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Summer 4-23-2021

Coagulation cascade and hemostatis

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Coagulation Cascade and Hemostasis

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Objectives

1. List the coagulation factors
2. Describe the steps involved in the mechanism of clot formation
3. Role of platelets in hemostasis

Hemostasis

- Hemostasis is the arrest of bleeding
- **Hemostasis:** Process of forming clots in walls of damaged blood vessels and preventing blood loss while maintaining blood in a fluid state within the vascular system

Hemostasis

Physiological balance exists between

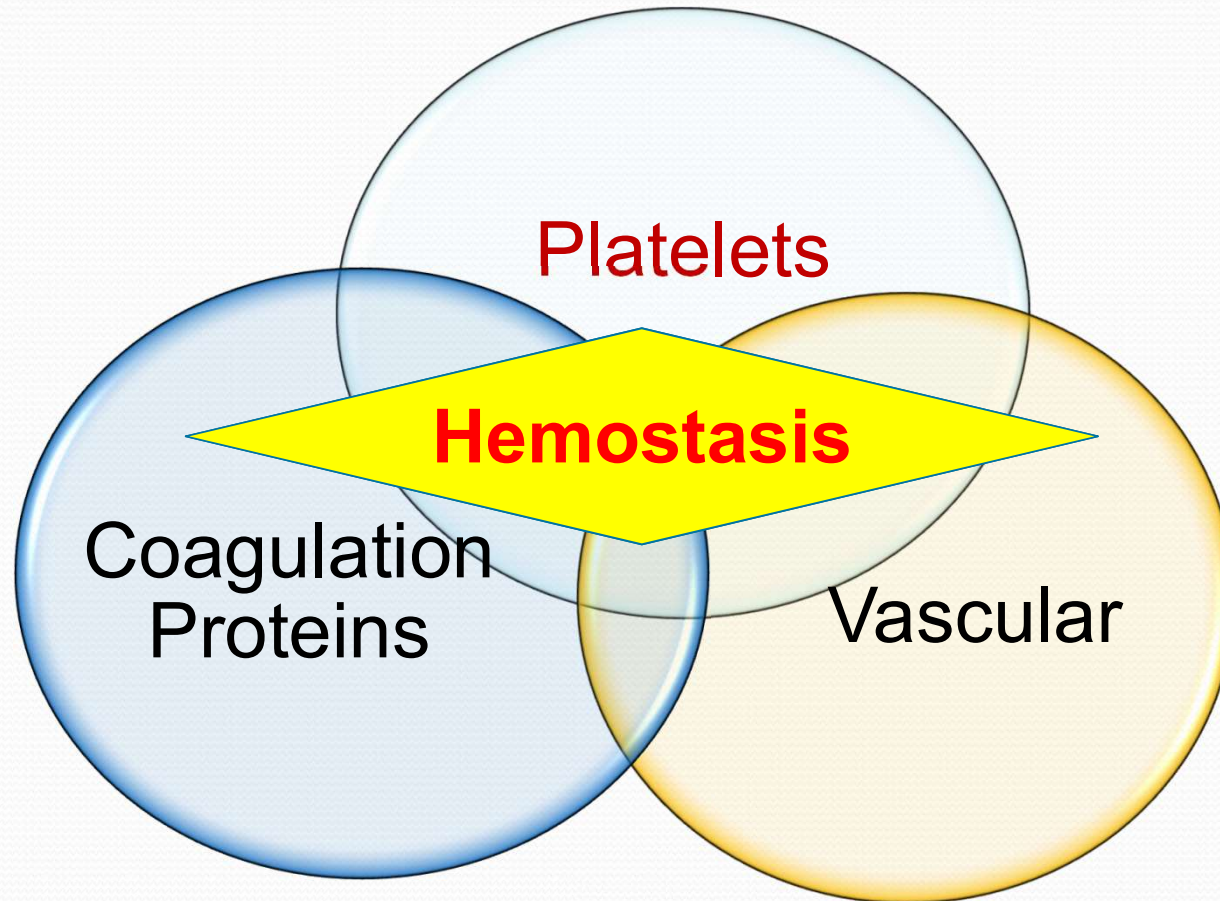
- Factors promoting coagulation (Procoagulants)
- Factors inhibiting coagulation (Anticoagulants)

Anticoagulants



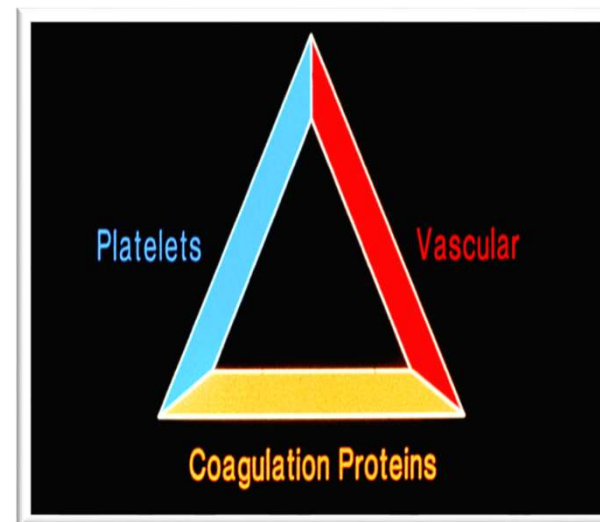
Procoagulants

Hemostasis



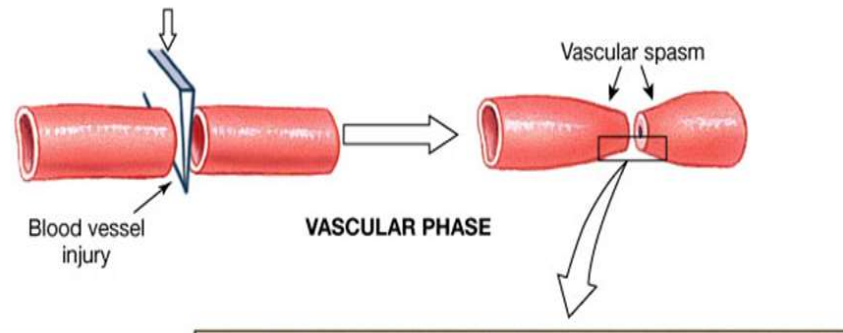
Hemostasis

1. Vasoconstriction
2. Platelet plug formation
3. Coagulation of blood



Vasoconstriction

- Constriction of blood vessel- local phenomenon,
- Nerve plexus
- Local myogenic spasm
- Local chemical factors
 - Serotonin
 - Thromboxan A2 released from platelets



