Hemostasis and Bleeding Disorders (Part 1)

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Learning Objectives:

By the end of this session, you will be able to:

1. **Describe Normal Hemostasis Mechanisms.**
2. **Describe the three mechanisms involved in hemostasis: Primary, Secondary, and Tertiary hemostasis.**
3. **Explain how extrinsic and intrinsic coagulation pathways lead to the common pathway, and the coagulation factors involved in each.**

HEMOSTASIS

Introduction to Normal Hemostasis Mechanisms

Normal Hemostasis

=Normal response of body on the damaged Blood Vessel [BV] to :

1. **Stop bleeding / blood loss from BV.**
2. **Keeping blood flow (in that BV).**

Significance of Hemostasis:

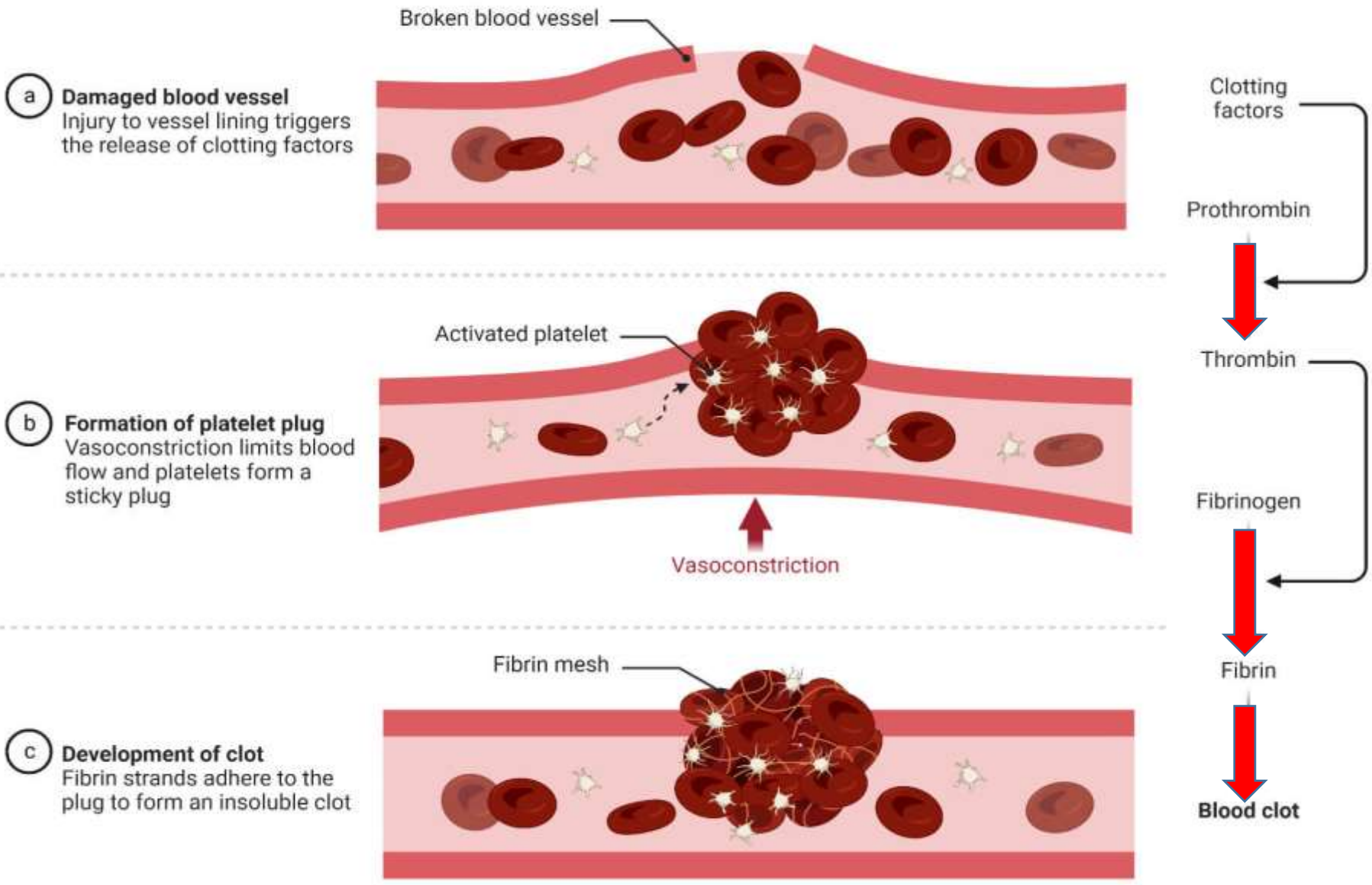
1) Triggers healing process of the ruptured BV.
2) Prevents blood loss and Anemia.
3) Prevents deposition of blood in the internal organs from ruptured BV.
4) Helps to maintain homeostasis= A state of balance among all the body systems needed for the body to survive and function correctly

