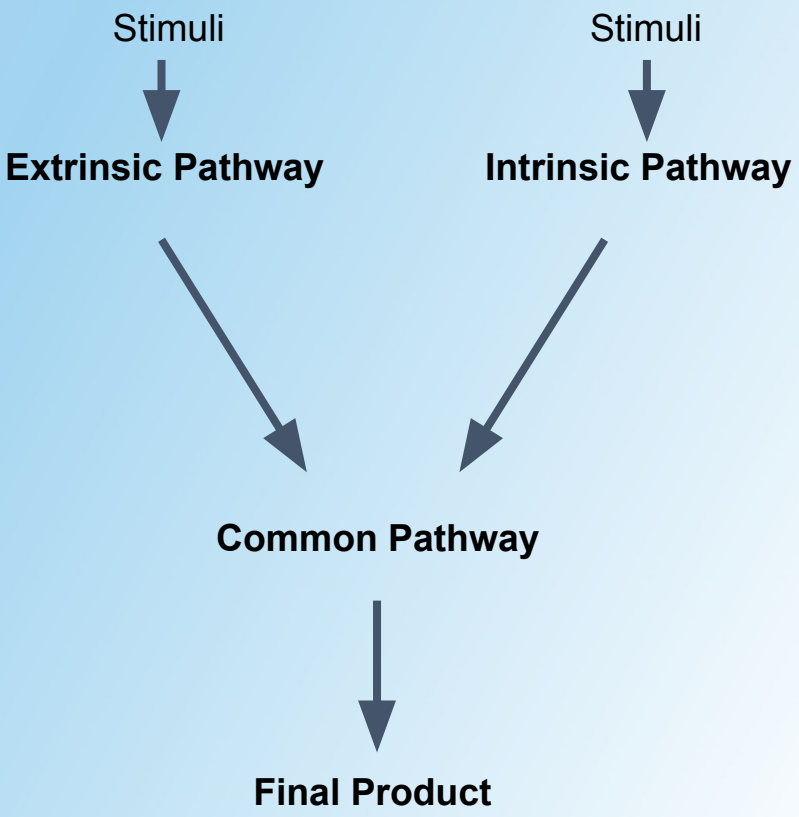


Fibrin (Cross linked)



Divide into Three

- Extrinsic Pathway
  - Tissue Factor Pathway
- Intrinsic Pathway
  - Contact Activation Pathway
- Common Pathway
  - Shared