Collagen fibers exposed in damaged blood vessel favors platelet plug formation

Properties of Platelets

When a blood vessel is injured,

1. Adhesion: Platelets adhere to exposed collagen & Von Willebrand factor

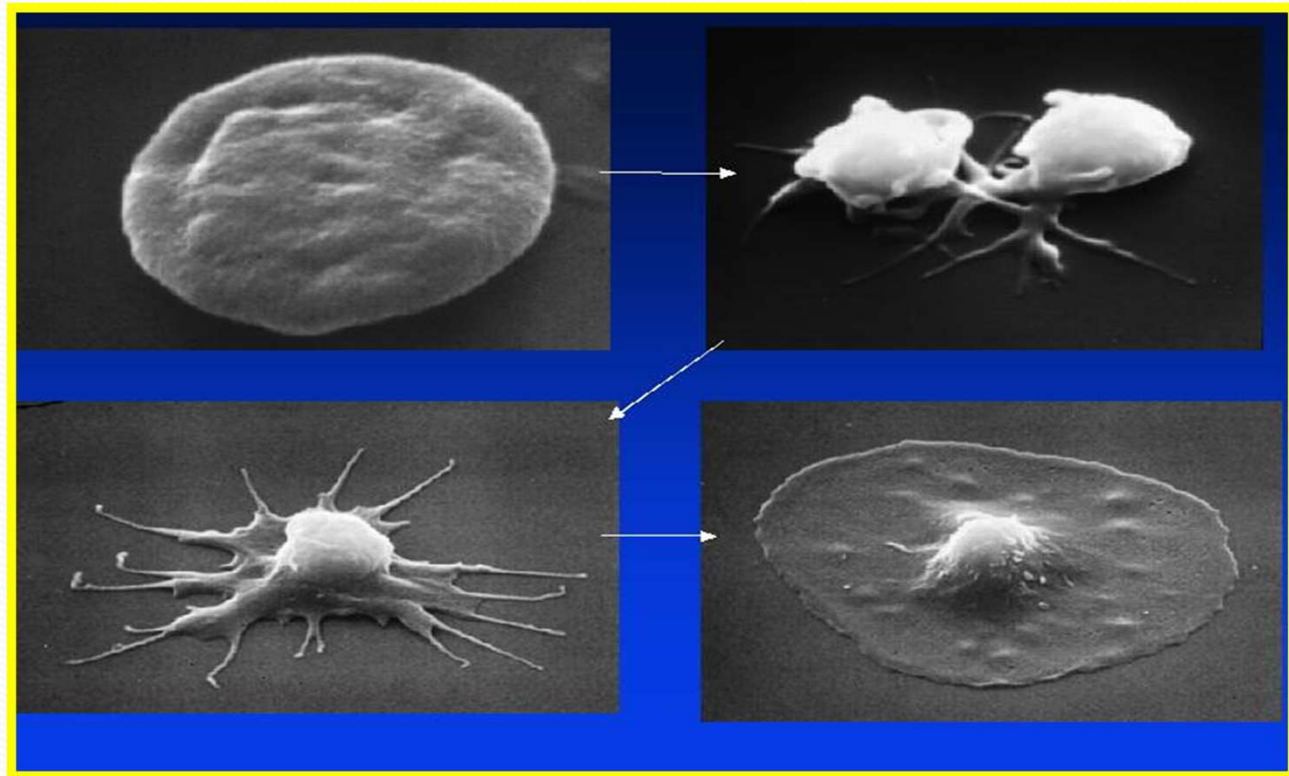
2. Activation:

- Platelets binding to collagen - platelet activation
- Activated platelets swell up, sticky, lose their shape, send pseudopodia
- Degranulate & attract more platelets

3. Aggregation:

- Released ADP, Platelet-activating factors act on other platelets to produce further accumulation

