BLOOD-2
(RBC Continue--)

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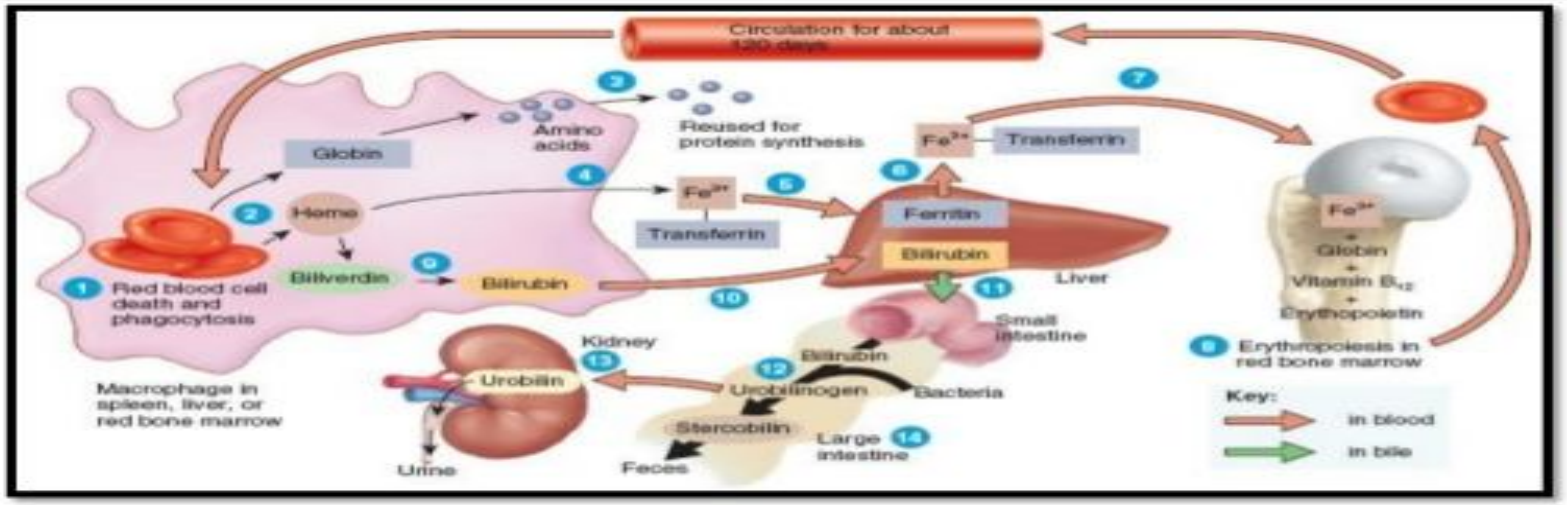
◆ Functions

- The main function is the transportation of oxygen throughout the body and the ability of the blood to carry out carbon dioxide which is called **carbamino – hemoglobin**.
- Maintaining the balance of blood is important.
- The balance can be measured by the acid and base levels in the blood.
- This is called **pH**.
- Normal pH of blood ranges between 7.35-7.45; this normal blood is called **Alkaline** (less acidic then water).
- A drop in pH is called **Acidic**.
- This condition is also called **Acidosis**.
- A jump in pH higher than 7.45 is called "**Alkalosis**".
- To maintain the homeostasis (or balance,) the blood has tiny molecules within the RBC that help prevent drops or increases from happening.

◆ Destruction

- Red blood cells are broken down and hemoglobin is released.
- The globin part of the hemoglobin is broken down into amino acid components, which in turn are recycled by the body.
- The iron is recovered and returned to the bone marrow to be reused.
- The heme portion of the molecule experiences a chemical change and then gets excreted as bile pigment (bilirubin) by the liver.
- Heme portion after being broken down contributes to the color of feces and your skin color changing after being bruised.



White Blood Cells

◆ Shape

- White blood cells are different from red cells in the fact that they are usually larger in size 10-14 micrometers in diameter.
- White blood cells do not contain hemoglobin which in turn makes them translucent.
- Many times in diagrams or pictures white blood cells are represented in a blue color, mainly because blue is the color of the stain used to see the cells.
- White blood cells also have nucleii, that are somewhat segmented and are surrounded by electrons inside the membrane.

