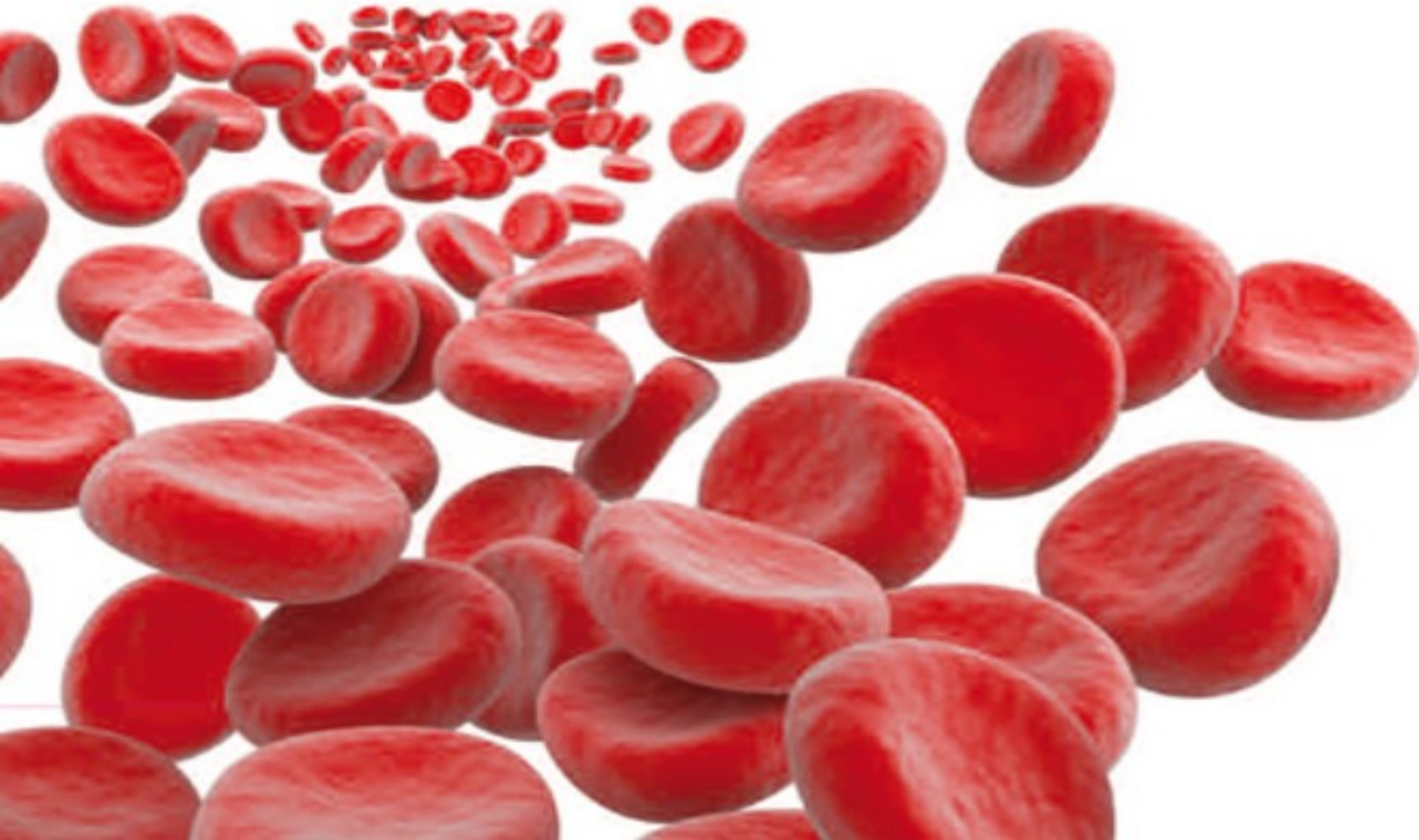


Blood Count



Basic blood tests

- **Basic screening test:** most frequently ordered
- **Valuable diagnostic test:** hematologic and other body systems, prognosis, response to treatment and recovery
- **Consist of series of tests:** variety, percentage, concentrations and quality of blood cells