Common Pathway

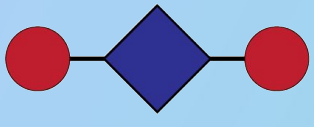
10 → 10a Stuart-Prower factor

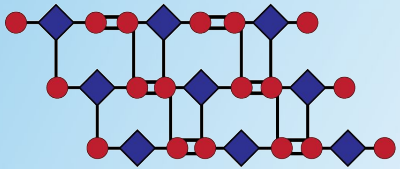
↓ 5a

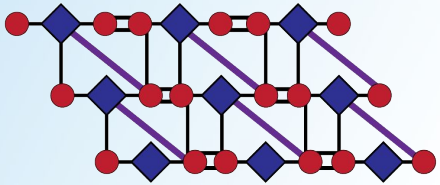
Prothrombin 2 → 2a Thrombin

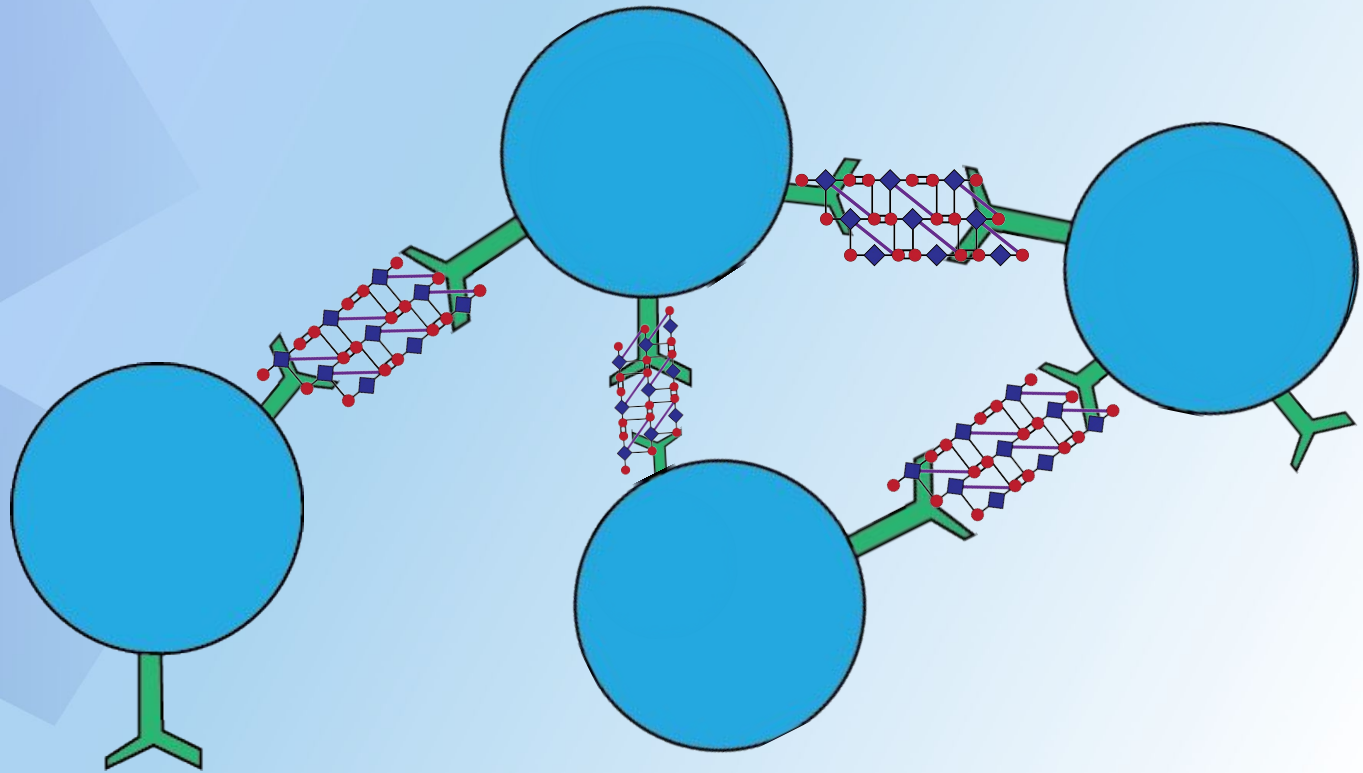
↓

