

Class 10:

Platelets

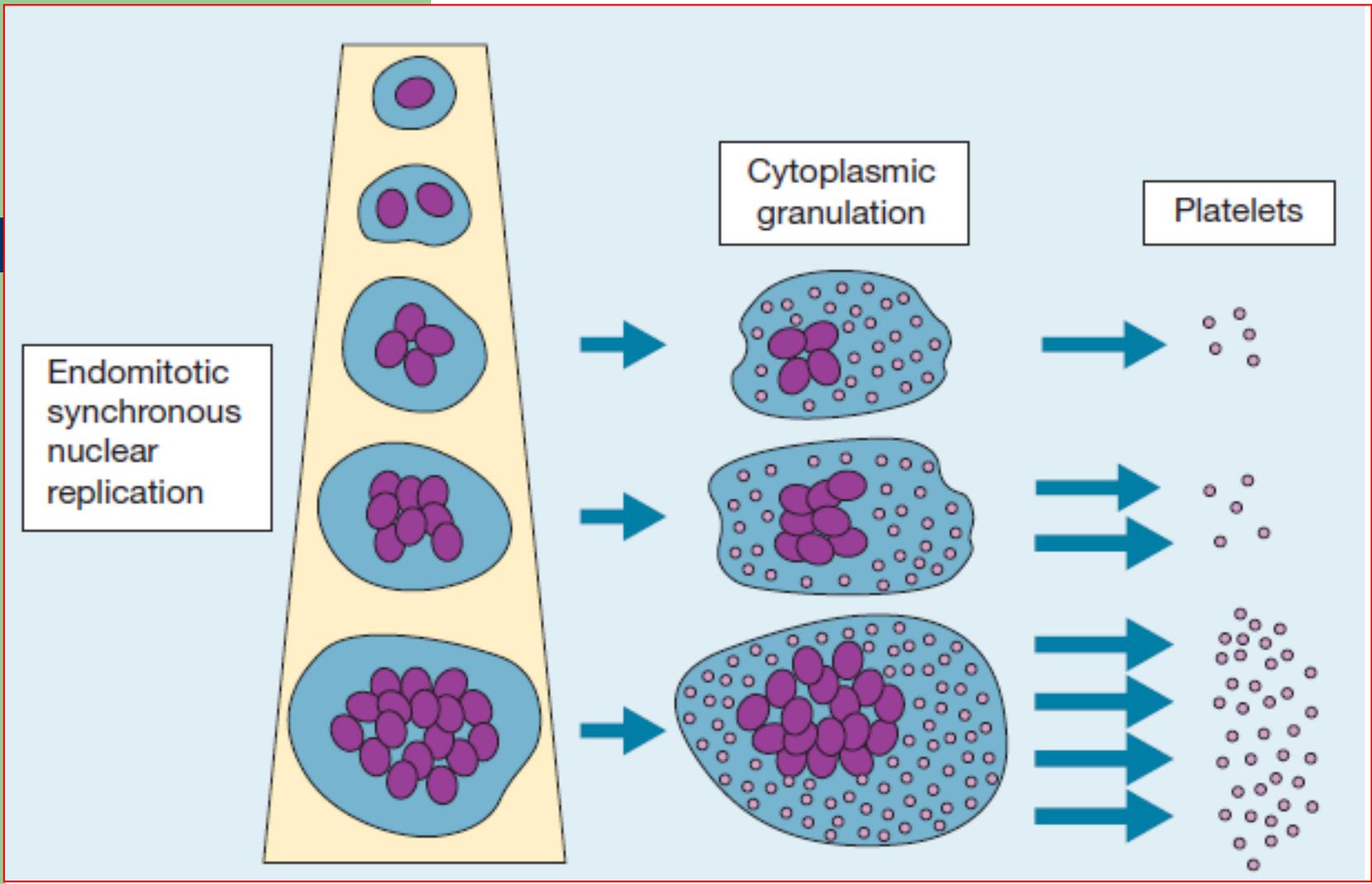
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Objectives for this lecture