Mechanism of Normal Hemostasis:

Including 4 rapidly sequenced steps:

1. Vascular spasm
2. Platelet plug formation
3. Blood coagulation / clotting system
4. Fibrinolysis system

Blood Clot Formation in Broken Vessel



1. Vascular Spasm= BV Constriction

***Triggered by*: يحفز بما يلي:**

1) Direct injury to vascular smooth muscle

2) Chemicals from endothelial cells

2) Chemicals from platelets.

2. Platelet Plug Formation:

(Primary Hemostasis)

- Platelets stick together
- Platelets stick to the damaged endothelium

= form platelet plug seal in *15 seconds* >>>>>>>>>>>> then degranulate >>>>>>>>>>>> release their chemicals >>>>>>>>>>>> more platelets stick >>>>>>>>>>>> then release their chemicals >>>>>>>>>>>> So On…….

3. Blood Coagulation or Blood Clotting:

(Secondary Hemostasis)

Done by = Thrombin.

- Sequential process by multiple interacting factors <<< coagulation cascade >>> ==> Insoluble Fibrin Clot
- Reinforce platelet plug by adding RBC + WBC in the fibrin mesh ==> clot stronger ==> Stay in BV wound.

Defects in:

Secondary Hemostasis = coagulation cascade = More Serious Bleeding than those due to Defects in: Primary hemostasis.

>>>>>>>bleeding into cavities (chest, joints and skulls) ++++

>>>>>>subcutaneous hematomas.