Formation of WBC's

- **White blood cells (leukocytes)** are also known as "WBC's".
- White blood cells are made in the bone marrow but they also divide in the blood and lymphatic systems.
- They are commonly amoeboid (cells that move or feed by means of temporary projections, called pseudopods (false feet), and escape the circulatory system through the capillary beds.
- They live for about 13-20 days.

• Classified according to the presence or absence of granules and the staining characteristics of their cytoplasm.

• Leucocytes appear brightly colored in stained preparations, they have a nuclei and are generally larger in size than RBC's.

♣ Granular leukocytes

- Neutrophils, eosinophils, basophils

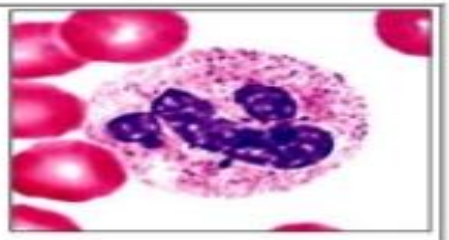
♣Agranular leukocytes

- Lymphocytes and monocytes

♠ Frequency of WBCs in Human Blood

WBC	%	number/mm3
• neutrophil	54-69	2700-6900
• lymphocyte	25-33	1250-3300
• monocyte	3-7	150-700
• eosinophil	1-3	50-300
• basophil	0-0.75	0-75

♣ Granuloctyes

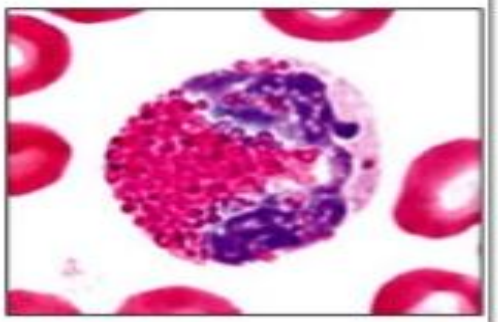


(c) Neutrophil

♦ Neutrophils

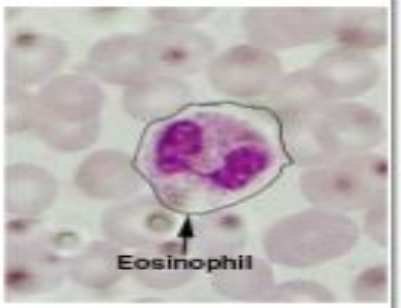
- Stain light purple with neutral dyes.
- Granules are small and numerous—course appearance
- Several lobes in nucleus.
- 65% of WBC count.
- Highly mobile/very active
- Diapedesis—Can leave blood vessels and enter tissue space.
- Phagocytosis (eater), contain several lysosomes (janitor)

♦ Eosinophils or Acidophils:



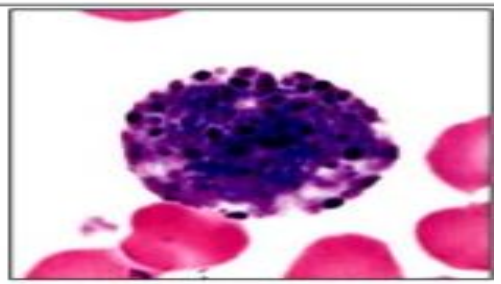
(a) Eosinophil

- Large, numerous granules
- Nuclei with two lobes
- 2-5% of WBC count
- Found in lining of respiratory and digestive tracts
- Important functions involve protections against infections caused by parasitic worms and involvement in allergic reactions
- Secrete anti-inflammatory substances in allergic reactions
- Eosinophils leave capillaries and enter tissue fluid
- Release histaminase, phagocytize antigen-antibody complexes and effective against certain parasitic worms



◆ **Basophils**

- Least numerous-0.5-1%
- Diapedesis—Can leave blood vessels and enter tissue space
- Contain histamine, serotonin, heparin—inflammatory chemical
- Basophils leave capillaries and release granules containing heparin, histamine and serotonin, at sites of inflammation
- Intensify inflammatory reaction
- Involved in hypersensitivity reactions (allergies)



(b) Basophil

♣ **Agranulocytes**

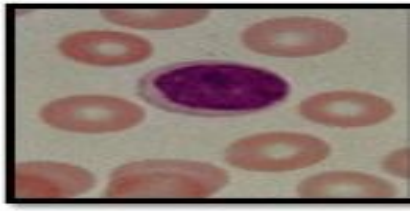
◆ **Lymphocytes**

- Smallest WBC
- Large nuclei/small amount of cytoplasm
- Account for 25% of WBC count
- Two types:

- T lymphocytes—attack an infect or cancerous cell,
- B lymphocytes—produce antibodies against specific antigens (foreign body)

(d) Lymphocyte

- Lymphocytes are the major soldiers of the immune system
  - **T cells** – attack viruses, fungi, transplanted cells, cancer cells and some bacteria, it develop in the thymus.
  - **B cells** – destroying bacteria and inactivating their toxins, it develop in the bone marrow.
  - **Natural Killer (NK) cells** – attack a wide variety of infectious microbes and certain tumor cells.
  - Lymphocytes originate in the **bone marrow**, but can proliferate in the spleen, thymus and other lymphoid tissues.
  - Often, large lymphocytes seen in the blood have been activated somewhere in the body, and are traveling to sites of action.



◆ **Monocytes**

- Largest of WBCs
- Dark kidney bean shaped nuclei
- Highly phagocytic
- Monocytes take longer to arrive but arrive in larger numbers and destroy more microbes
- Enlarge and differentiate into macrophages

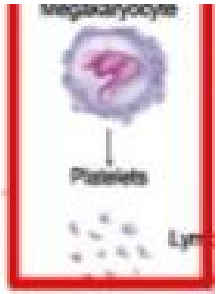
(e) Monocyte

◘ Leukemia

- Leukemia is a cancer of the blood or bone marrow characterized by an abnormal proliferation of blood cells, usually white blood cells (leukocytes).
- It is part of the broad group of diseases called hematological neoplasms.
- Damage to the bone marrow, by way of displacing the normal marrow cells with increasing numbers of malignant cells, results in a lack of blood platelets, which are important in the blood clotting process.
- This means people with leukemia may become bruised, bleed excessively, or develop pin-prick bleeds (petechiae).
- White blood cells, which are involved in fighting pathogens, may be suppressed or dysfunctional, putting the patient at the risk of developing infections.
- The red blood cell deficiency leads to anaemia, which may cause dyspnea.
- All symptoms may also be attributable to other diseases; for diagnosis, blood tests and a bone marrow biopsy are required.

◘ Platelets

- Platelets (thrombocytes) are minute discs 1-4 mm.
- Produced in the bone marrow by fragmentation of the cytoplasm of megakaryocytes.
- Normal count: 150,000-400,000/μL (250,000)
- Life span 7-10 days.
- Removed from circulation by tissue macrophage system mainly in spleen.
- Thrombopoietin: major regulator of platelet production (produced by liver and kidney).
- It increases no. & rate of maturation of megakaryocytes.
- Platelets **do not have nuclei** and cannot reproduce.



♦ Hemostasis (coagulation or clotting)

- Hemostasis is the natural process of stopping blood flow or loss of blood following an injury.
- (hemo = blood; stasis = standing).

♠ Hemostasis is achieved by several mechanisms:

1. Vascular constriction,
2. Formation of a platelet plug,
3. Formation of a blood clot as a result of blood coagulation, and
4. Growth of fibrous tissue into the blood clot to close the hole in the vessel permanently.

