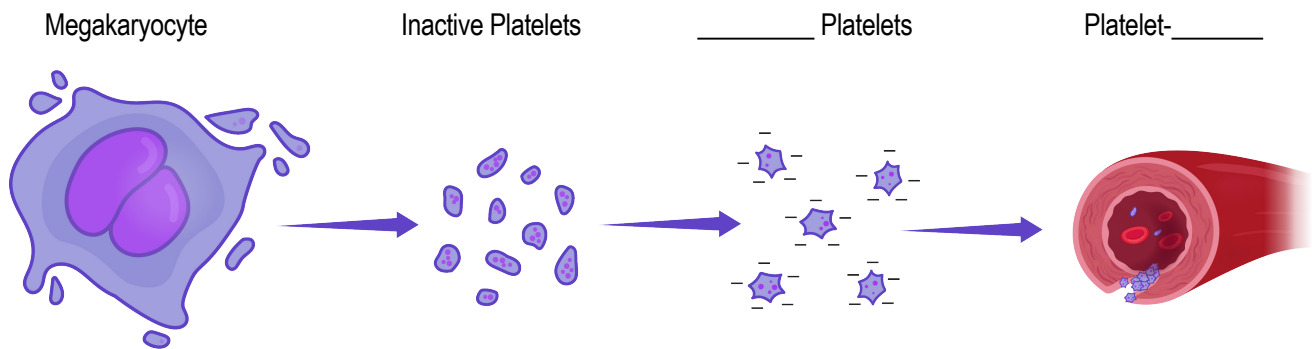


## TOPIC: PLATELETS: HEMOSTASIS

### Introduction to Platelets

- ♦ **Platelets (Thrombocytes):** cell \_\_\_\_\_ that “plug” holes in damaged blood vessels, preventing blood loss.
  - Lack a nucleus but contain cytoplasmic \_\_\_\_\_ with proteins & chemicals involved in clotting.
  - Originate from large cells called \_\_\_\_\_ that *fragment* to form platelets.
  - Upon activation, platelets change shape & express some \_\_\_\_\_ charged surface proteins.



### EXAMPLE

Which of the following formed elements is not technically considered to be a complete cell?

- a) Erythrocytes.
- b) Leukocytes.
- c) Platelets.
- d) They are all considered to be cells.

### PRACTICE

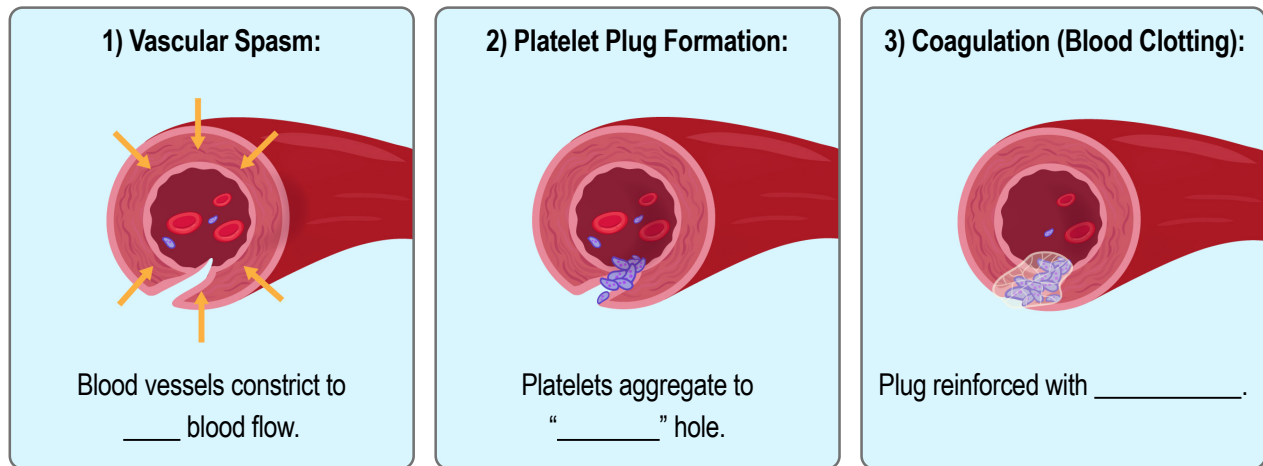
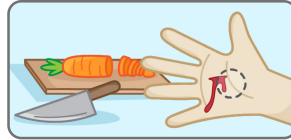
Platelets are similar to erythrocytes in that both structures do not contain a \_\_\_\_\_. Platelets are similar to leukocytes in that both their primary functions involve \_\_\_\_\_ the body.