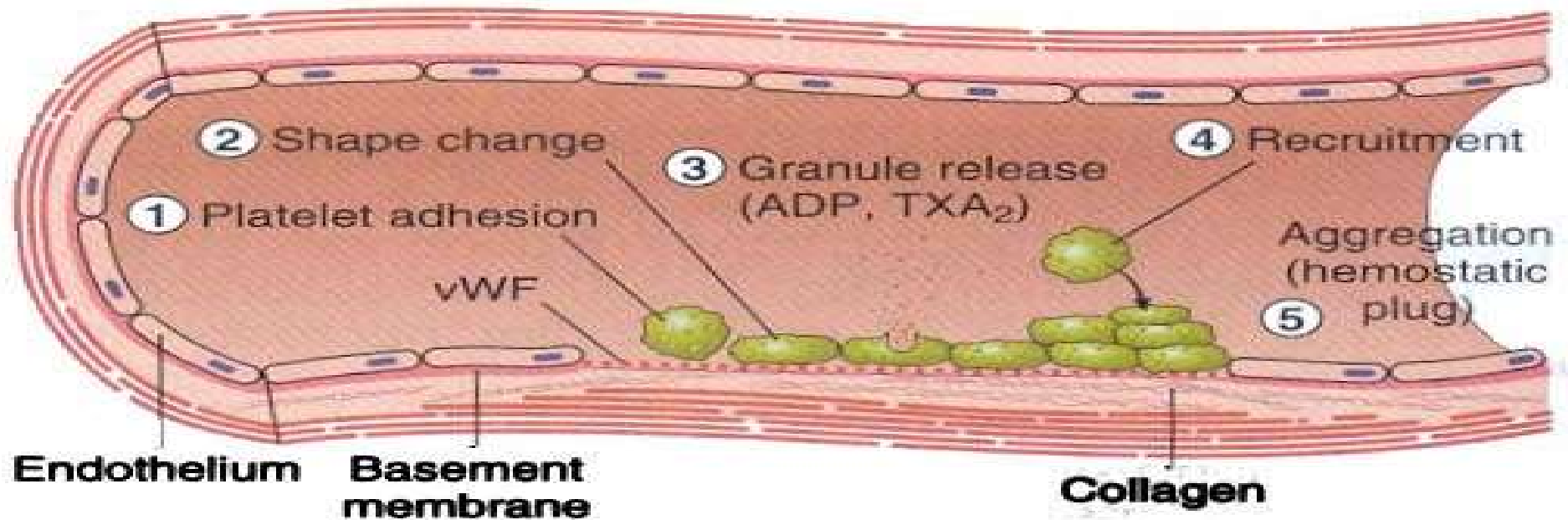
Properties of Platelets



Platelets change their shape

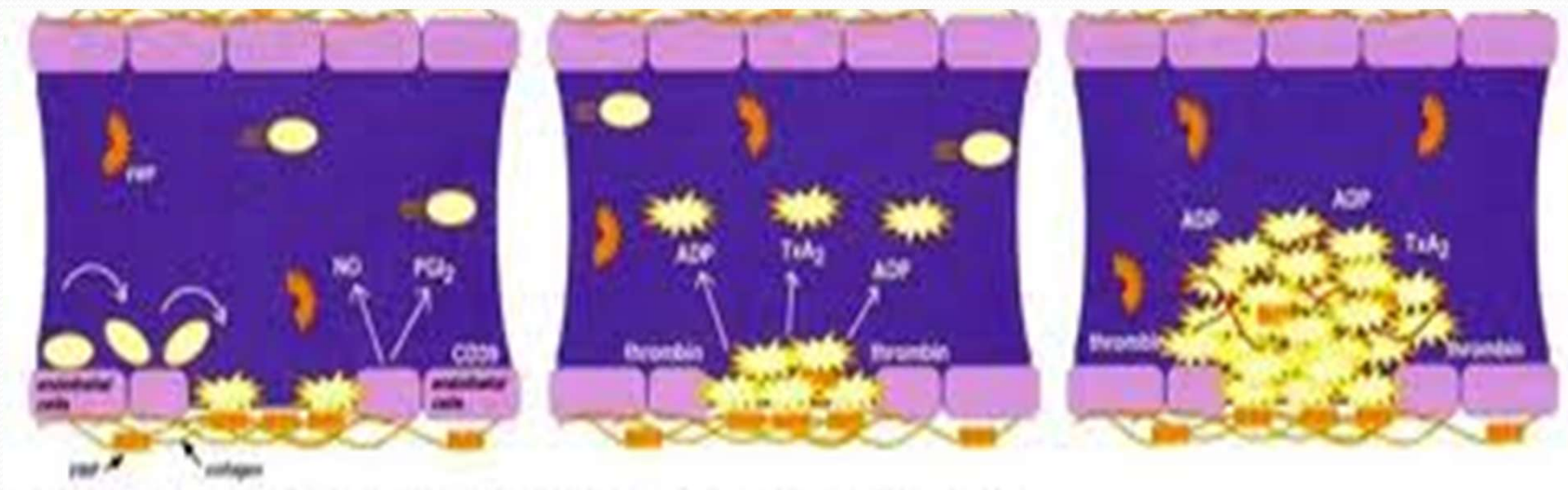
Primary Hemostasis

B. PRIMARY HEMOSTASIS



Platelet plug formation

Platelets aggregate and form a temporary loose plug to prevent blood loss--Platelet Plug- **Primary hemostasis**



Blood coagulation or clotting

- Process of conversion of fluid blood into semisolid jelly like mass is known as coagulation or clotting of blood
- Occurs over temporary hemostatic plug
- Must for permanent arrest of bleeding

Coagulation of blood: Clotting factors

I- **F**ibrinogen,

II- **P**rothrombin,

III- **T**issue thromboplastin,

IV- **C**alcium,

V- **L**abile factor, Proaccelerin,

No factor VI

VII- **S**tale factor Proconvertin

VIII- **A**nti haemophilic factor, AHF-A

IX- **C**hristmas factor, AHF-B

X- **S**tuart prower factor,

XI- **P**lasma Thromboplastin Antecedent, AHF-C

XII- **H**agemans factor, Glass factor

XIII- **F**ibrin stabilizing F, Laki-Lorand F

Foolish **P**eople **T**ry **C**limbing **L**ong **S**lopes,

After **C**hristmas **S**ome **P**eople **H**ave **F**allen

Coagulation of blood

Clotting factors:

VIII- Anti haemophilic factor, AHF-A

IX- Christmas factor, AHF-B

X- Stuart prower factor,

XI- Plasma thromboplastin antecedent, AHF-C

XII- hagemans factor, Glass factor

XIII- fibrin stabilizing F, Laki-Lorand F

Clotting Cascade

- Factors, act like a row of dominoes toppling against each other
- Create a chain reaction
- If one factor is missing, chain reaction cannot proceed





Steps of coagulation

1. Prothrombin activator complex formation
2. Conversion of prothrombin to thrombin
3. Conversion of fibrinogen to fibrin & clot formation

Blood Coagulation

Intrinsic pathway

Extrinsic pathway

Prothrombin activator complex

Prothrombin → Thrombin

Fibrinogen → Fibrin → Clot



Question

- Explain the mechanism of blood coagulation, when blood taken in a glass tube.