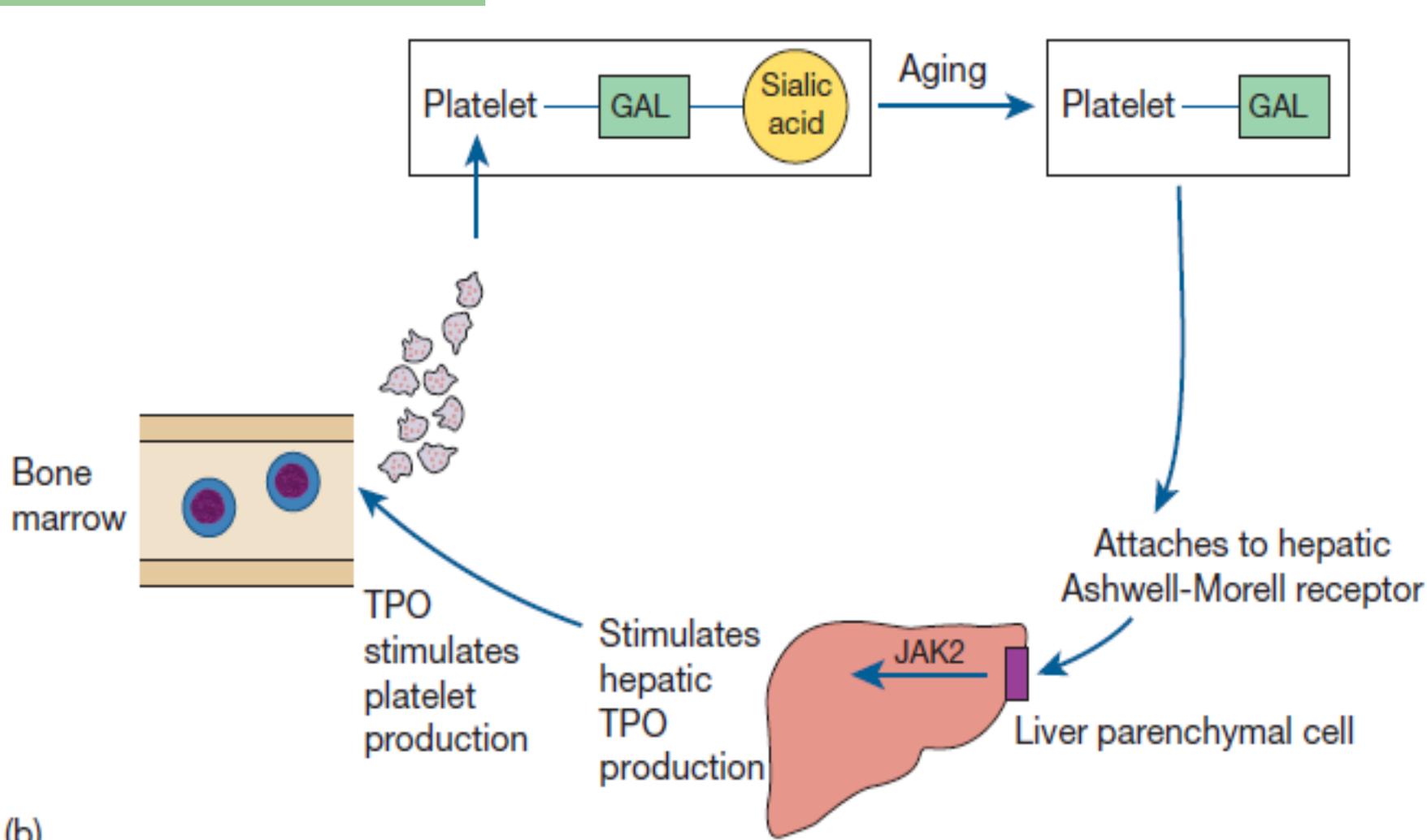
- Discuss the structure and functions of Platelets.
- understand the blood coagulation pathways.

Platelets

- **Produced** in the bone marrow by fragmentation of the cytoplasm of megakaryocytes.
- each megakaryocyte give rise to 1000–5000 platelets.
- **Regulated** by *Thrombopoietin (TPO)*, in which 95% of it is produced by the **liver**.
- normal platelet lifespan is 10 days.
- **Function** is formation of plugs during the vascular injury.



platelet production from megakaryocytes.



