

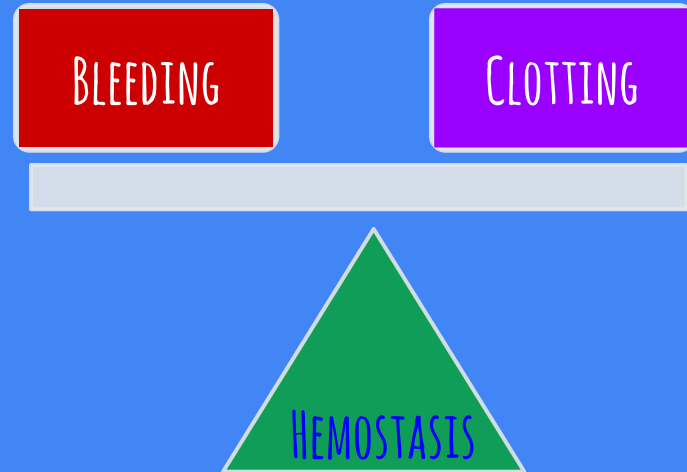
A microscopic view of a blood smear. The field is dominated by numerous red blood cells (erythrocytes), which appear as small, pinkish-red, biconcave discs. In the center of the image, there is a single white blood cell (leukocyte) with a large, dark purple nucleus and a thin rim of light blue cytoplasm. The background is a pale, off-white color.

INTRODUCTION TO HEMOSTASIS

PRIMARY HEMOSTASIS - BLOOD VESSELS AND
PLATELETS

WHAT IS HEMOSTASIS?

- THE MAINTENANCE OF CIRCULATORY BLEEDING AND CLOTTING THROUGH A BALANCED PROCESS OF COAGULATION AND FIBRINOLYSIS.



HEMOSTASIS IS THE HIGHLY INTEGRATED AND REGULATED INTERACTION OF:

MAJOR SYSTEMS

- BLOOD VESSELS
- PLATELETS
- COAGULATION PROTEINS
- FIBRINOLYSIS
- SERINE PROTEASE INHIBITORS

MINOR SYSTEMS

- KININ SYSTEM
- COMPLEMENT SYSTEM

TWO STAGES:

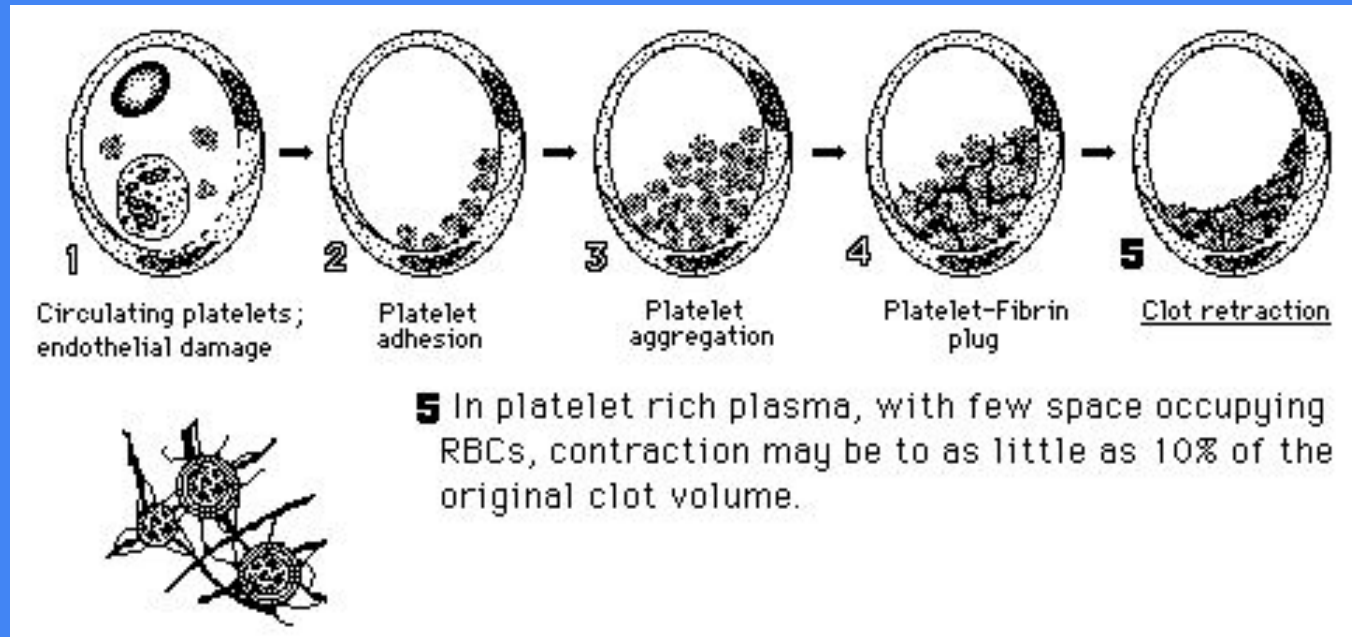
PRIMARY

- INITIAL RESPONSE TO VASCULAR INJURY – THE PLATELET PLUG

SECONDARY

- ENZYMATIC ACTIVATION OF THE COAGULATION PROTEINS TO PRODUCE FIBRIN FROM FIBRINOGEN.

COAGULATION

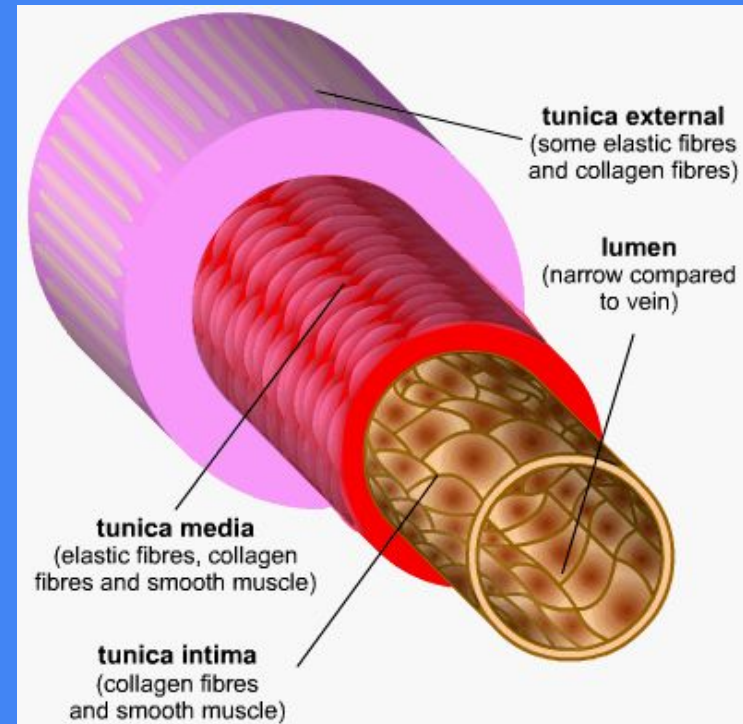


Actin in the filipods and myosin in the platelet body contract, shortening the fibrin strands and shinking the platelet-fibrin plug. This process utilizes large amounts of energy (plateletATP) and Ca^{++} .
Add more Ca^{++} !!!!

STEPS 1-3 ARE PRIMARY HEMOSTASIS. STEPS 4 AND 5 ARE SECONDARY HEMOSTASIS

BEFORE WE GET INTO HEMOSTASIS LET'S TALK ABOUT THE VASCULAR SYSTEM.

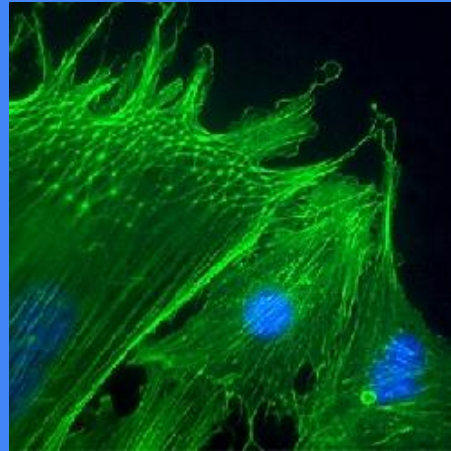
- TUNICA INTIMA
 - INNER MOST
 - SINGLE ENDOTHELIAL LAYER
- TUNICA MEDIA
 - MIDDLE LAYER
 - ELASTIC AND SMOOTH MUSCLE
- TUNICA ADVENTITIA
 - OUTER MOST
 - FIBROUS CONNECTIVE TISSUE