Basic blood tests

- **White blood cell count (WBC):** leukocytes fight infection
- **Specific pattern of WBC**
- **RBC indices:** calculated values of size and Hb content of RBCs-**important in the test for anemia**
- **Hematocrit (Hct):** measures of RBC mass
- **Hemoglobin (Hb):** main component of RBCs and transport O₂

Basic blood tests

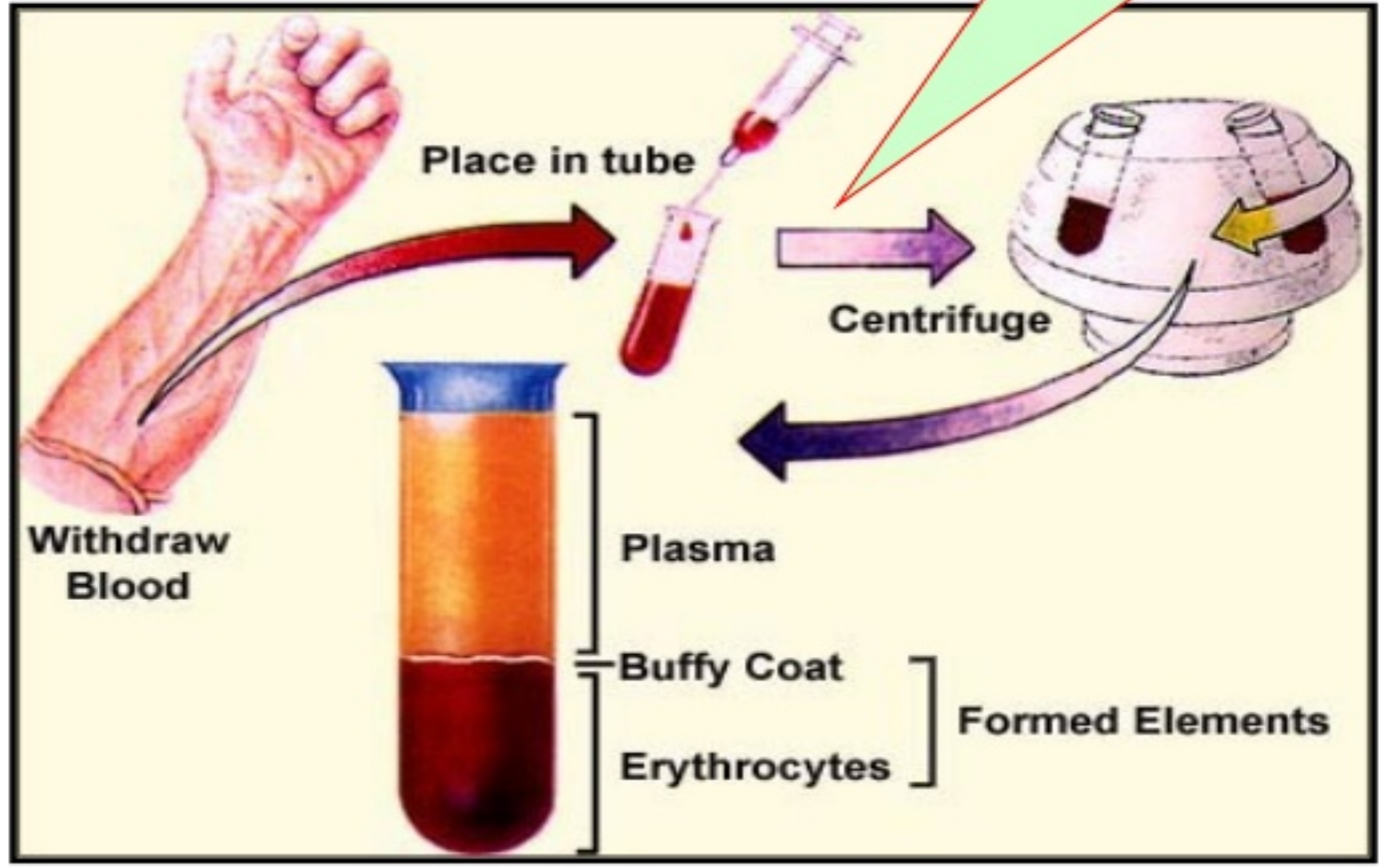
- **Mean corpuscular volume (MCV)**
- **Mean corpuscular Hb concentration (MCHC)**
- **Mean corpuscular Hb (MCH)**
- **Red cell distribution and degree of variability (RDW)**