- a) Plasma membrane; nourishing.
- b) Plasma membrane; protecting.
- c) Nucleus; nourishing.
- d) Nucleus; protecting.

## TOPIC: PLATELETS: HEMOSTASIS

### Overview of Hemostasis

- ♦ **Hemostasis:** fast, local, & controlled process to *prevent & control* \_\_\_\_\_ after injury.
  - Under normal circumstances, blood does NOT clot because clotting factors are \_\_\_\_\_.
  - Upon blood vessel injury, hemostasis consists of \_\_\_\_\_ steps:



♦ NOTE: after hemostasis is complete, \_\_\_\_\_ steps help complete the healing process (clot retraction & fibrinolysis).

### EXAMPLE

When someone gets a wound, it is advised to "compress" and/or tightly wrap the wound. Why?

- a) It causes clotting factors to become inactive.
- b) It decreases the oxygen content in the blood that is being lost.
- c) It increases the speed of platelet plug formation.
- d) It enhances vascular spasm by decreasing blood vessel diameter, thereby reducing blood flow.

### PRACTICE

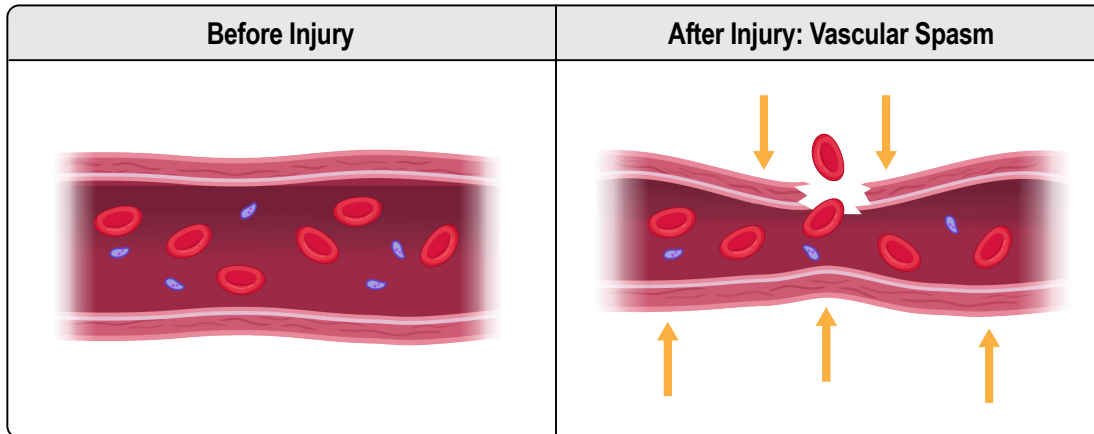
Which physiological response causes a reduction in blood flow immediately after a blood vessel injury?

- a) Migration of leukocytes to the site of the injury.
- b) Platelet plug formation.
- c) Vascular spasm.
- d) Release of tissue plasminogen activator.

## TOPIC: PLATELETS: HEMOSTASIS

### 1) Vascular Spasm

- ♦ **Vascular Spasm:** immediate \_\_\_\_\_ of damaged blood vessel (vasoconstriction) to reduce blood loss.
  - ▶ Initiated by chemicals released by damaged endothelial cells, smooth muscle, & activated platelets.
  - ▶ Reduced blood loss “buys” sufficient \_\_\_\_\_ for the next 2 steps of hemostasis to occur.