VESSEL SIZE COMPARISON

VESSEL	SIZE	VESSEL	SIZE
AORTA	25 MM	VENA CAVA	20 MM
ARTERY	4MM	VEIN	5 MM
ARTERIOLE	30 μ M	VENULE	20 μ M
PRE SPHINCTER CAPILLARY	35 μ M	CAPILLARY	8 μ M

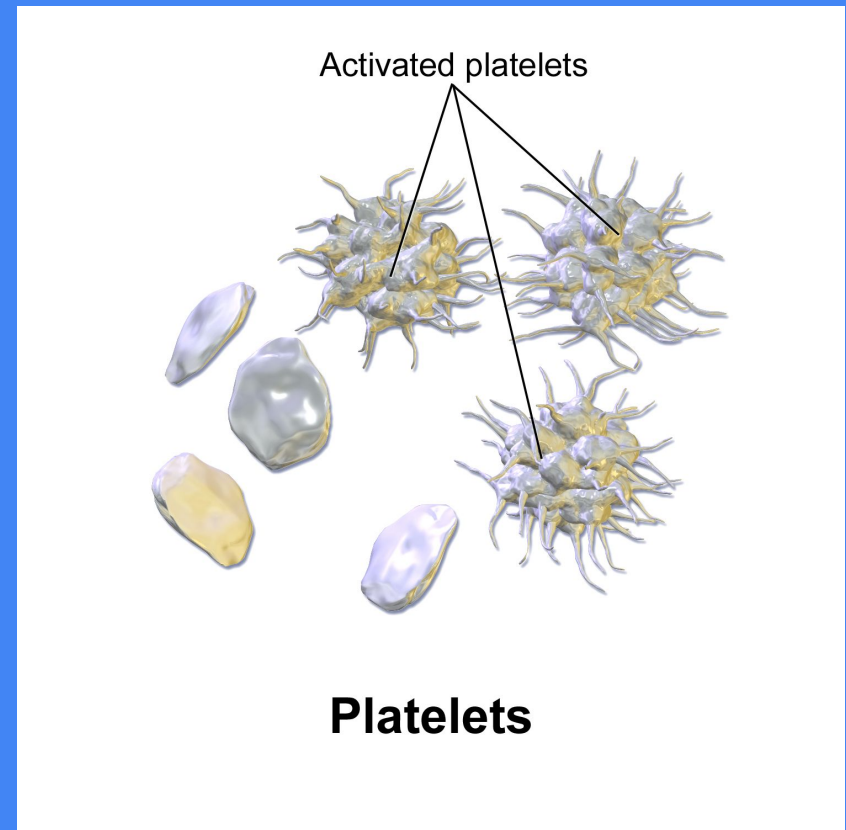
ROLE OF INTACT ENDOTHELIUM



IT IS THROMBORESISTANT!

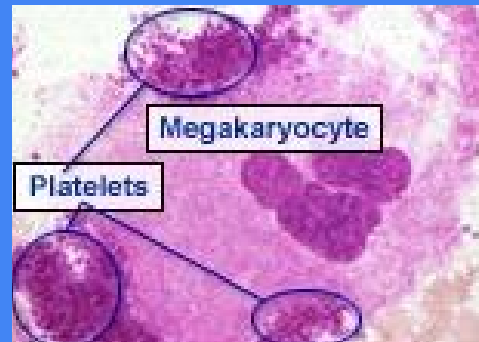
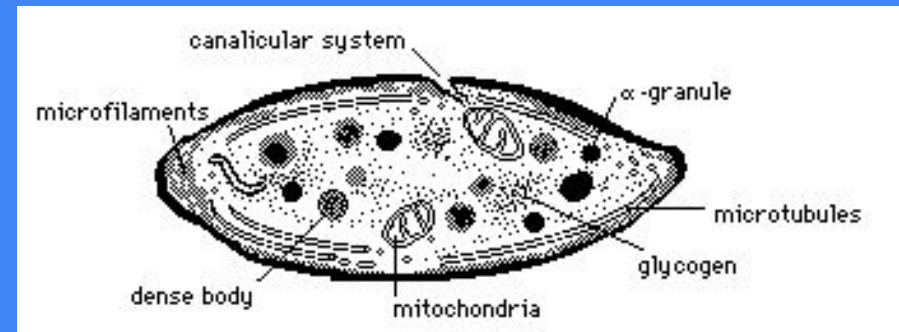
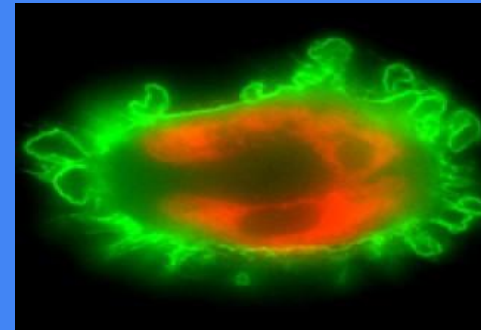
PLATELET FACTS