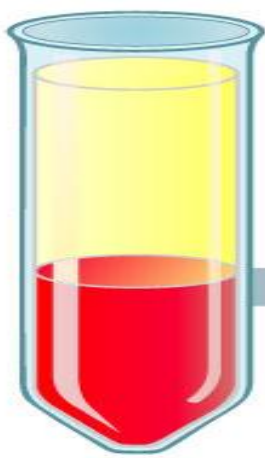
Basic blood tests

- **Platelet count**
- **Mean platelet volume (MPV):
index of platelet production**
- **Reticulocytes**


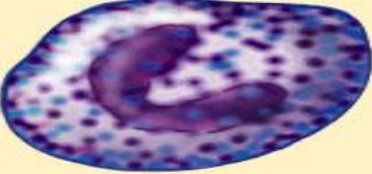
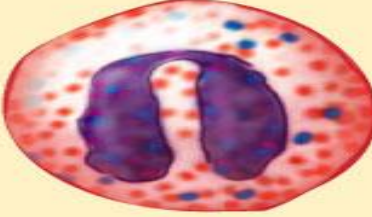

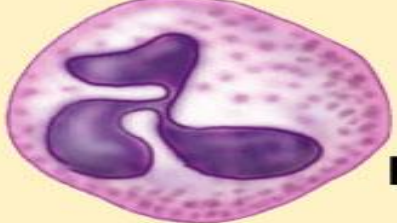
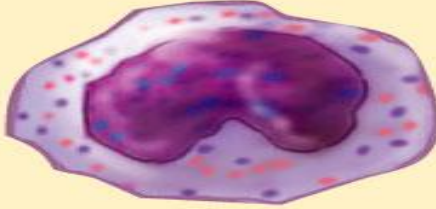

Centrifuged Blood Sample

Add anticoagulants
(heparin, potassium oxalate)