### EXAMPLE

Damaged endothelial cells release peptide hormones called endothelins, which help initiate vascular spasm. Considering this, what is the primary effect of endothelins?

- a) Vasodilation.
- b) Vasoconstriction.
- c) Platelet aggregation.
- d) Increased blood pressure.

### PRACTICE

Which of the following statements about vascular spasm is false?

- a) It occurs when smooth muscle cells surrounding the blood vessel relax, increasing the vessel's diameter.
- b) It can help reduce blood flow immediately after a blood vessel is damaged, thereby reducing blood loss.
- c) It is the first step of hemostasis, directly preceding platelet plug formation.
- d) It is initiated by chemicals released by damaged endothelial cells, smooth muscle, & activated platelets.

## TOPIC: PLATELETS: HEMOSTASIS

### 2) Platelet Plug Formation

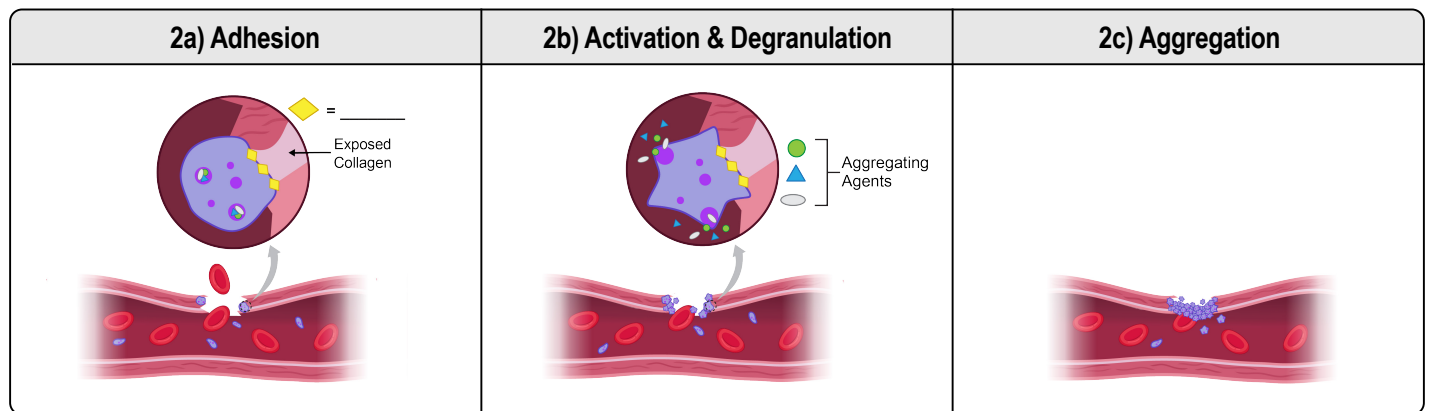
♦ **Platelet Plug Formation:** platelets aggregate to “\_\_\_\_\_” hole in a damaged blood vessel. Occurs in 3 steps:

2a) **Adhesion:** *von Willebrand factor* (\_\_\_\_\_) protein “\_\_\_\_\_” it to exposed collagen.

2b) **Activation & Degranulation:** “activated” platelets extend projections & release chemical-filled \_\_\_\_\_.

- ▶ ADP, serotonin, & thromboxane A2 (aggregating agents).

2c) **Aggregation:** more platelets recruited to form an unstable plug, which can \_\_\_\_\_ blood loss.



### EXAMPLE

Which molecule acts as the glue between exposed collagen in damaged endothelial cells and platelets, initiating platelet plug formation?

- a) Von Willebrand Factor.
- b) ADP.
- c) Serotonin.
- d) Thromboxane A2.

### PRACTICE

Prostacyclin is a hormone that is normally active in the blood but becomes inactive when a blood vessel ruptures, and hemostasis begins. Considering this, which of the following is the most likely function of prostacyclin?

- a) Causes platelets to aggregate.
- b) Prevents platelets from aggregating.
- c) Activates vWF.
- d) Initiates coagulation.