◘ Mechanism Of Blood Coagulation

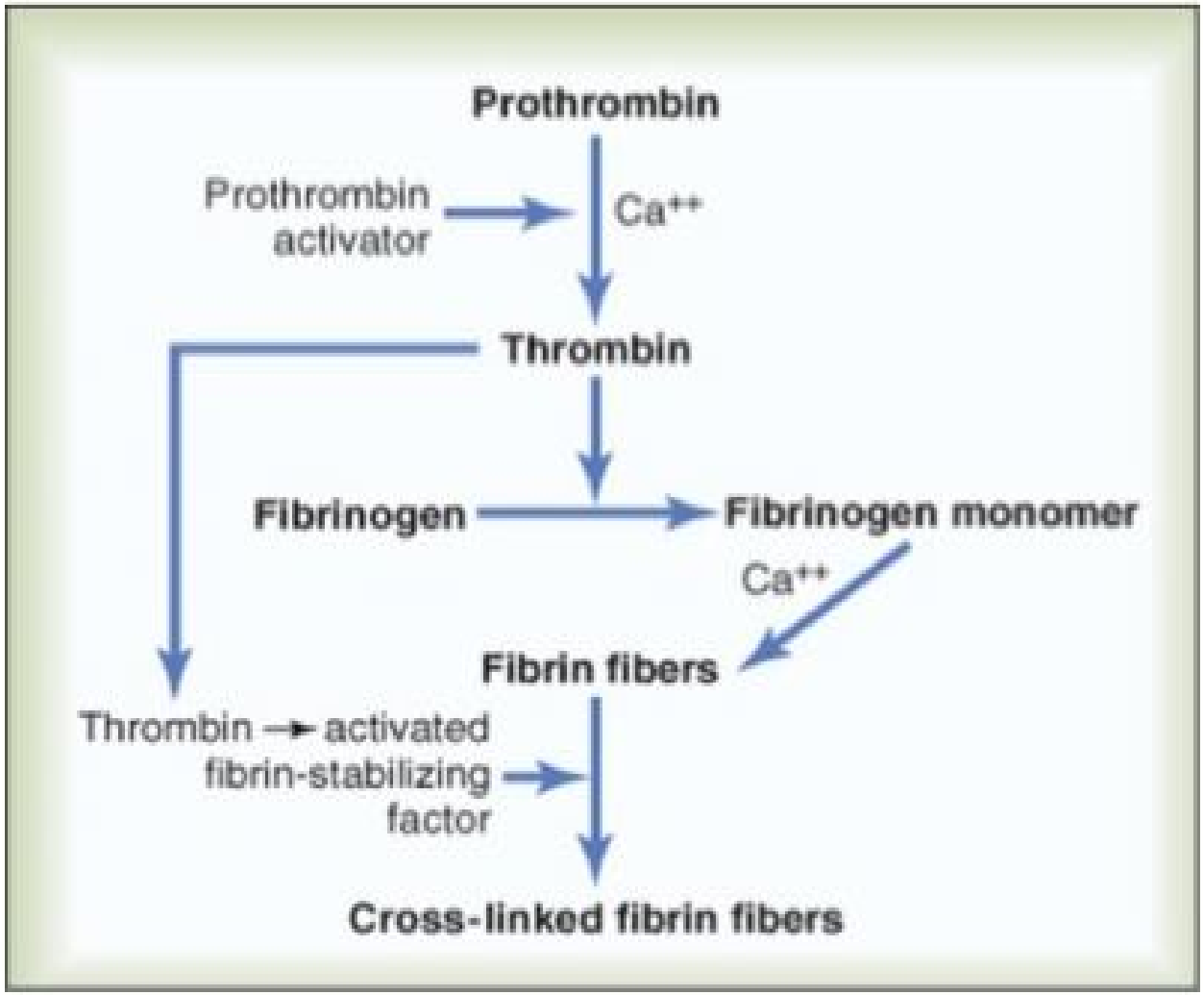
♣ Basic Theory:

○ More than 50 important substances that cause or affect blood coagulation have been found in the blood and in the tissues

- Some that promote coagulation, called procoagulants,
- and others that inhibit coagulation, called anticoagulants.