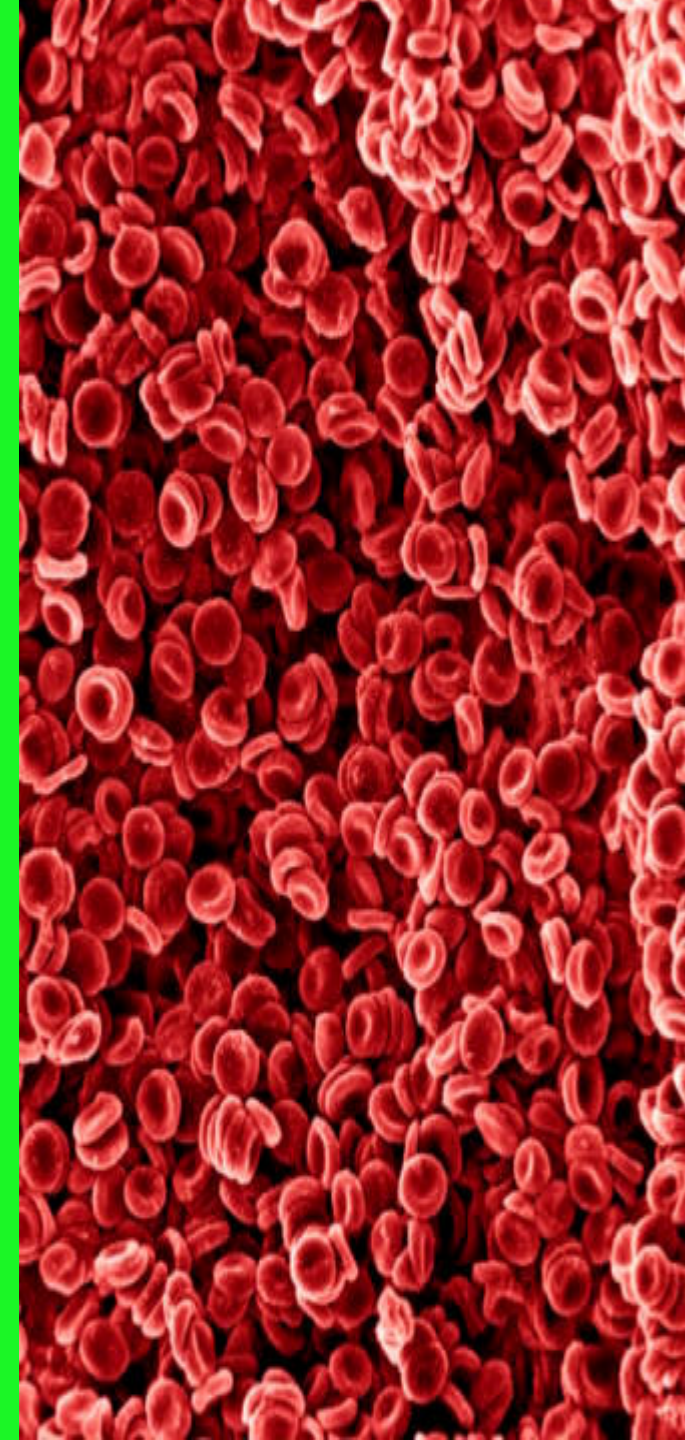




Centrifuged blood sample

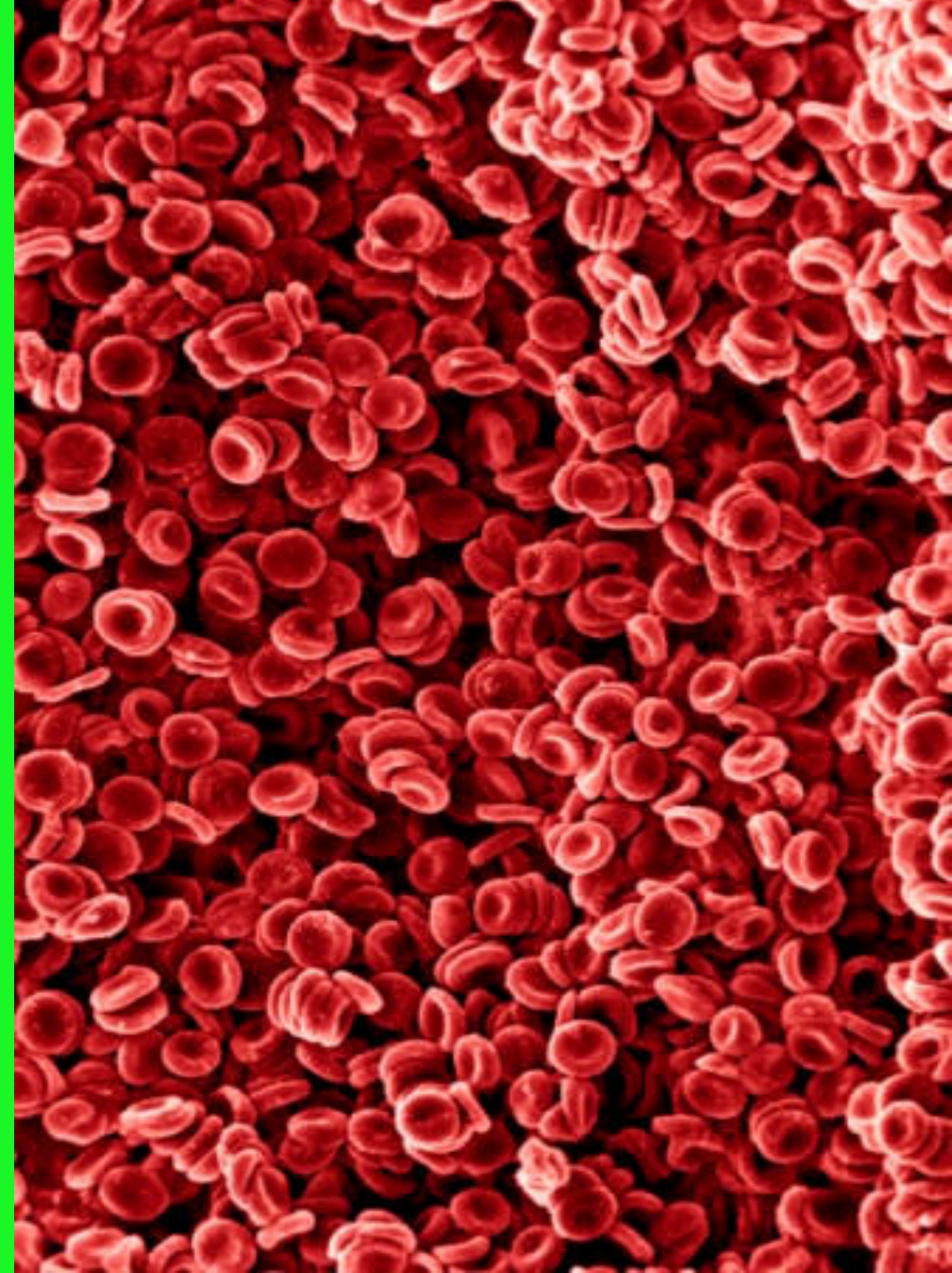
Cellular elements (45%)		
Cell type	Number per μL (mm^3) of blood	Functions
Erythrocytes (red blood cells) 	5–6 million	Transport of oxygen (and carbon dioxide)
Leukocytes (white blood cells)	5,000–10,000	Defense and immunity
 Basophil		 Lymphocyte
 Neutrophil	Eosinophil	 Monocyte
 Platelets	250,000–400,000	Blood clotting