## TOPIC: PLATELETS: HEMOSTASIS

### 3) Coagulation (Blood Clotting)

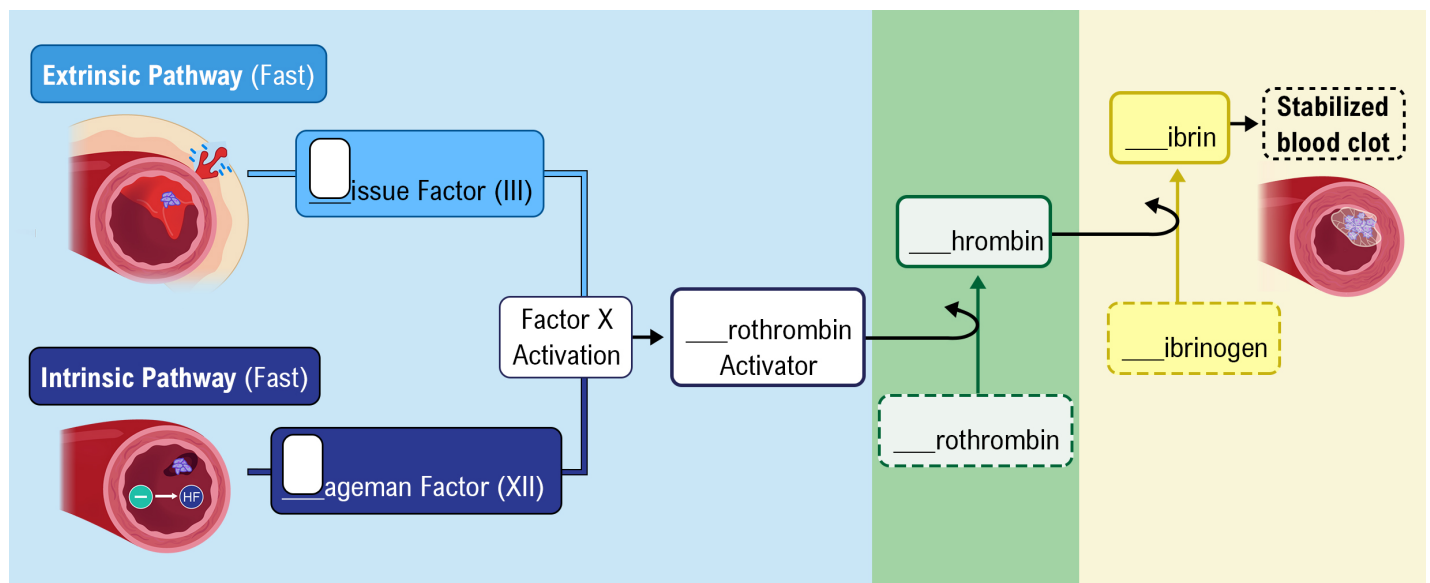
- ◆ Coagulation \_\_\_\_\_ unstable platelet plug using protein \_\_\_\_\_ as a molecular “\_\_\_\_\_”.
- ◆ Occurs via a VERY complex enzyme cascade but can be simplified into \_\_\_\_\_ phases:

► **Phase 1:** can occur via 1 of \_\_\_\_\_ different pathways; both lead to formation of Prothrombin Activator.

- **Extrinsic Pathway:** initiated by factors \_\_\_\_\_ blood, specifically Tissue Factor (III).
- **Intrinsic Pathway:** initiated by factors \_\_\_\_\_ blood, specifically Hageman Factor (XII).

► **Phase 2:** Prothrombin Activator converts Prothrombin → \_\_\_\_\_.

► **Phase 3:** Thrombin converts Fibrinogen → \_\_\_\_\_, which is cross-linked to stabilize platelet plug (clot).



◆ NOTE:  $\text{Ca}^{2+}$  & Vitamin \_\_\_\_\_ play important roles in blood clotting.

### EXAMPLE

Which phase 1 pathway of coagulation can be initiated by components that are not present in blood?

- a) Extrinsic pathway.
- b) Intrinsic pathway.
- c) Neither extrinsic nor intrinsic pathway.
- d) Both extrinsic and intrinsic pathways.