(b)

platelet production through hepatic clearance of de-sialylated platelets

Platelet function

1. ***Adhesion*** to the vessel wall, the glycoprotein of the surface coat involved in the adhesion.
2. ***Aggregation*** by cross-linking of platelets through active receptors with fibrinogen bridges.
3. ***Platelet release reaction and amplification***, Thromboxane A₂ (TXA₂) is platelet activation forming a stable platelet aggregate.
4. ***Platelets express ABO*** and human leucocyte antigen.

Blood coagulation

- **Initiated after vascular injury by** the interaction of the membrane bound tissue factor (TF), exposed and activated by vascular injury, with plasma factor VII.
- **Surface-mediated reactions** occur on exposed *collagen* (site of vessel wall injury), platelet phospholipid and tissue factor.

Blood coagulation

- **cascade of circulating precursor proteins** (the coagulation factor enzymes) which in the **generation of thrombin** converts plasma fibrinogen into fibrin.
- **Fibrin** inter between platelet aggregates at the sites of vascular injury and converts the platelet plugs to definitive and stable plugs.

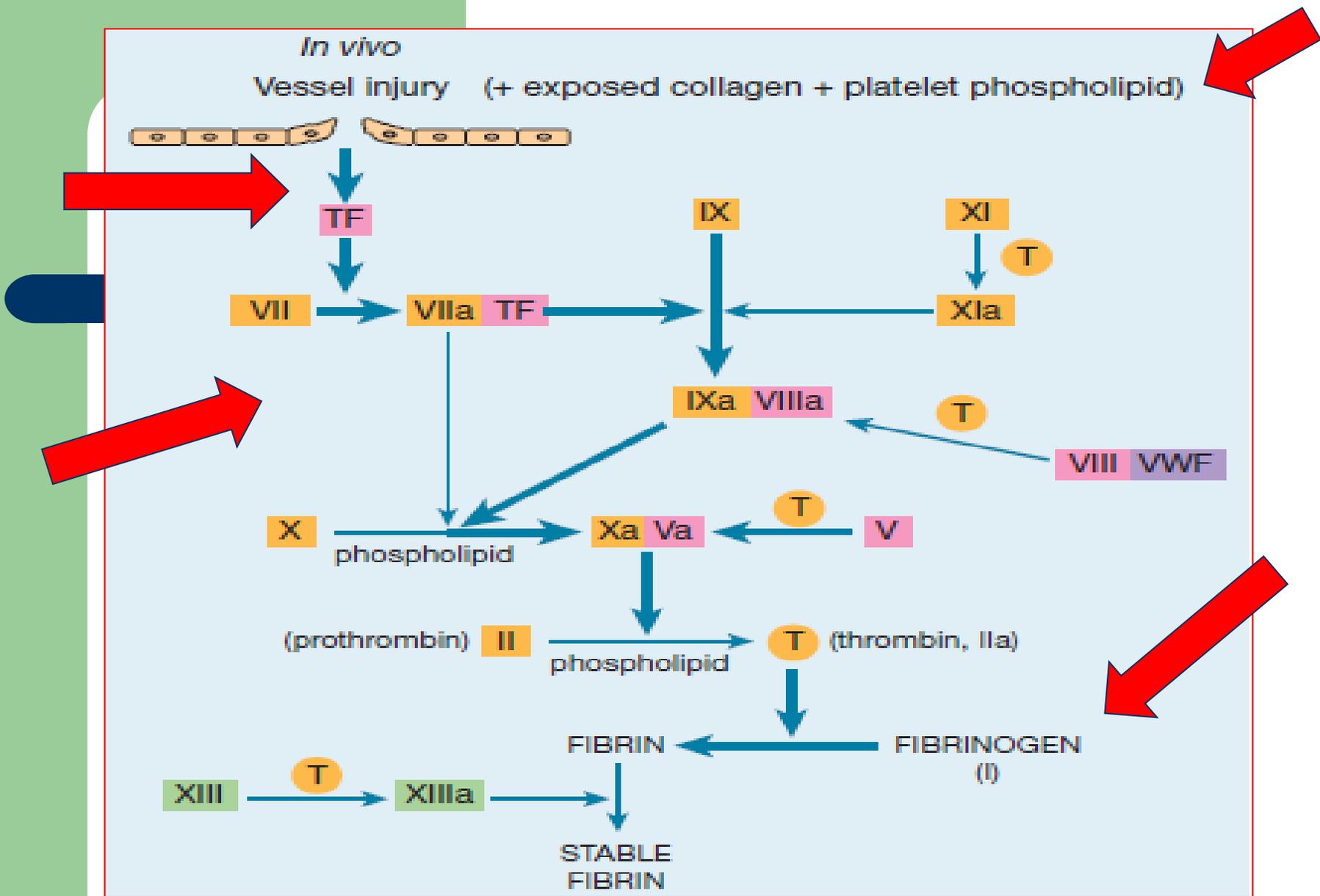


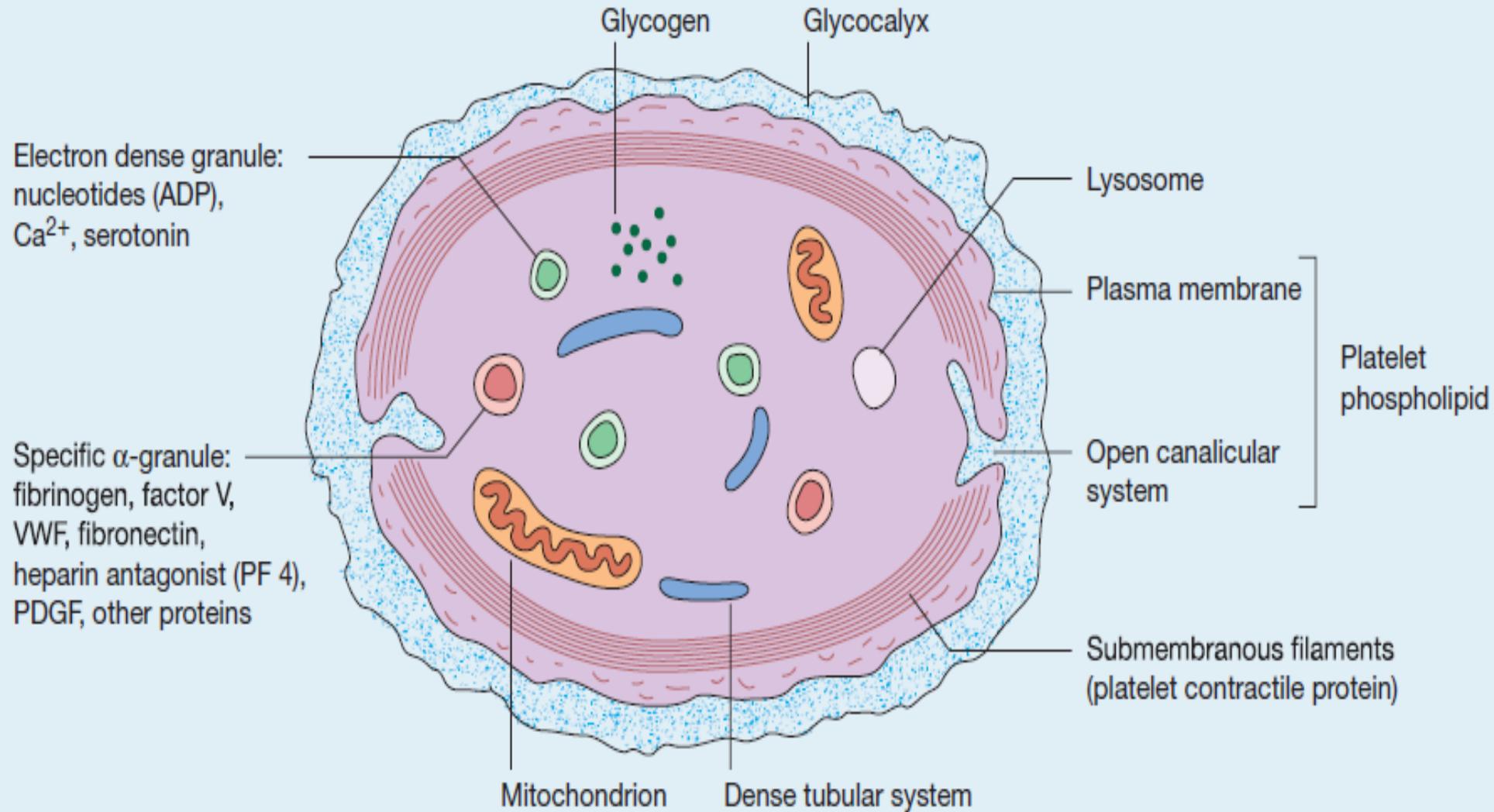
Figure 24.8 The pathway of blood coagulation *in vivo* initiated by tissue factor (TF) on the cell surface.