لانـها ستؤدي الى نزيف في تجاويف

الجسم المختلفه ونزف تحت الجلد

* ***Immediate Bleeding Type =*** **problems in primary hemostasis elements.**

* ***Delayed Bleeding Type=*** **problems in secondary hemostasis elements.**

4. Fibrinolytic System (Fibrinolysis):

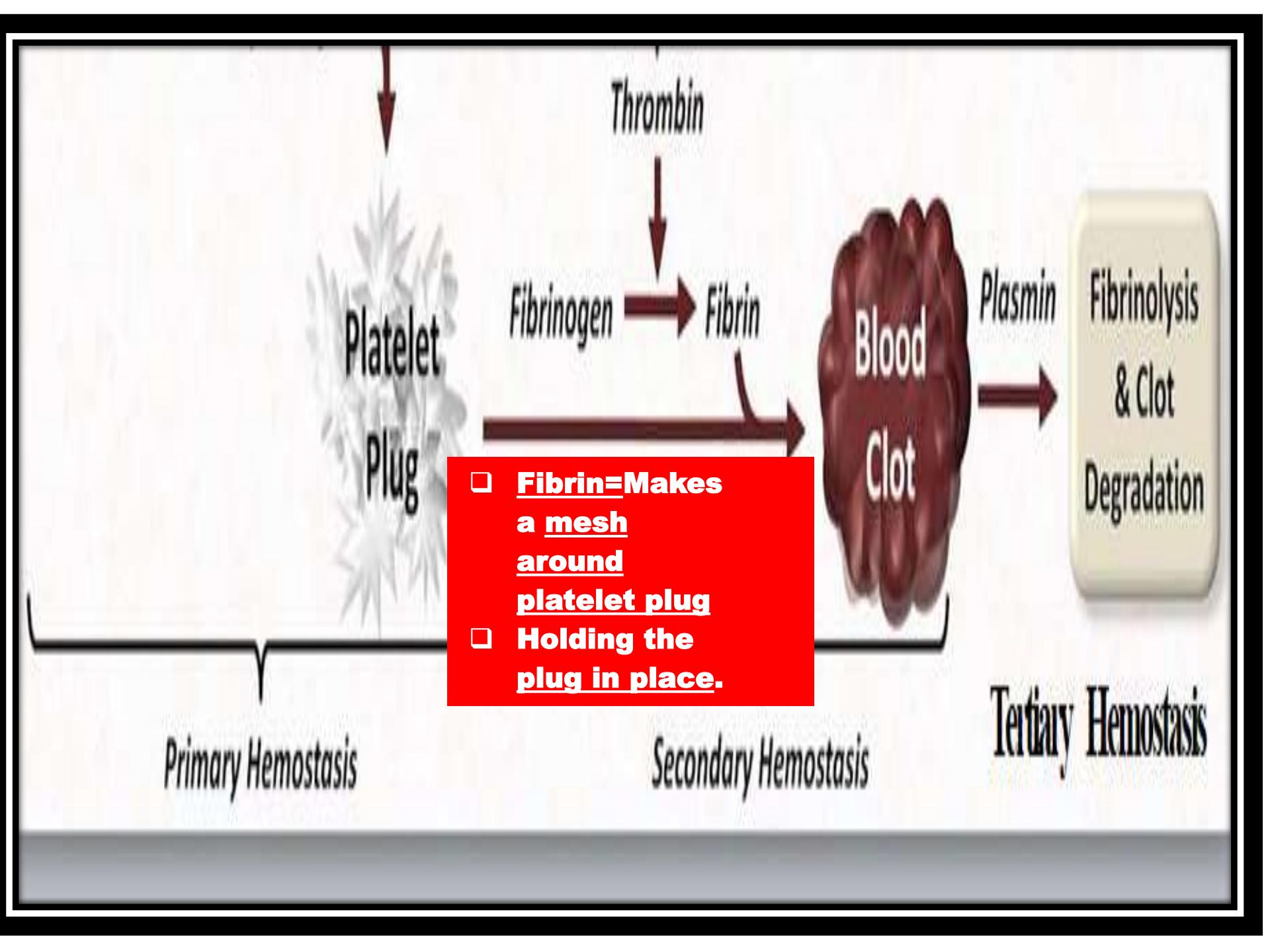
(Tertiary Hemostasis)

Done by = Plasmin .

➔ To stop clotting progression.

➔ To reorganize blood clots.

➔ To keep patency of blood vessels.