Blood can be defined as
a *specialized connective*
composed of a
corpuscular part
(**erythrocytes, leukocytes**
and platelets)
and
fluid part (**plasma**)



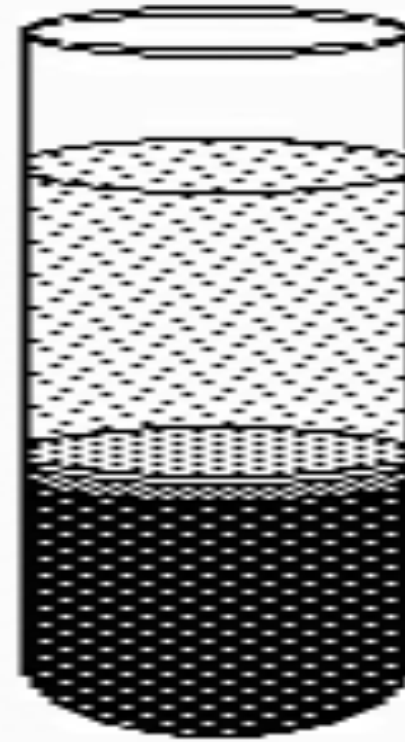
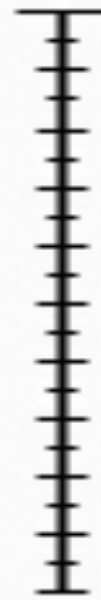
What are blood functions?

- Respiratory
- Nutritive
- Excretory
- Transportation
- Thermoregulatory
- Regulating PH
- Regulating acid base balance
- Defence
- Coagulation





0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0



plasma

platelets

leucocytes

erythrocytes

- * **Hematocrit (45%)** = percentage of the elements of the total blood volume
- * Plasma (55%)
- * Buffy Coat (1%)
- * Erythrocytes (45%)