TABLE 55–1 Numerical System for Nomenclature of Blood Clotting Factors

Factor	Common Name(s)
I	Fibrinogen
II	Prothrombin
III	Tissue factor
<p>} These factors are usually referred to by their common names</p>	
IV	Ca ²⁺
<p>Ca²⁺ is usually not referred to as a coagulation factor</p>	
V	Proaccelerin, labile factor, accelerator (Ac-) globulin
VII ^a	Proconvertin, serum prothrombin conversion accelerator (SPCA), cothromboplastin
VIII	Antihemophilic factor A, antihemophilic globulin (AHG)
IX	Antihemophilic factor B, Christmas factor, plasma thromboplastin component (PTC)
X	Stuart-Prower factor
XI	Plasma thromboplastin antecedent (PTA)
XII	Hageman factor
XIII	Fibrin stabilizing factor (FSF), fibrinoligase

Blood coagulation

- platelet contains three types of storage granules:
 1. *Dense*: contain ATP, serotonin and calcium
 2. *α* : contain clotting factors
 3. *Lysosomes*: contain hydrolytic enzymes
- During the release reaction, the contents of the granules are discharged into the circular system.



The ultrastructure of platelets.

Haemostatic response

- ***Vasoconstriction*** of the injured vessel for slowing of blood flow to the area of injury.
This vascular reaction prevents exsanguination.
- ***Adherence of platelets*** to receptors exposed in connective tissue.
Platelet aggregation from the circulating blood promotes the growth of the haemostatic plug.
- ***Stabilization of the platelet plug by fibrin***
plug begins to autodigest during the same time.

Haemostatic response

- *Limitation of blood coagulation*, because blood coagulation would lead to occlusion of blood vessels (thrombosis) if the mechanisms of coagulation were not in operation.

Haemostatic response

- *Coagulation factor inhibitors* in endothelial cells limit the main *in vivo* pathway.
Initiated by endothelial cell surface receptor.
 - ✓ *Heparin potentiates its action.*
 - ✓ *Antiplatelet drugs inhibit platelet responses, e.g. aspirin (acetylsalicylic acid).*

Haemostatic response

- ***Fibrinolysis*** (like coagulation) is a normal haemostatic response to vascular injury. Plasmin generation for digesting of fibrinogen, fibrin, and other proteins.

Laboratory Tests Measure Platelet Aggregation

- Platelet count
- Bleeding time/closure time
- Platelet aggregation
- Activated partial thromboplastin time (aPTT or PTT)
- Prothrombin time (PT)
- Thrombin time (TT)
- Concentration of fibrinogen
- Fibrin clot stability
- Measurement of fibrin degradation products.

References

- Victor A Hoffbrand, Paul Moss, J Pettit; ***Essential Haematology***. Essentials Series Blackwell Science, New York; 2008.
- Victor W. Rodwell, David A. Bender, Kathleen M. Botham, Peter J. Kennelly, P. Anthony Weil. ***Harper's Illustrated Biochemistry***. McGraw-Hill Ed, 31 ed, 2018.