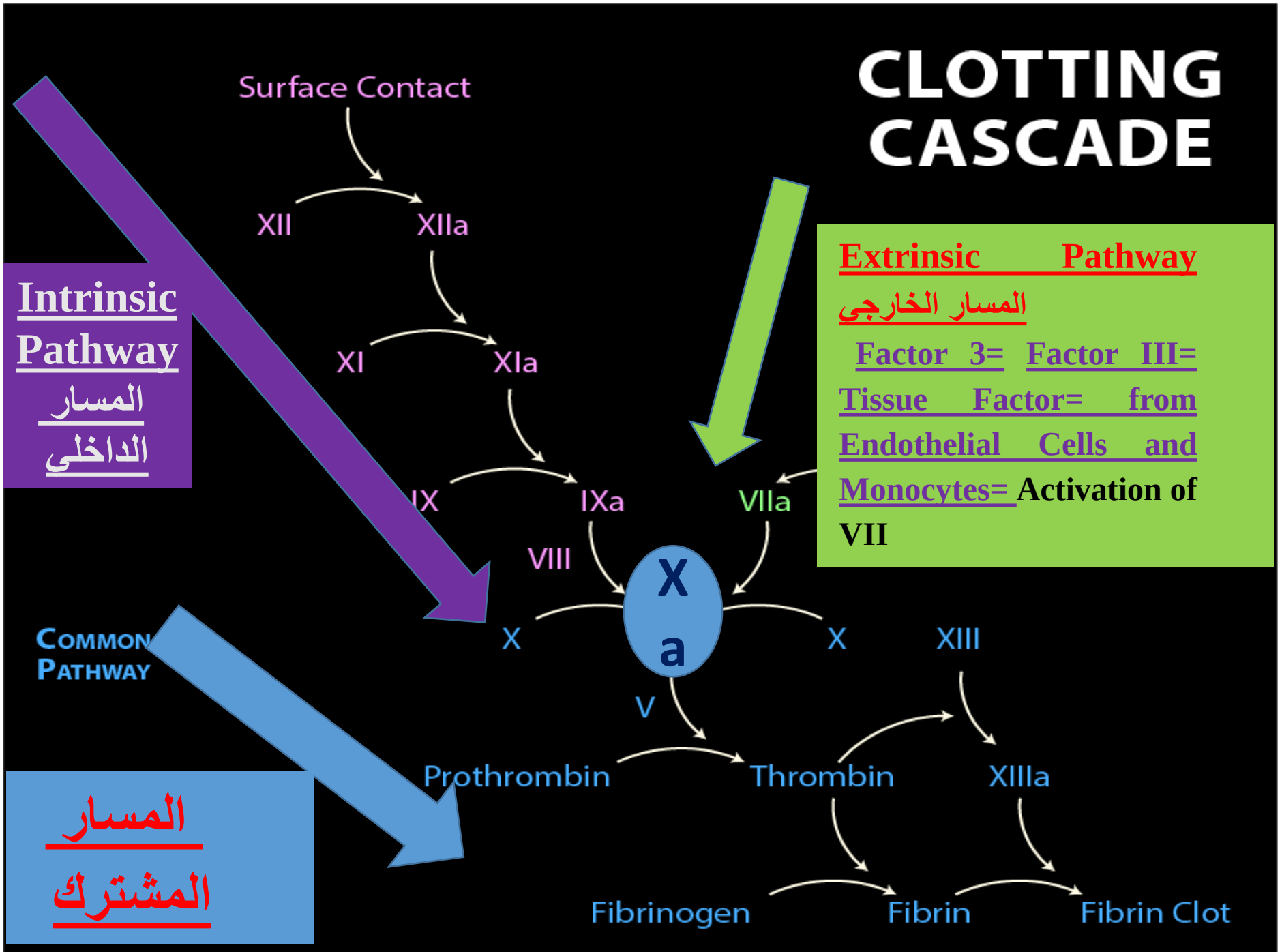
- **Fibrin=Makes a mesh around platelet plug**
- **Holding the plug in place.**

Coagulation Cascade:

3 pathways:

1. Intrinsic
2. Extrinsic
3. Common.

➔ ➔ ➔ **Clotting Factors= Manufactured in liver ➔ ➔ ➔ go to circulation ➔ Inactive form ➔ ➔ ➔ Require activation ➔ ➔ ➔ Once platelet plug formed➔ ➔ ➔ Activated**


CLOTTING CASCADE
Surface Contact
XII
XIIa
XI
XIa
IX
IXa
VIII
VIIa
X
Xa
X
V
Prothrombin
Thrombin
XIII
XIIIa
Fibrinogen
Fibrin
Fibrin Clot
Intrinsic Pathway
المسار الداخلي
Extrinsic Pathway
المسار الخارجي
Factor 3= Factor III= Tissue Factor= from Endothelial Cells and Monocytes= Activation of VII
Common Pathway
المسار المشترك

Natural hemostasis is most desired.....