Fibrinogen 1 → 1a Fibrin → 13a, Ca2+









Collagen, basement membrane, activated platelets

12 → 12a

↓

11 → 11a

↓

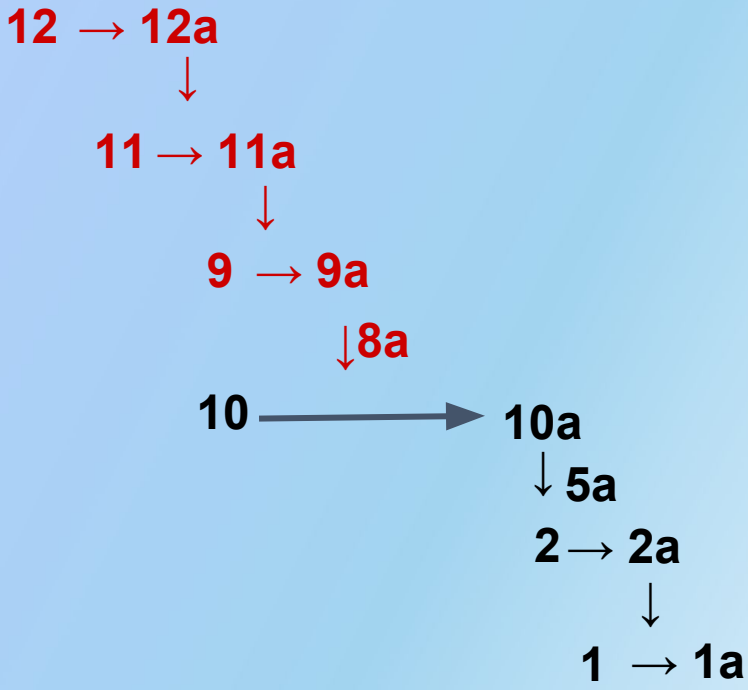
9 → 9a

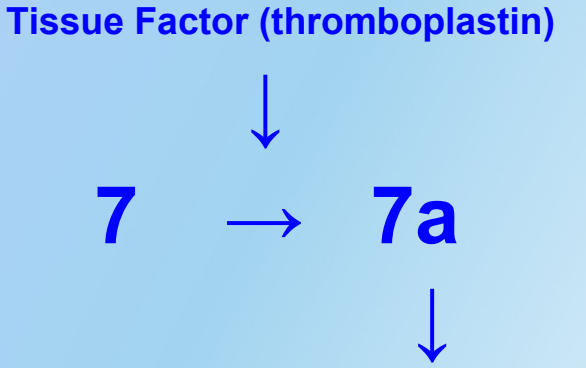
↓

8a

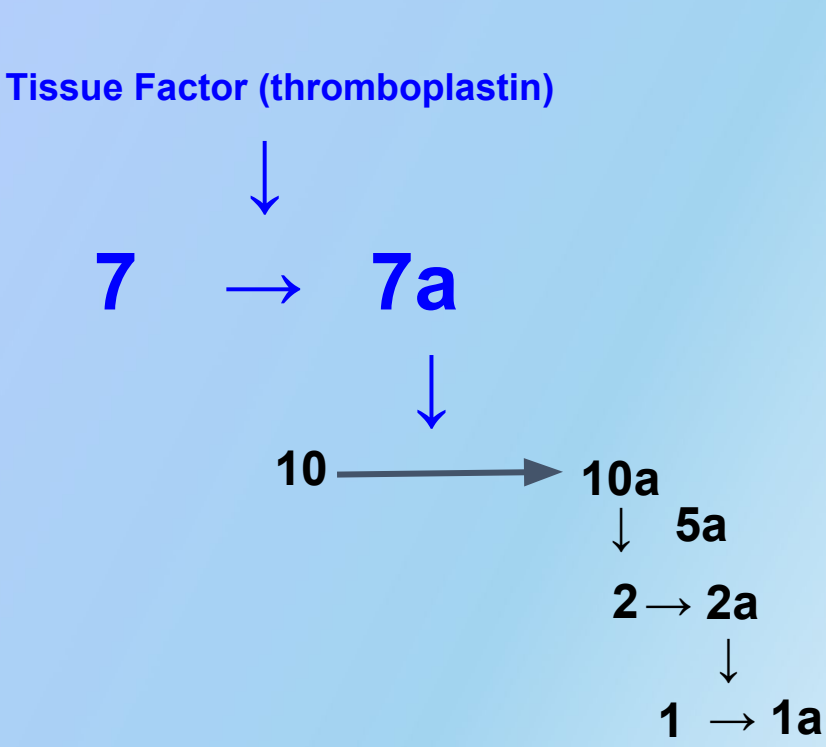
Intrinsic Pathway