## **TOPIC: PLATELETS: HEMOSTASIS**

### **PRACTICE**

Which of the following is the most likely outcome if platelets could not release aggregating agents?

---

- a) Platelets would not be able to bind to collagen within damaged endothelial cells.
- b) Too many platelets would aggregate at the site of injury, causing blood clots that are too large.
- c) Not enough platelets would aggregate at the site of the injury and an effective clot may not form.
- d) There would be no effect.

## TOPIC: PLATELETS: HEMOSTASIS

### How To Remember Important Coagulation Components

\_\_\_trinsic: \_\_\_issue \_\_\_actor (\_\_\_)

\_\_\_trinsic: \_\_\_ageman \_\_\_actor (\_\_\_)

\_\_\_latelets \_\_\_ack \_\_\_ightly \_\_\_or \_\_\_ibrin

r  
o  
t  
h  
r  
o  
m  
b  
i  
n

r  
o  
t  
h  
r  
o  
m  
b  
i  
n

h  
r  
o  
m  
b  
i  
n

i  
b  
r  
i  
n  
o  
g  
e  
n

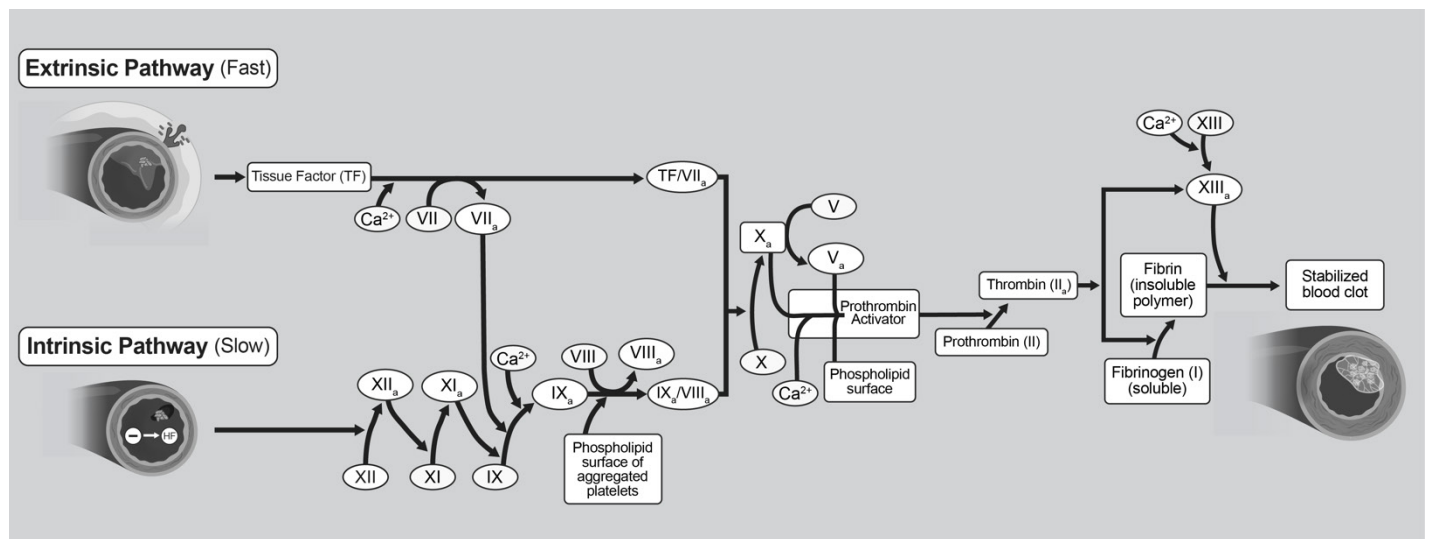
i  
b  
r  
i  
n

Activator

## PRACTICE

Which option correctly arranges/orders the components of the coagulation pathway?