- 1 MEGAKARYOCYTE = 1000-2000 PLATELETS
- MATURATION TIME = 5 DAYS
- LIFE SPAN = 7-10 DAYS
- BM TO SPLEEN = 2 DAYS
 - CIRCULATING POOL/ACTIVE SPLENIC POOL
- 70% PLATELETS IN CIRCULATION
- 30% PLATELETS IN SPLEEN FOR EXCHANGE
- $150-450 \times 10^9/L$ @ 2-4 MICRONS



PLATELET STRUCTURE

- PERIPHERAL ZONE
 - GLYCOCALYX
 - PLATELET MEMBRANE
 - OCS
- SOL-GEL ZONE
 - MICROTUBULES AND MICROFILAMENTS
- ORGANELLE ZONE
 - GRANULES
 - MITOCHONDRIA
 - DENSE TUBULAR SYSTEM



WHAT HAPPENS WHEN A BLOOD VESSEL IS INJURED?

- VASOCONSTRICTION
- DIVERSION OF BLOOD FLOW
- INITIATION OF CONTACT ACTIVATION OF PLATELETS
- CONTACT ACTIVATION OF COAGULATION CASCADE

WHAT'S RELEASED FROM DAMAGED VESSELS?

COAGULATION	ANTICOAGULANT	FIBRINOLYSIS	ANTIFIBRINOLYSIS
COLLAGEN VWF TISSUE FACTOR	HEPARIN SULFATE PGI ₂ TFPIs THROMBOMODULIN	T-PA	PAIS

HOW DO PLATELETS PARTICIPATE IN HEMOSTASIS?

- PROVIDE NEGATIVELY CHARGED PHOSPHOLIPID SURFACE FOR FACTOR X AND PROTHROMBIN ACTIVATION
- RELEASE SUBSTANCES THAT MEDIATE VASOCONSTRICTION, PLATELET AGGREGATION, COAGULATION, AND VASCULAR REPAIR
- PROVIDING SURFACE MEMBRANE GLYCOPROTEINS TO ATTACH TO OTHER PLATELETS VIA FIBRINOGEN, COLLAGEN, AND SUBENDOTHELIUM

ACHIEVE THIS VIA:

- SHAPE CHANGE
- ADHESION
- AGGREGATION
- SECRETION

PLATELET FUNCTION

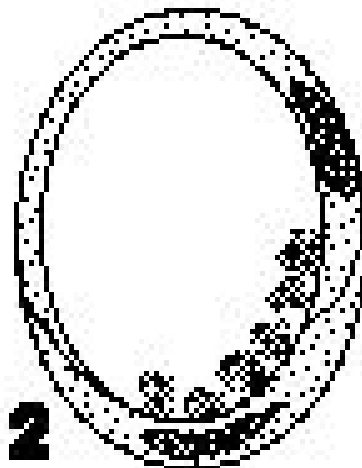
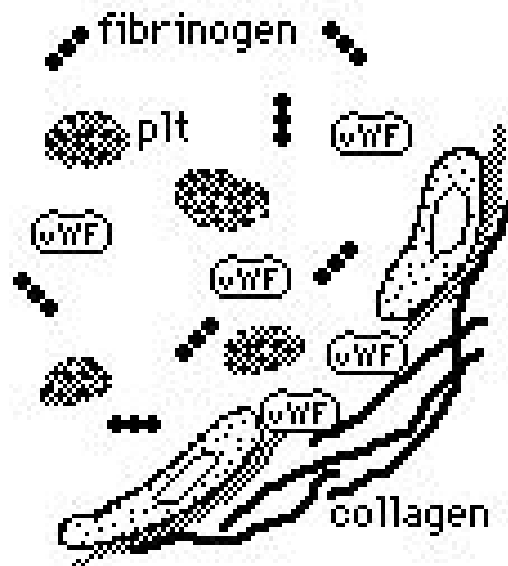
- SHAPE CHANGE – PSEUDOPOD FORMATION AND CONTRACTIONS SIGNAL INTRACELLULAR ACTIVATION
- ADHESION TO SITE OF INJURY VIA GPIB AND VWF
- AGGREGATION – PLATELETS STICK TO ONE ANOTHER VIA GPIIB/IIIA AND FIBRINOGEN
- SECRETION – RELEASE OF GRANULE CONTENTS AMPLIFIES THE PLATELET RESPONSE