Collagen, basement membrane, activated platelets

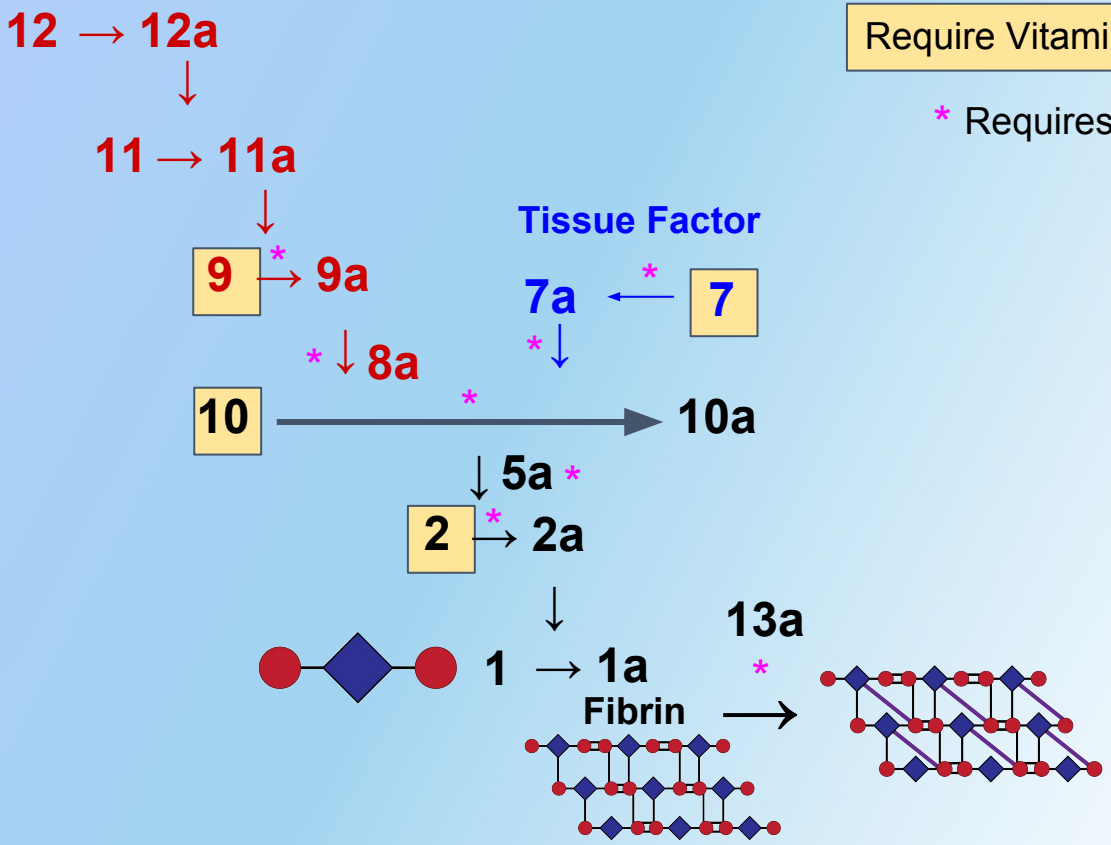




Extrinsic Pathway


Tissue Factor (thromboplastin)
7
7a
10
10a
5a
2
2a
1
1a

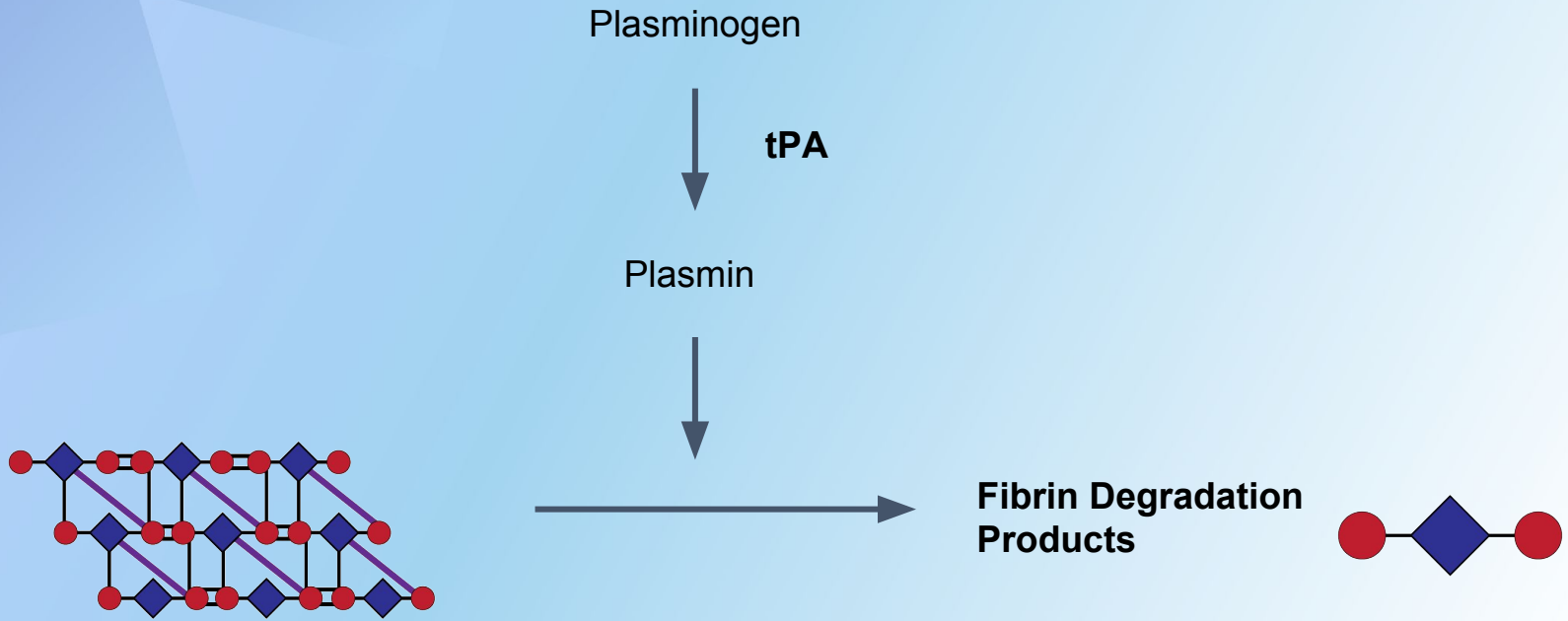
Collagen, basement membrane, activated platelets



