

Coagulation of Blood

Define Haemostasis?

Spontaneous arrest or prevention of bleeding by physiology process is called "haemostasis".

Haemostatic Mechanism

Injury to vessel wall → formation of Clot → Seals off damage vessel

↓
Prevent further loss of blood

Injury to vessel wall

(A)

- Release of **5HT** and other vasoconstrictⁿ from platelets
- Local myogenic spasm
- Nervous reflexes from damaged tissues.

Constriction of injured blood vessel

(B)

Endothelium disrupted

Underlying layer of collagen is exposed

Platelets adhesion (Platelets attach to collagen in vessel wall)

Platelets activatⁿ

loose platelet aggregatⁿ

Formation of Temporary Haemostatic Plug of platelets

(C)

Release of tissue thromboplastin

Via Intrinsic System

Via Extrinsic System

Activatⁿ of Coagulatⁿ

formatⁿ of fibrin

Definitive Haemostatic Plug

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Q Enumerate steps in haemostasis. (5M)

Haemostasis involve 4 main steps.

1. Vascular spasm
- 2 [3. Platelets reaction
- 3 [4. Blood Coagulation

1. Vascular Spasm: Reduces flow of blood from injured vessel.
cause → Sympathetic Reflex

Release vasoconstrictⁿ (serotonin) from platelets that adhere to walls of damaged vessels.

2. Platelets Plug formation

Platelets Adhesion: When a blood vessel wall injured, platelets adhere to exposed collagen → Platelet activated.

Activated Platelets release content i.e ADP, TXA which activate nearby platelets to produce further accumulatⁿ and forming a platelet plug.
(Platelets aggregatⁿ)

3. Blood Coagulation

This clotting mechanism involve a cascade of reactions in which clotting factors are activated.

Clotting factors

Factor I	fibrinogen	Factor VIII	Antihemophilic factors
Factor II	Prothrombin	factor IX	Christmas factor
Factor III	Thromboplastin	factor X	Stuart power factor
Factor IV	Ionic calcium	factor XI	Plasma thromboplastin antecedent (PTA)
factor V	Labile factor	factor XII	Hageman factor or Contact factor
factor VI			
Factor VII	Proconvertin	factor XIII	Fibrin Stabilizing factor

Q What are the vitamin K dependent clotting factors? (2M)

The vitamin K-dependent clotting factors are factors **II, VII, IX, X**

Q Enumerate factors involved in blood clotting and describe two mechanisms of blood coagulation. Add a note on anti-coagulant. (15M)

There are 12 factors involved in the blood clotting.

Factor I - factor XII (factor VI is not present).

(Write all 12 factors and their names)

Two mechanisms of blood coagulation

1. Intrinsic pathway
2. Extrinsic pathway

Inside body

Intrinsic Pathway

outside factor

In vivo triggered by

(i) when blood is exposed to the collagen fibres underlying the endothelium in blood vessel.

(ii) change in blood constituents

In vitro brought by exposing the blood to electropositively charged wettable surface such as glass.

Contact

Inactive XII (~~Fibrin stabilising factor~~)

Active XII (XIIa)

Inactive XI → Active XI (XIa)

Inactive IX → Active IX (IXa)

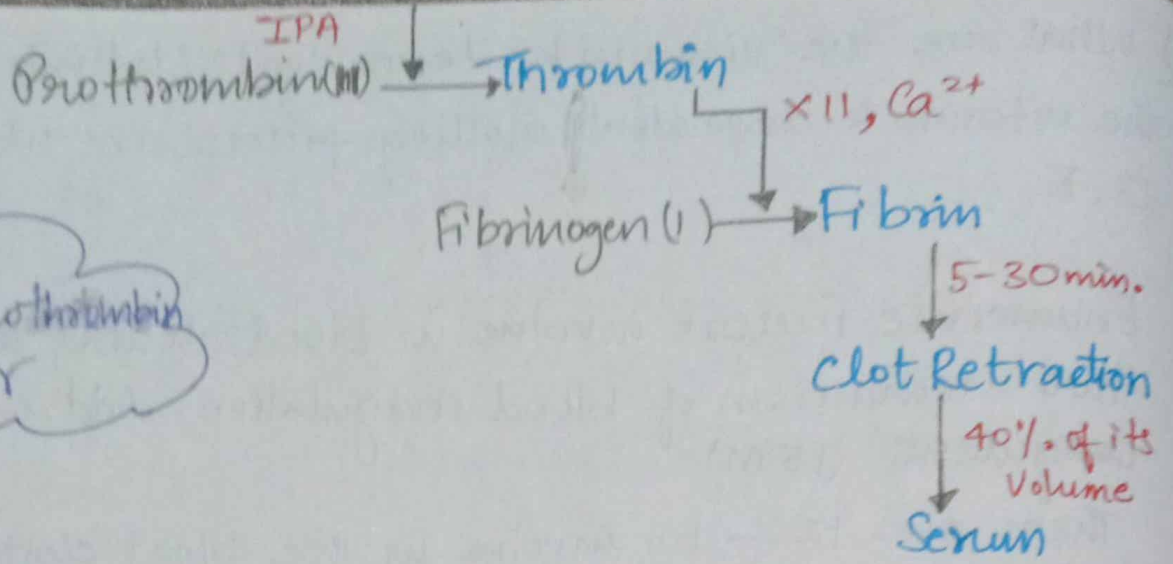
VIIIa

Inactive X → Active X (Xa)