- Prothrombin Activator → Thrombin → Prothrombin → Fibrinogen → Fibrin.
- Prothrombin Activator → Prothrombin → Thrombin → Fibrinogen → Fibrin.
- Prothrombin → Prothrombin Activator → Thrombin → Fibrinogen → Fibrin.
- Prothrombin Activator → Prothrombin → Thrombin → Fibrin → Fibrinogen.



## TOPIC: PLATELETS: HEMOSTASIS

### Clot Retraction & Fibrinolysis

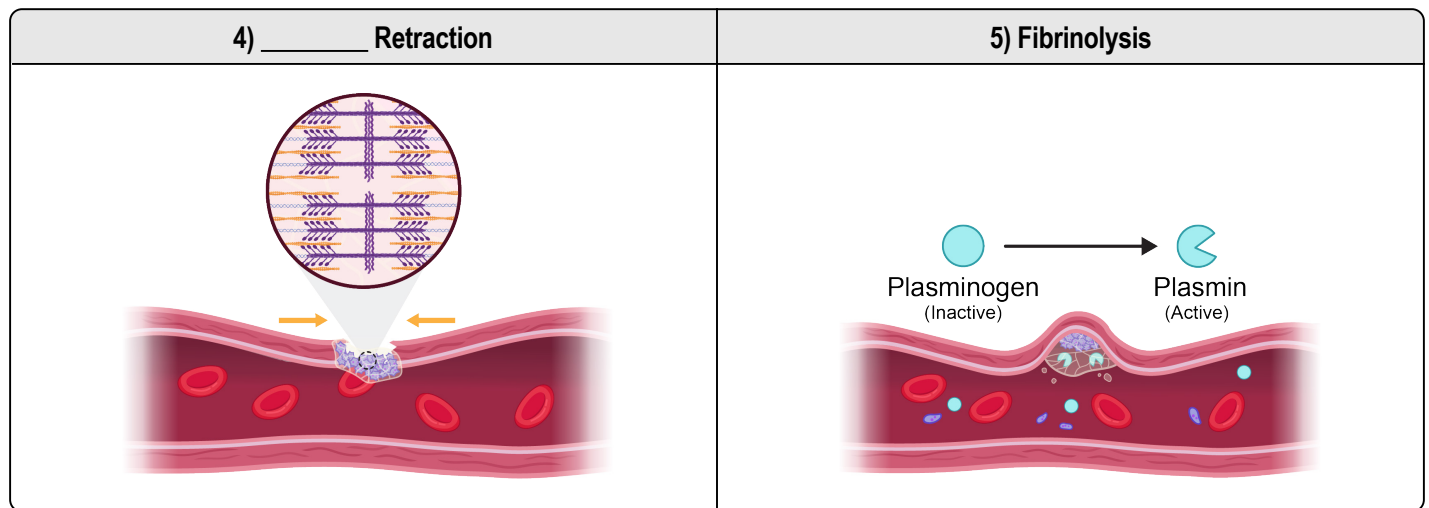
◆ Recall: after hemostasis , \_\_\_\_\_ more steps help complete the healing process:

**4) Clot Retraction:** platelet-induced process to further \_\_\_\_\_ clot & promote \_\_\_\_\_.

- Coagulated platelets in clot \_\_\_\_\_ to pull ruptured edges of blood vessel together.
- Platelets secrete *Platelet-Derived Growth Factor* (\_\_\_\_\_) to promote healing.

**5) Fibrinolysis:** process *after* blood vessel healing that breaks down fibrin to \_\_\_\_\_ unneeded clot.

- Plasminogen (inactive plasma protein) is converted to \_\_\_\_\_ (a fibrin-digesting enzyme).



### EXAMPLE

Which of the following issues might arise if fibrinolysis did not occur?

- a) Decreased blood pressure.
- b) Increased platelet count.
- c) Increased hematocrit.
- d) Buildup of blood clots.

### PRACTICE

What would happen if plasminogen was activated before clot retraction?

- a) Clot retraction would be completed even faster.
- b) Fibrinolysis would occur too early & the healing process could be interrupted.
- c) There would be no significant effect.