But Other Means for Achieving Hemostasis → Vital for Survival in Many Emergencies.

→ **Hemostasis during Surgical procedures achieved by various other ways by:**

1. Direct pressure
2. Ligation
3. Hemostatic agents

Clinical Assessment of Patient with bleeding disorder

History:

1) Family history of bleeding
2) Duration of bleeding

Indicate whether the disorder is congenital or acquired.

3) Coexisting illness
4) Drug therapy.

Predispose to bleeding = Should be inquired

Clinical Examination:

Check For:

- Bruising
- Purpura
- Prolonged bleeding from cuts
- Excessive post-surgical bleeding
- Epistaxis
- GI hemorrhage
- Menorrhagia →
- Suggest=

1) Platelet Disorder
2) Thrombocytopenia
3) Von Willebrand Disease.

- Telangiectasia on lips →
- Suggest=
- Congenital causes

- Bleeding in the joints = Hemoarthrosis) →
- Indicate= coagulation defect..

- Hepatomegaly
- Splenomegaly.

Blood Coagulation Tests

Investigations for Bleeding Disorders:

Initial screening tests:

1) **Platelet Count**
2) **Bleeding Time (BT)**
3) **Prothrombin Time (PT)**
4) **Partial Thromboplastin Time (PTT)**
5) **Thrombin Time (TT)**

1..Platelet Count:

Quantitative evaluation of platelet

- **Normal platelet count = platelet count =150000 - 400000 cells/mm^3.**
- **Thrombocytopenia= platelet count < 150000 cells/mm^3**

➔ **Major Post-Operative Bleeding.**

2..Bleeding Time(BT):

Evaluation adequacy of platelet function

- **Time for a skin incision to stop bleeding by formation of a hemostatic plug.**
- **Normal BT= 1 and 6 minutes**

➔ Prolonged bleeding time:

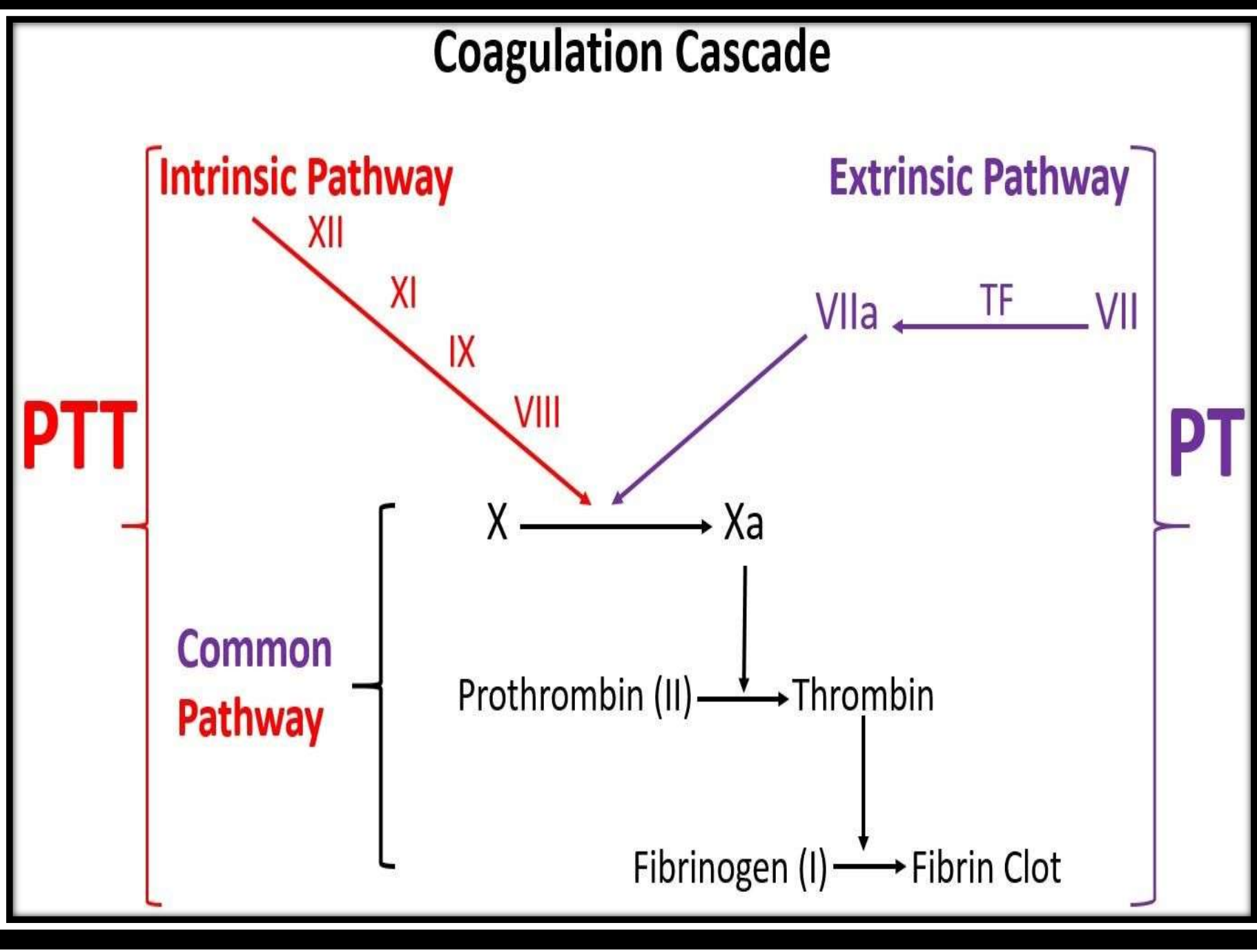
1) **Platelet abnormalities**
2) **Medications affect platelet function.**