Blood Coagulation

Intrinsic pathway: When blood exposed to

1. Damaged endothelial cells
2. Collagen fibers underlying endothelium
3. Trauma to the blood itself
4. Electro negatively charged wetttable surfaces like glass

Blood Coagulation

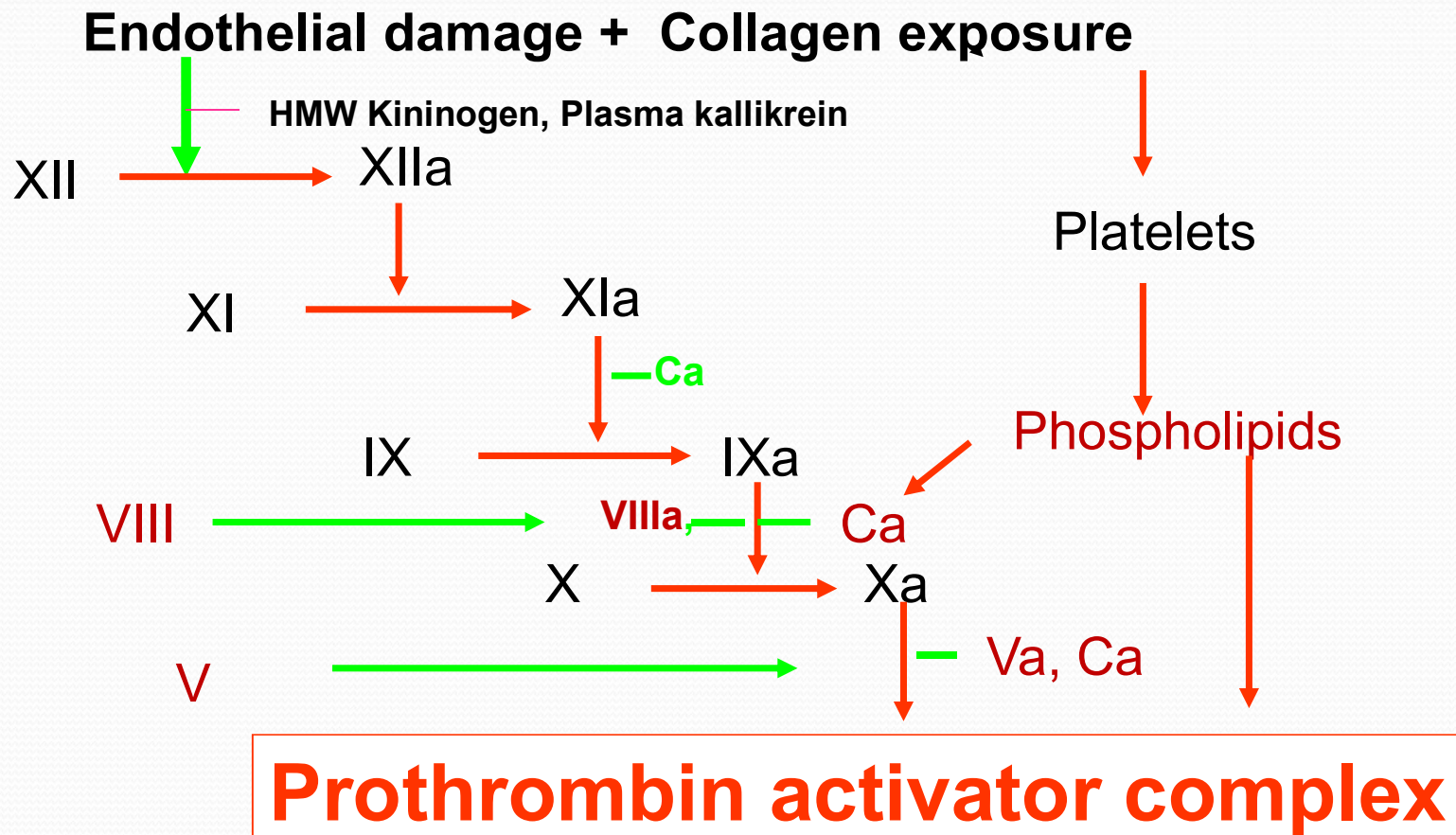
Extrinsic pathway:

- Begins with tissue thromboplastin (F-III)
- Released from the traumatized tissue

Clotting inside the body,

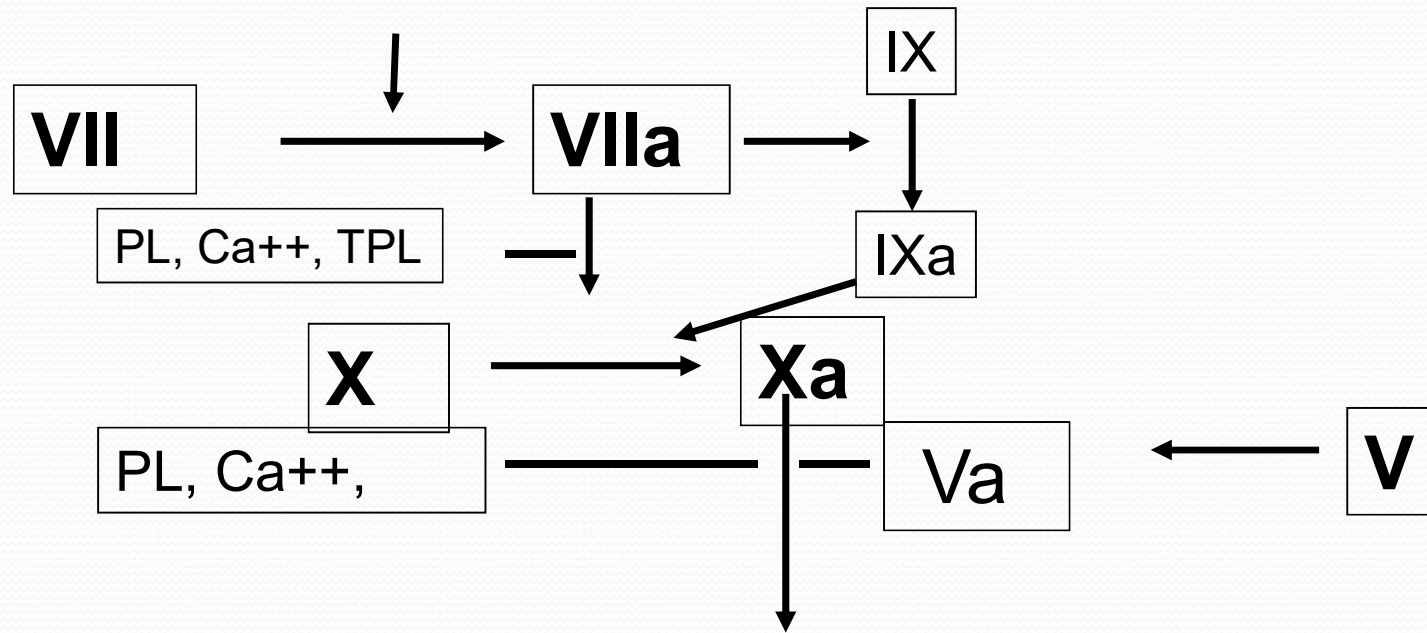
- Involves both intrinsic & extrinsic systems
- they both complement each other