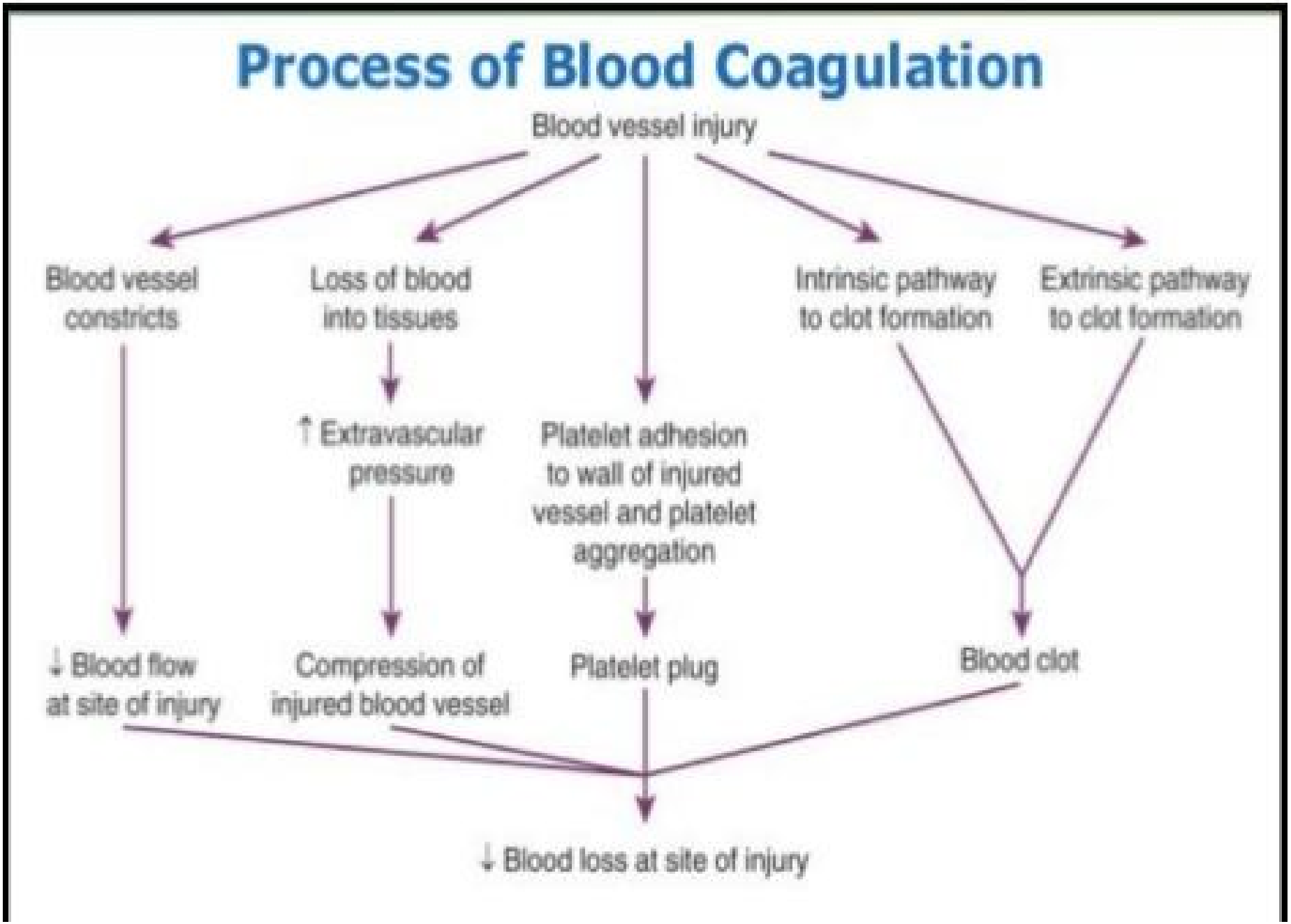
- Whether blood will coagulate depends on the balance between these two groups of substances.
- In the blood stream, the anticoagulants normally predominate, so that the blood does not coagulate while it is circulating in the blood vessels.
- But when a vessel is ruptured, procoagulants from the area of tissue damage become "activated" and override the anticoagulants, and then a clot does develop.

Basic Mechanism Of Clotting



Clotting Factors in Blood and Their Synonyms

Clotting Factor	Synonyms
Fibrinogen	Factor I
Prothrombin	Factor II
Tissue factor	Factor III; tissue thromboplastin
Calcium	Factor IV
Factor V	Proaccelerin; labile factor; Ac-globulin (Ac-G)
Factor VII	Serum prothrombin conversion accelerator (SPCA); proconvertin; stable factor
Factor VIII	Antihemophilic factor (AHF); antihemophilic globulin (AHG); antihemophilic factor A
Factor IX	Plasma thromboplastin component (PTC); Christmas factor; antihemophilic factor B
Factor X	Stuart factor; Stuart-Prower factor
Factor XI	Plasma thromboplastin antecedent (PTA); antihemophilic factor C
Factor XII	Hageman factor
Factor XIII	Fibrin-stabilizing factor
Prekallikrein	Fletcher factor
High-molecular-weight kininogen	Fitzgerald factor; HMWK (high-molecular-weight) kininogen
Platelets	


Process of Blood Coagulation
Blood vessel injury
Blood vessel constricts
Loss of blood into tissues
Intrinsic pathway to clot formation
Extrinsic pathway to clot formation
↑ Extravascular pressure
Platelet adhesion to wall of injured vessel and platelet aggregation
↓ Blood flow at site of injury
Compression of injured blood vessel
Platelet plug
Blood clot
↓ Blood loss at site of injury


THANK YOU