Types of Coagulation Tests

Prothrombin Time (PT)
Evaulates ability to clot

International Normalized Ratio (INR)
Ensures that results from a PT test are the same from one lab to another

Partial Thromboplastin Time (PTT)
Determines if blood-thinning therapy is effective


Coagulation Cascade
Intrinsic Pathway
Extrinsic Pathway
XII
XI
IX
VIII
VIIa
TF
VII
PTT
PT
X
Xa
Common Pathway
Prothrombin (II)
Thrombin
Fibrinogen (I)
Fibrin Clot

3..Prothrombin Time

(PT)= 10 and 15 seconds.

❑ Clinical use:

1) Bleeding
2) liver synthetic function
3) DIC.
4) Monitor oral anticoagulant therapy (such as warfarin treatment).

❑ Assess:

1) Extrinsic pathway
2) Common pathway=

❑Prolonged PT:

1) Deficiencies of factors= (Factors VII + X+ Prothrombin (II) + Fibrinogen (I)
2) Liver disease.

- **International Normalized Ratio (INR):**
- **=PT ratio= Patient's PT / Control PT.**
- **Normal INR =*0.8–1.2* ➔**
- **تقريباً = 1.**

INR =

Clotting Process Takes Longer Time >normal.

3.. Partial Thromboplastin Time

(PTT) = 25-35 seconds

Clinical uses: monitoring of unfractionated heparin.

1) **Monitor oral anticoagulant therapy (such as unfractionated heparin).**
2) **Best test for coagulation disorders:**

A. **Bleeding**

B. **DIC**

❑ Assess:

1) **Intrinsic pathway**
2) **Common pathway**

❑Prolonged PT:

Deficiencies of Intrinsic +Common pathway factors

4..Thrombin Time:

(TT): = 9 - 13 seconds.