Intrinsic pathway



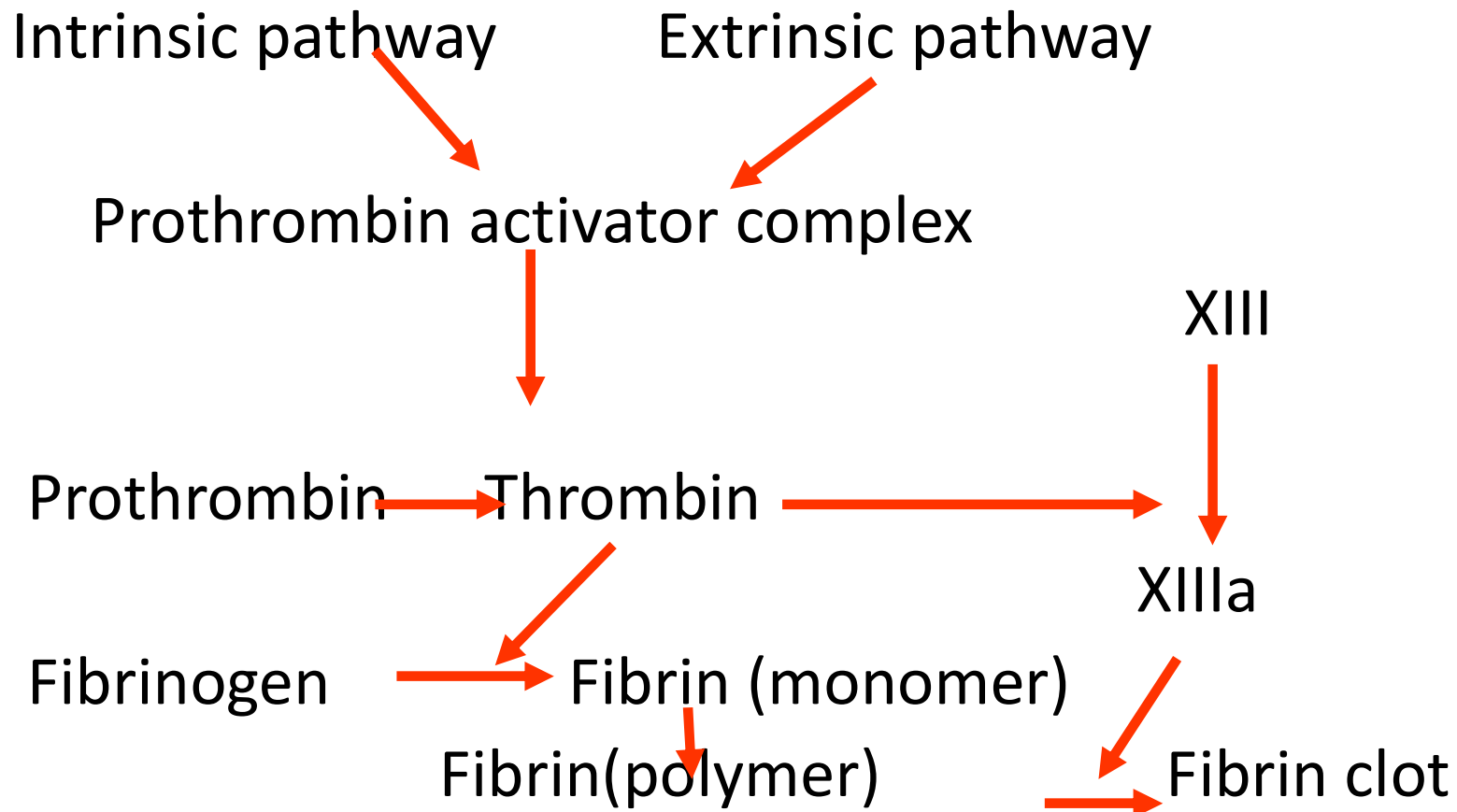
Extrinsic Pathway

Tissue thromboplastin (TPL)