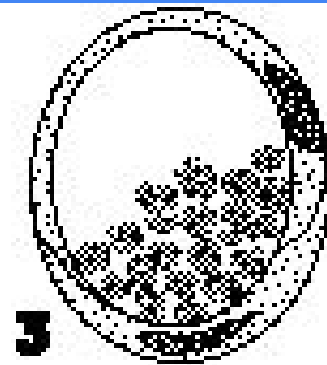
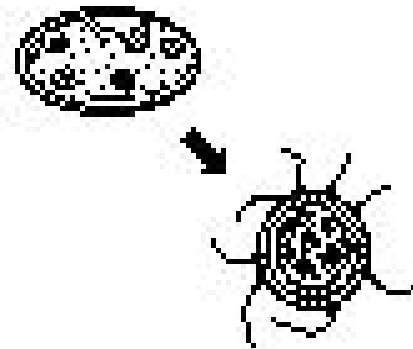
Activated platelets show little cell feet called pseudopodia.



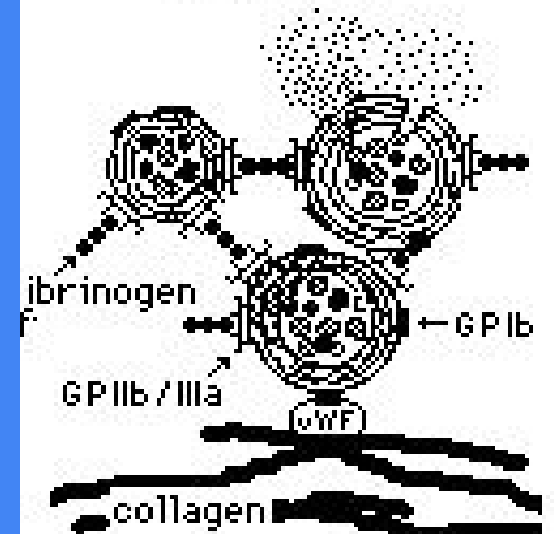
1
Circulating platelets,
endothelial damage



2
Platelet
adhesion



3
Platelet
aggregation



fibrinogen \longleftrightarrow ;
 von Willebrand factor (vWF) \circ ;
 GP Ib — ;
 GP IIb/IIIa Y

IN SUMMARY

The diagram illustrates the process of platelet adhesion to a blood vessel wall. A red vessel wall is shown with a pink platelet attached to it. The platelet is shown in a cross-section, revealing its internal structure, including a nucleus and various organelles. The vessel wall is shown with a wavy, irregular surface, representing the endothelium. The platelet is shown with its GPIIb/IIIa receptor (alpha_{IIb}β₃) bound to fibrinogen (represented by blue Y-shaped structures), which is in turn bound to fibrin (represented by red X-shaped structures). The diagram is annotated with handwritten text: 'Step 2: Platelet Adhesion' at the top, 'Endothelin' and 'Nitric Oxide + Prostacyclin II' on the left, and 'Platelet' in a pink box with 'αIIb β3' below it. The Khan Academy logo is at the bottom left.

Step 2: Platelet Adhesion


Endothelin

Nitric Oxide + Prostacyclin II

Platelet

$\alpha_{IIb} \beta_3$

PRIMARY HEMOSTASIS

 KHANACADEMY

CREDITS

- ALL IMAGES AND VIDEOS ARE NOT ORIGINALS. THEY WERE OBTAINED FROM GOOGLE SLIDES SEARCH OR WERE GIVEN TO ME BY PREVIOUS MLS 411 INSTRUCTOR.
- TEXTBOOK: MCKENZIE, S.B., & WILLIAMS, J.L (2015).
CLINICAL LABORATORY HEMATOLOGY, PEARSON EDUCATION INC. ISBN 978-0-13-307601-1.