- **Thrombin converts:** → **Fibrinogen insoluble fibrin= blood clot.**

❑ Prolonged TT:

1) **Excessive plasmin**
2) **Fibrin Split Products.**

←

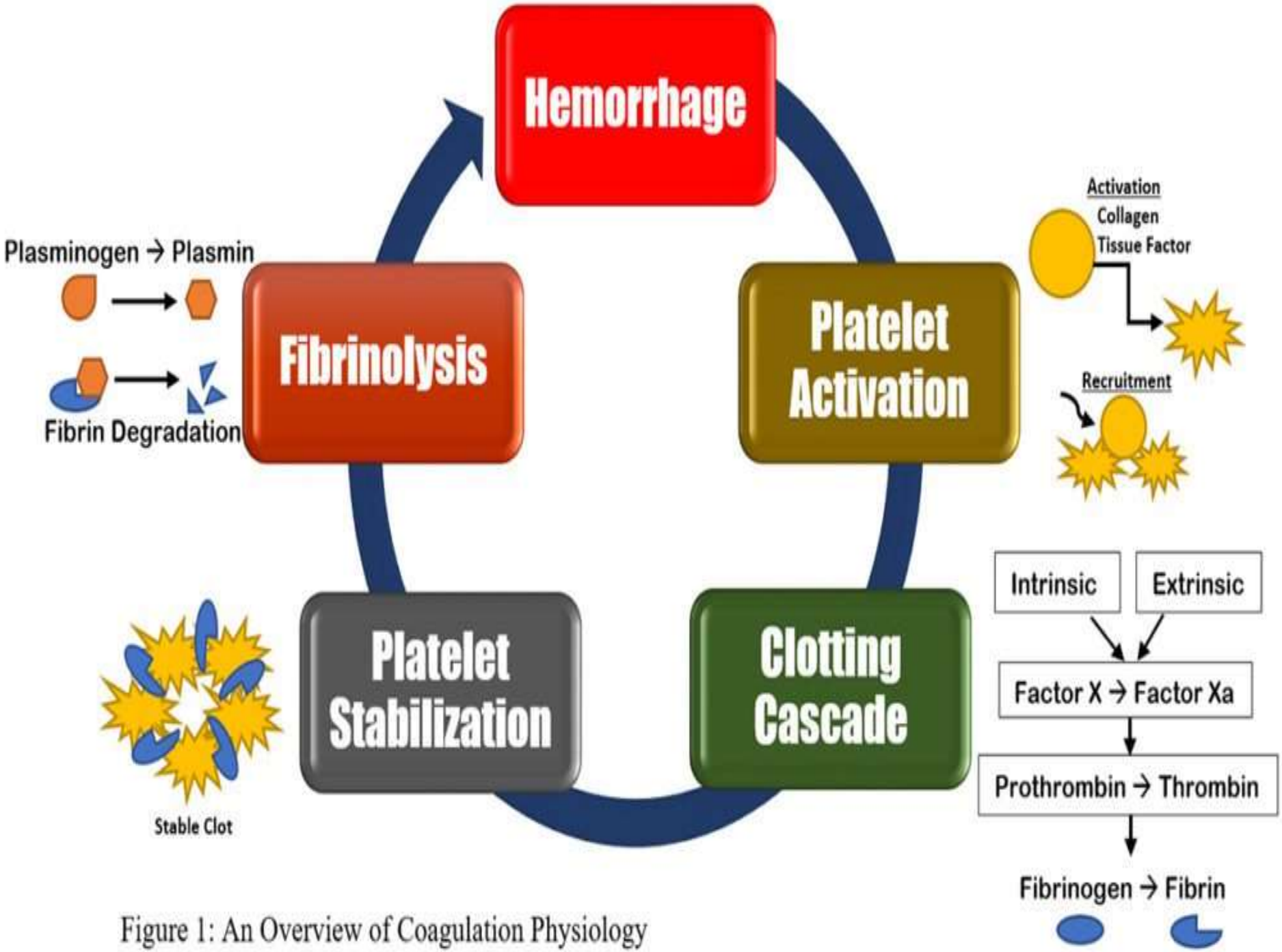


Figure 1: An Overview of Coagulation Physiology

Any questions?

Thank You For Your Attention