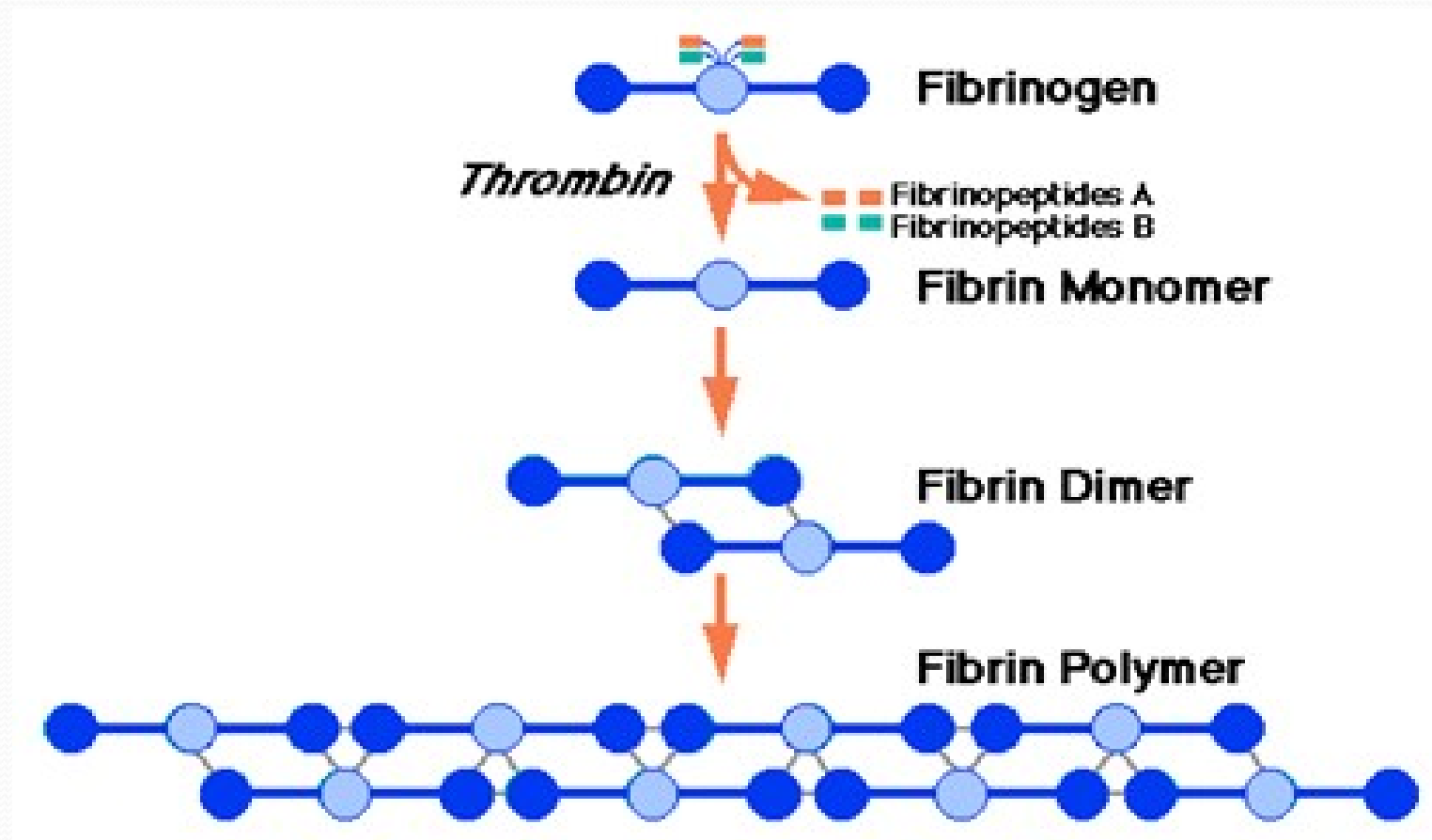


Prothrombin activator complex

Blood Coagulation



Blood Coagulation

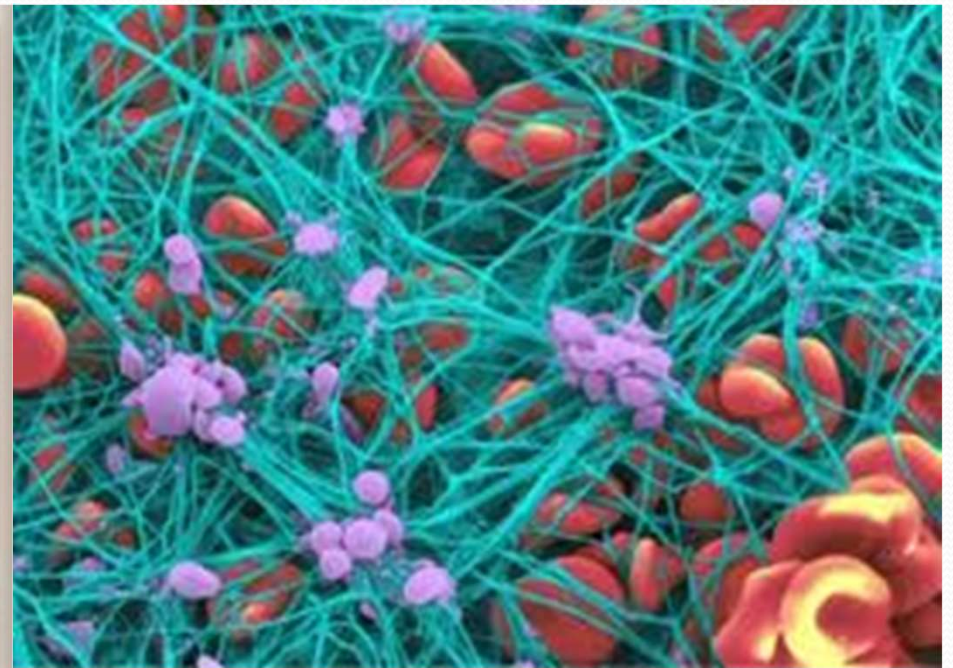


Clot retraction

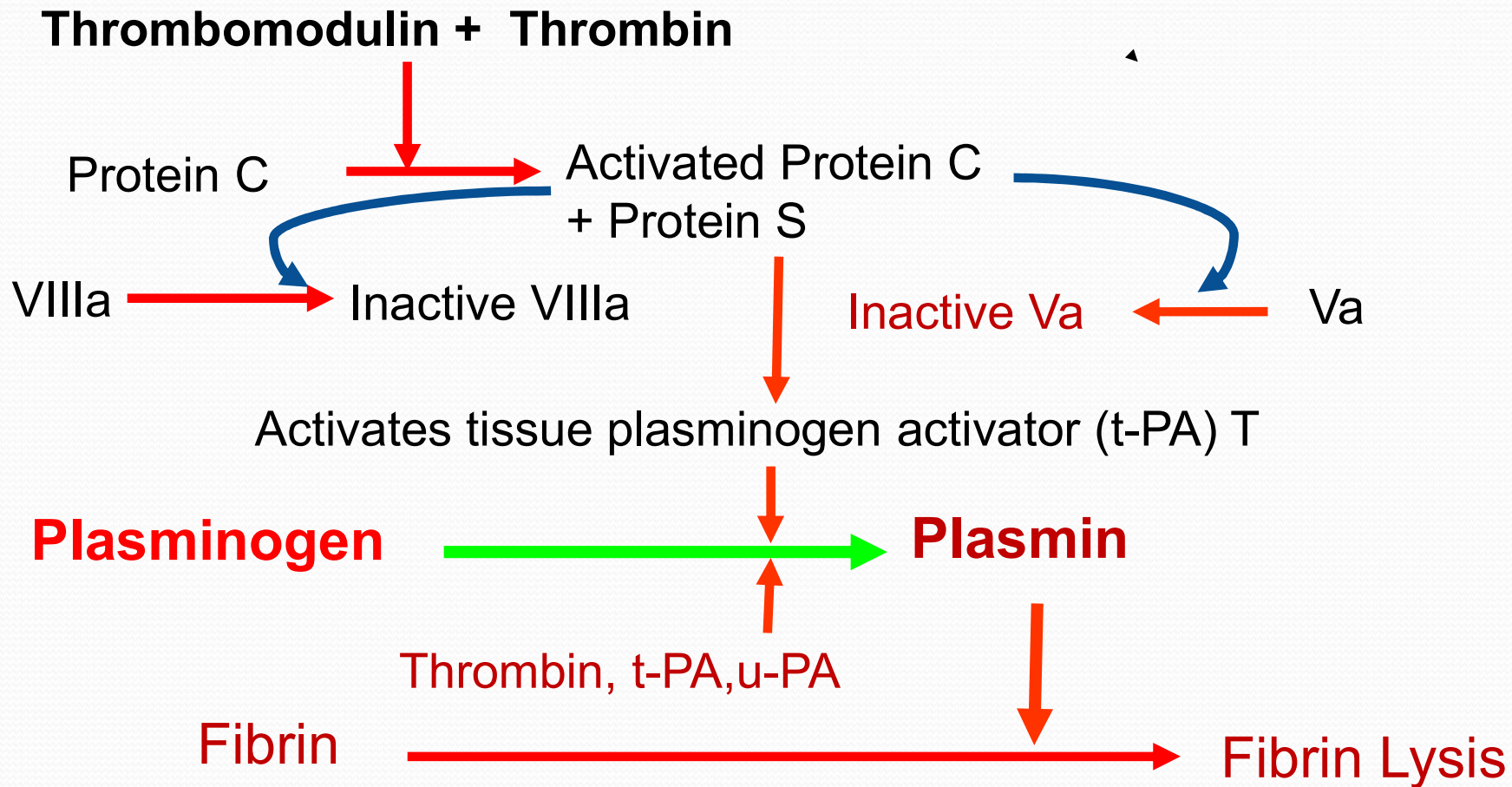
- Fibrin threads, attaches to platelet plug & damaged vessels
- Contraction of platelet spicules attached to fibrin – clot retraction
- As clot retracts edges of cut blood vessels are brought together
- Help for ultimate state Hemostasis
- Clot retraction-20-60min
- 40- 60% decrease in size of clot

Blood Clot

- Meshwork of fibrin threads & entrapping blood cells and plasma
- Serum – oozes out of it



Fibrinolytic System



Functions of Platelets

- Role in Vasoconstriction
- Primary Hemostasis-by temporary Platelet Plug
- Secondary hemostasis-Help in clot formation
- Clot retraction: Due to actin, & Myosin
- Repair of capillary endothelium: PDGF- Multiplication of endothelial cells & fibroblasts

Special attributes of Coagulation Process

- Enzyme substrate reaction
- System acts as a bio amplifier system
- Cascade reaction
- There are +ve & -ve feedback mechanisms
- Ca^{++} are essential in almost all steps