(Key Reaction of Both Systems)

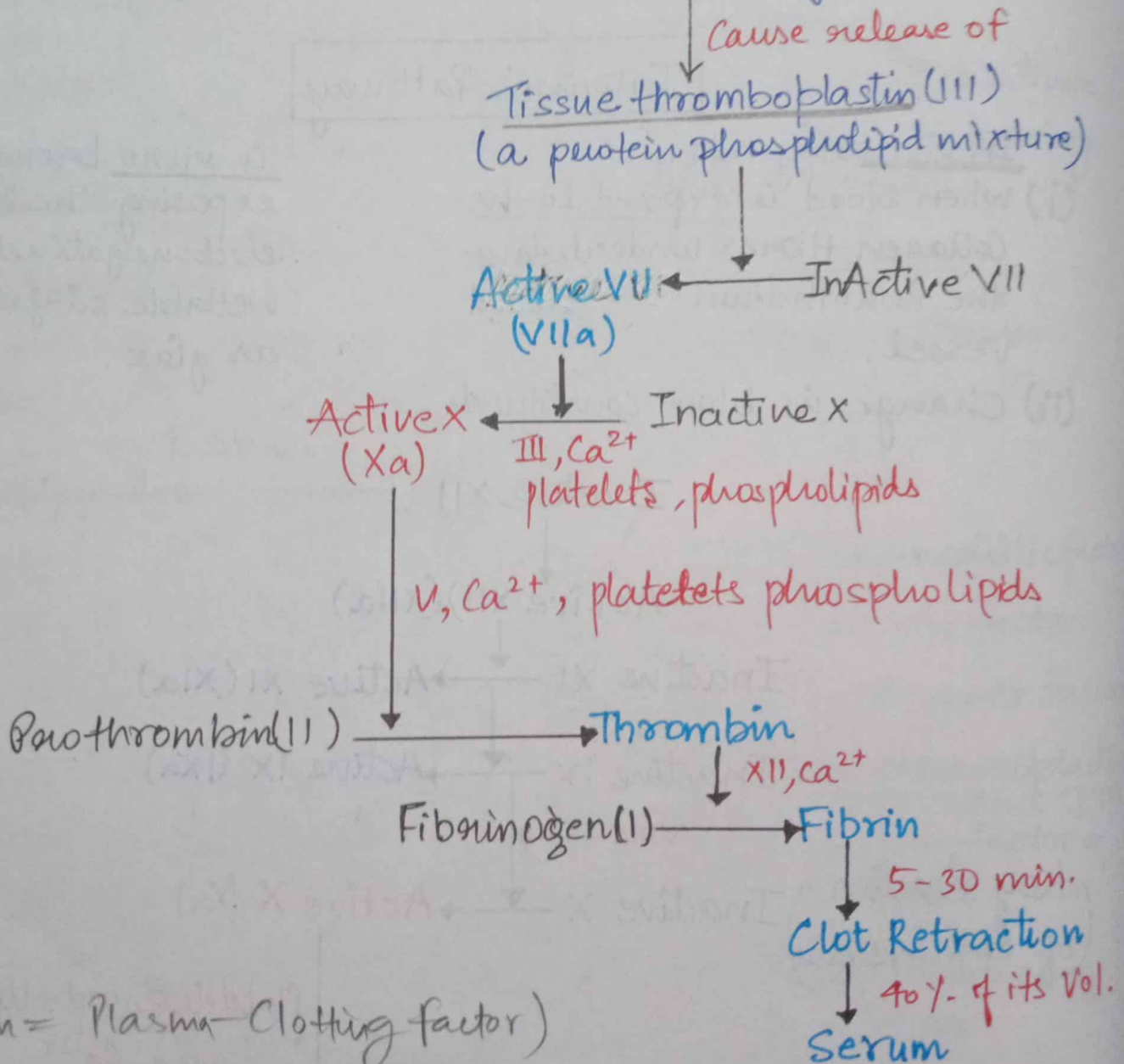
Platelets, phospholipids and Ca^{2+}

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Extrinsic Pathway

It is triggered by injury to (i) Blood vessel wall.
 (ii) Other body tissues.



Anti-Coagulant

Anticoagulant prevent the blood from clotting as quickly or as normal.

A. Natural ^{Anti-}Coagulants

Heparin

Powerful natural anti-coagulants. First isolated from liver and many other organs e.g. lungs.

- Responsible for fluidity of blood.
- Prevent spread of intravascular thrombosis.

Anti-thrombin or Heparin co-factor II. It inhibits thrombin.

B. Synthetic Anticoagulants

Vit. K Antagonists

Effective orally. This include

- Coumarin derivatives
- Warfarin
- Phenindione

Haemorrhage (bleeding) disorders

A. Defective Blood Clotting

Haemophilia A

- It cause by abnormality of deficiency of factor VIII.
- It is inherited sex-linked due to abnormal gene on X-chromosome.
- Transmitted by females.
- Genes responsible for Haemophilia present on X-chromosomes.

Vit. K Deficiency

It is required for synthesis of prothrombin (factor II) and factor, VII, IX, X.

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B. Defective Capillary Contractility

Purpura

The clinical condition in which capillary abnormality results in bleeding is known as purpura.

Spontaneous Haemorrhages beneath skin, mucous membranes and internal organs.