Require Vitamin K - 2,7,9,10

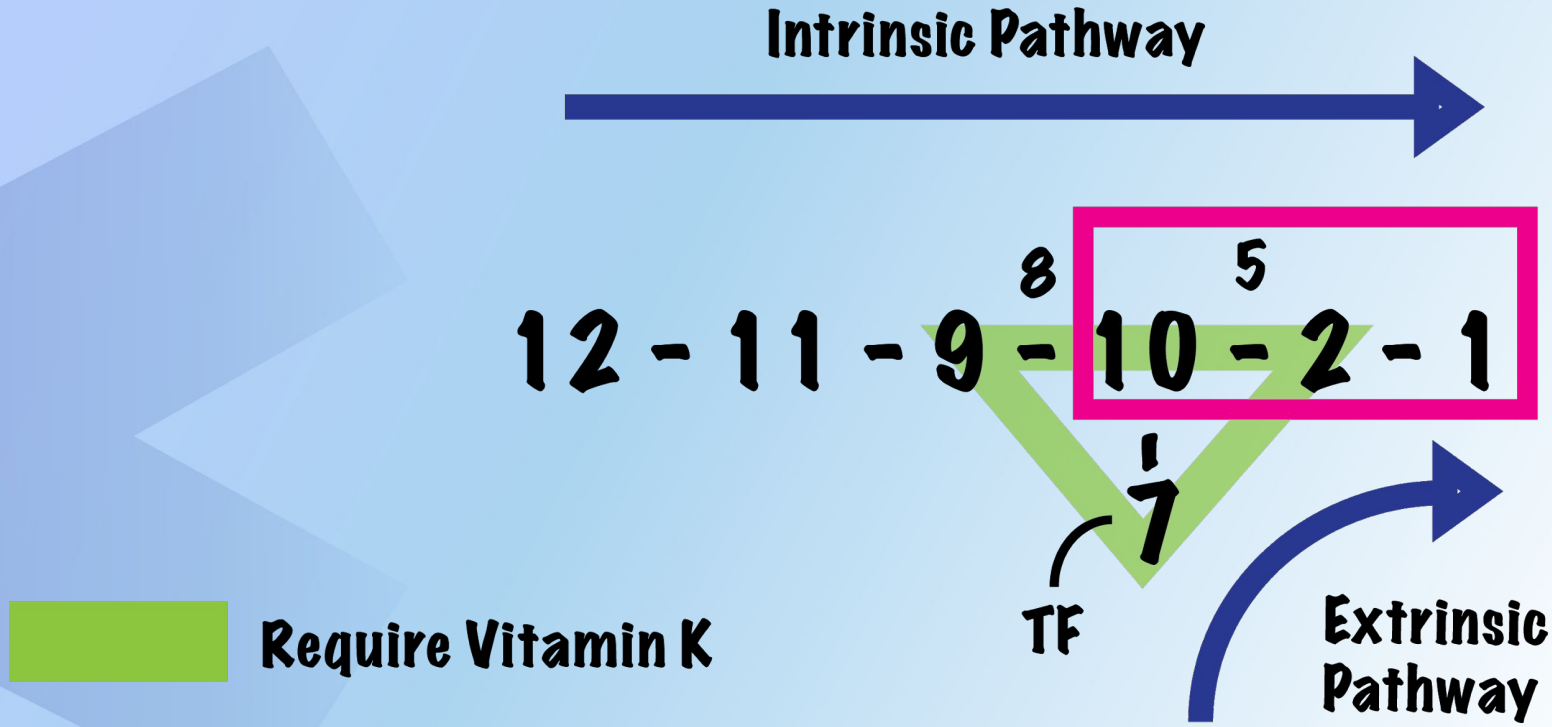
* Requires Calcium

Fibrinolytic System



Honorable Mentions

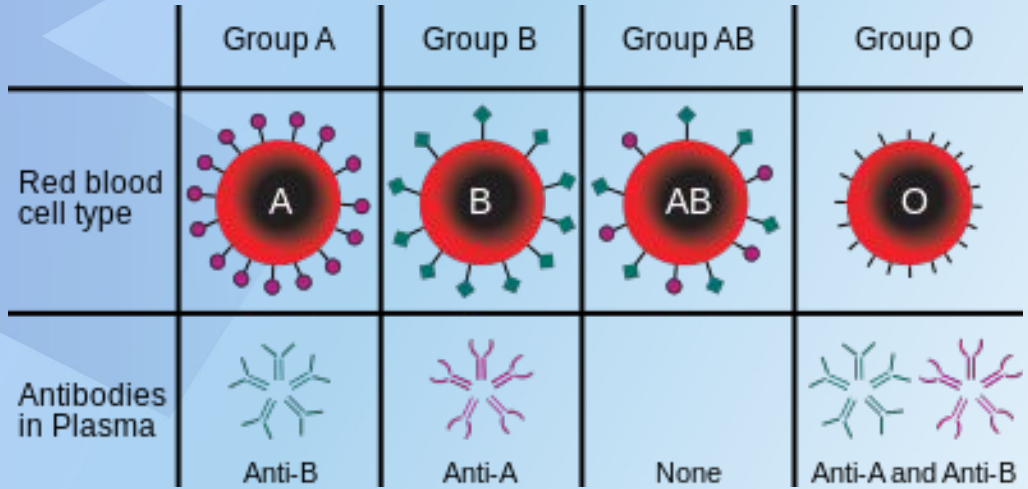
- **Protein C + Protein S** → Inactivation of Va, VIIIa
- **Antithrombin** → II, VII, IX, X, XI, XII


Intrinsic Pathway
8
5
12 - 11 - 9 - 10 - 2 - 1
7
TF
Extrinsic Pathway
Require Vitamin K
Common Pathway

Blood

Red Blood Cells

- Lifespan of 120 days
- Proliferation stimulated by erythropoietin



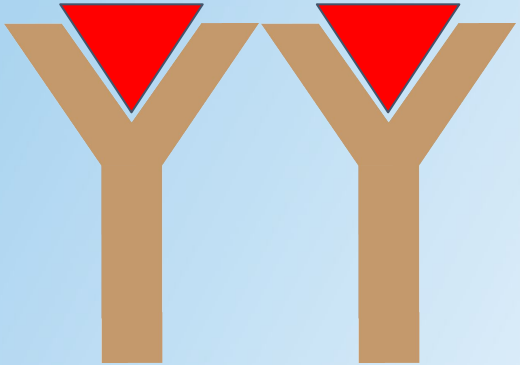
Agglutinogens

Agglutinins

Agglutinogens

Agglutinins

Agglutination



Platelets

- Primary Hemostasis
- Derived from megakaryocytes (stimulated by **thrombopoietin**)
- Lifespan of about **10 days**

White Blood Cells

- Granulocytes = Basophils, Eosinophils, Neutrophils, Mast Cells
- Mononuclear cells = Monocytes, Lymphocytes
- Neutrophils - 60%
- Lymphocytes - 30%
- Monocytes - 6%
- Eosinophils - 3%
- Basophils - 1%
    - **N**ever **L**et **M**onkeys **E**at **B**ananas

Macrophages

- Phagocytose!
- Blood: monocyte → migration into tissue → macrophage
- Activated by Interferon-γ
  - Interferons: group of signaling proteins that respond to pathogens e.g. viruses

Lymphocytes

- B Cells
  - Humoral Response (produce antibodies)
  - Originate from & mature in bone marrow
- T Cells
  - Cellular immune response (cytotoxic, regulatory)
  - Originate from bone marrow, mature in thymus