Applied Physiology

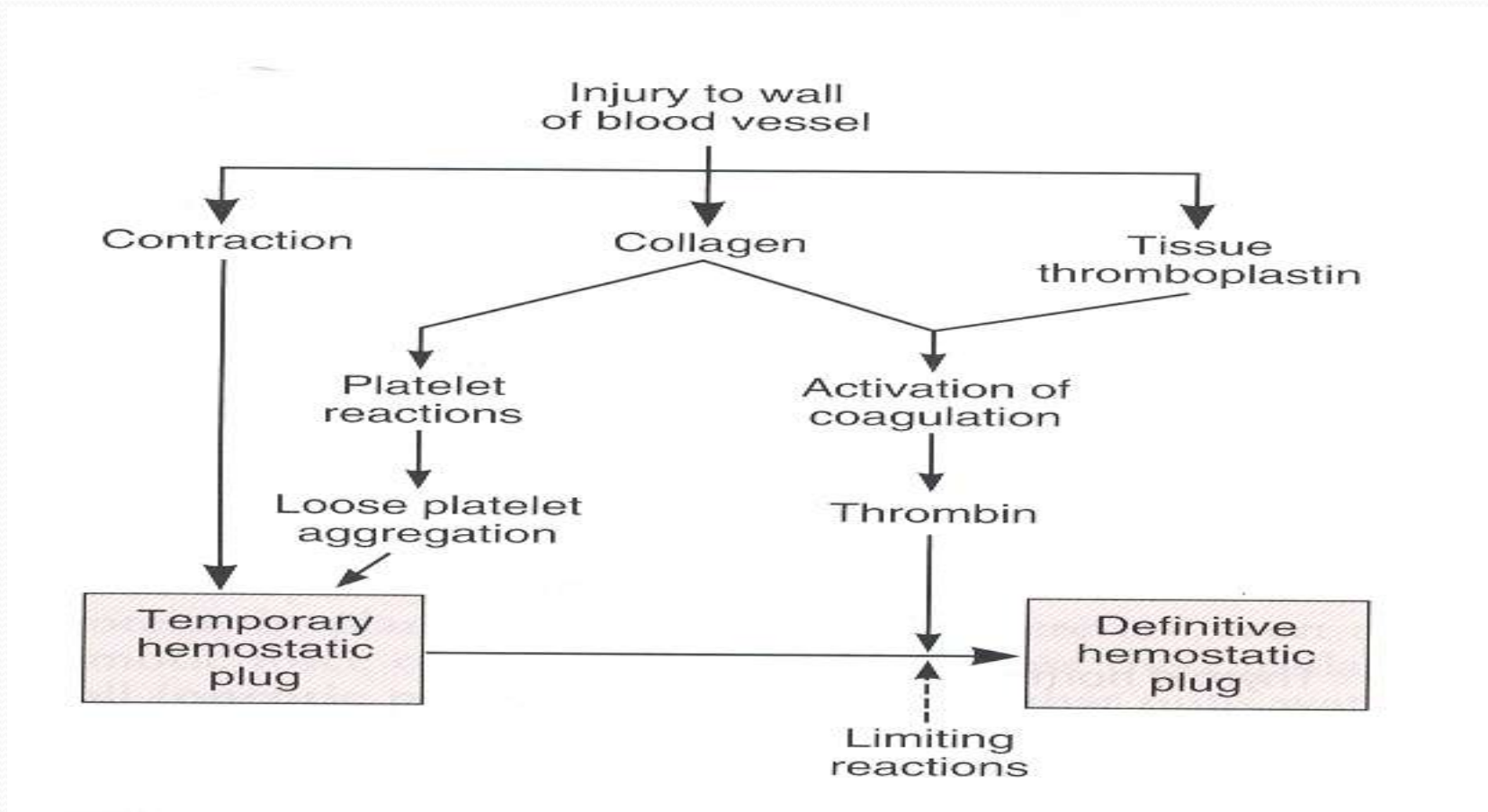
- Purpura: Immune thrombocytopenic Purpura
- Hemophilia
- Disseminated intravascular coagulation (DIC)

Applied Physiology

Commonly Performed Tests

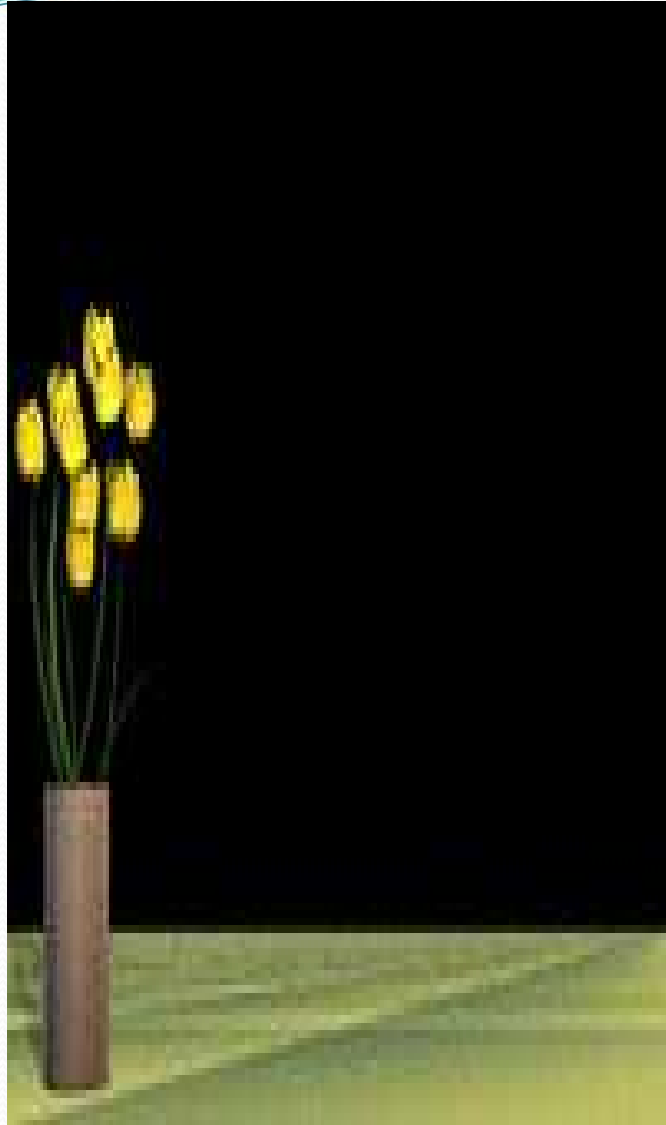
- Bleeding time
- Clotting Time
- Prothrombin time
- Activated partial thromboplastin time (aPTT or APTT)
- Assay of individual clotting factors

Summary - Hemostasis




Any questions





Thank you

- 
- Bleeding time is prolonged in -----Thrombocytopenia
 - Classic hemophilia is due to ----- Factor 8 deficiency
 - Prothrombin time is the test for..... Extrinsic pathway
 - Anticoagulant potency of Heparin increases by combining withantithrombin
 - Fibrin stabilizing factor is mainly released fromPlatelets