Laboratory Language

- **PLASMA (55%)**

Water

Protein

-Albumin

-Fibrinogen

-Coagulation factors

-Antibodies

Lipid

Glucose

Amino Acids

- **Buffy Coat (1%)**

White blood cells

Neutrophils

Eosinophils

Basophils

Monocytes

Lymphocytes

Platelets

- **Red Blood Cells (44%)**

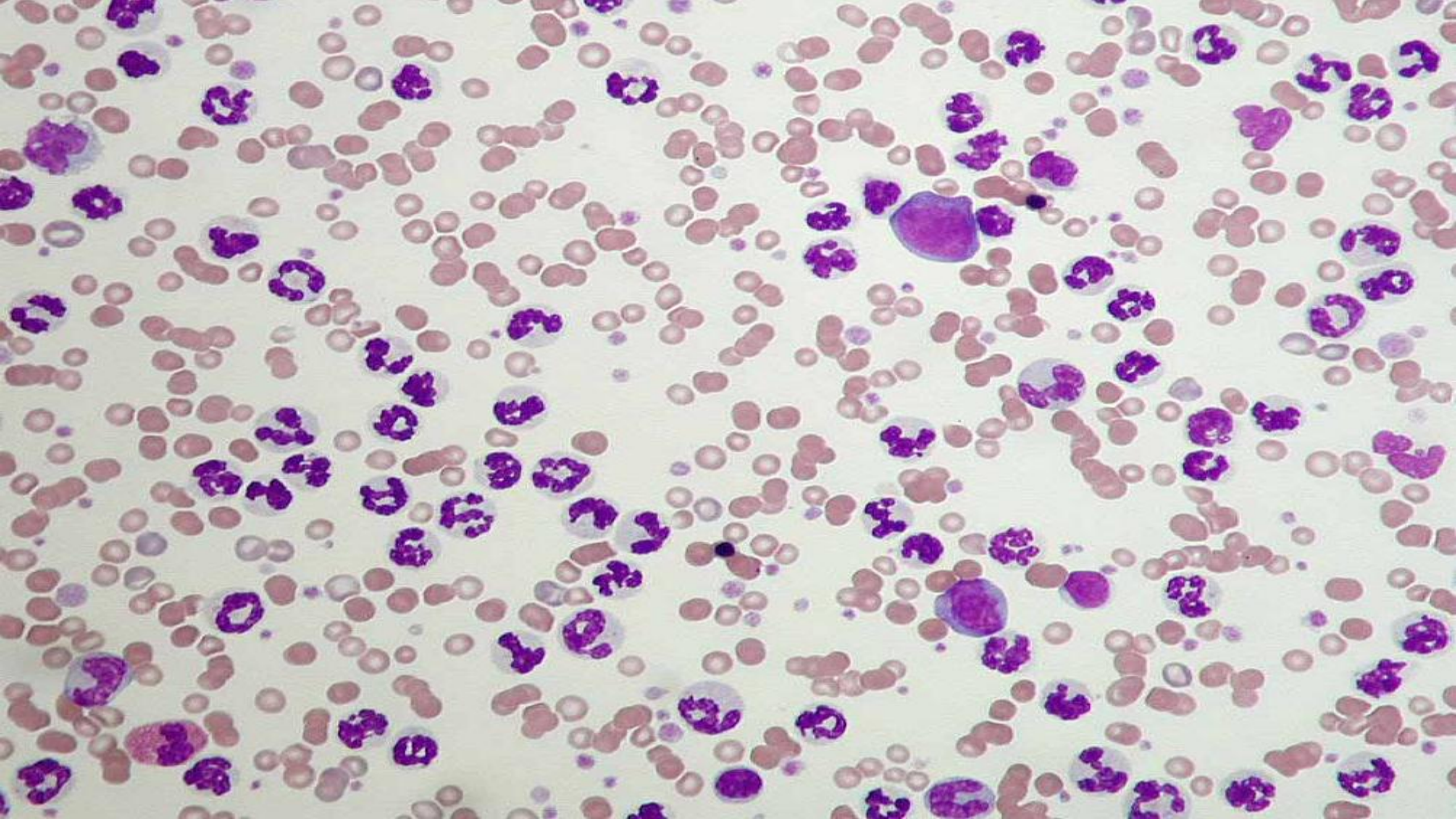


Complete Blood Count:

	Patient Value	Normal Range 2 years – 6 years
WBC	$8.4 \times 10^9 / L$	(5.0 – 17.0)
RBC	$2.77 \times 10^{12} / L$	(3.90 – 5.30)
Hgb	7.5 g/dl	(11.5 – 13.5)
Hct	21.8 %	(34.0 – 40.0)
MCV	78.6 fl	(75.0 – 87.0)
MCH	26.9 pg	(25.0 – 31.0)
MCHC	34.2 gm/dl	(31.0 – 36.0)
RDW	17.3 %	(11.5 – 15.0)
PLT	$192 \times 10^9 / L$	(150 – 450)

Differential:

	Absolute	Normal Range Number	2 years – 6 years
Neutrophils	43 %	(3.61)	(1.50 – 8.50)
Bands	6 %	(0.50)	(0.00 – 1.00)
Lymphocytes	41 %	(3.44)	(3.00 – 9.50)
Monocytes	4 %	(0.34)	(0.00 – 0.80)
Eosinophils	3 %	(0.25)	(0.02 – 0.65)
Metamyelocytes	3 %	(0.25)	N/A
NRBC / 100 WBC	1		



Staining

Giemsa

Striscio di sangue



3 minuti con il
colorante di Wright :
Eosina Y
Azur B
Biu di metilene
Essiccamento e
osservazione

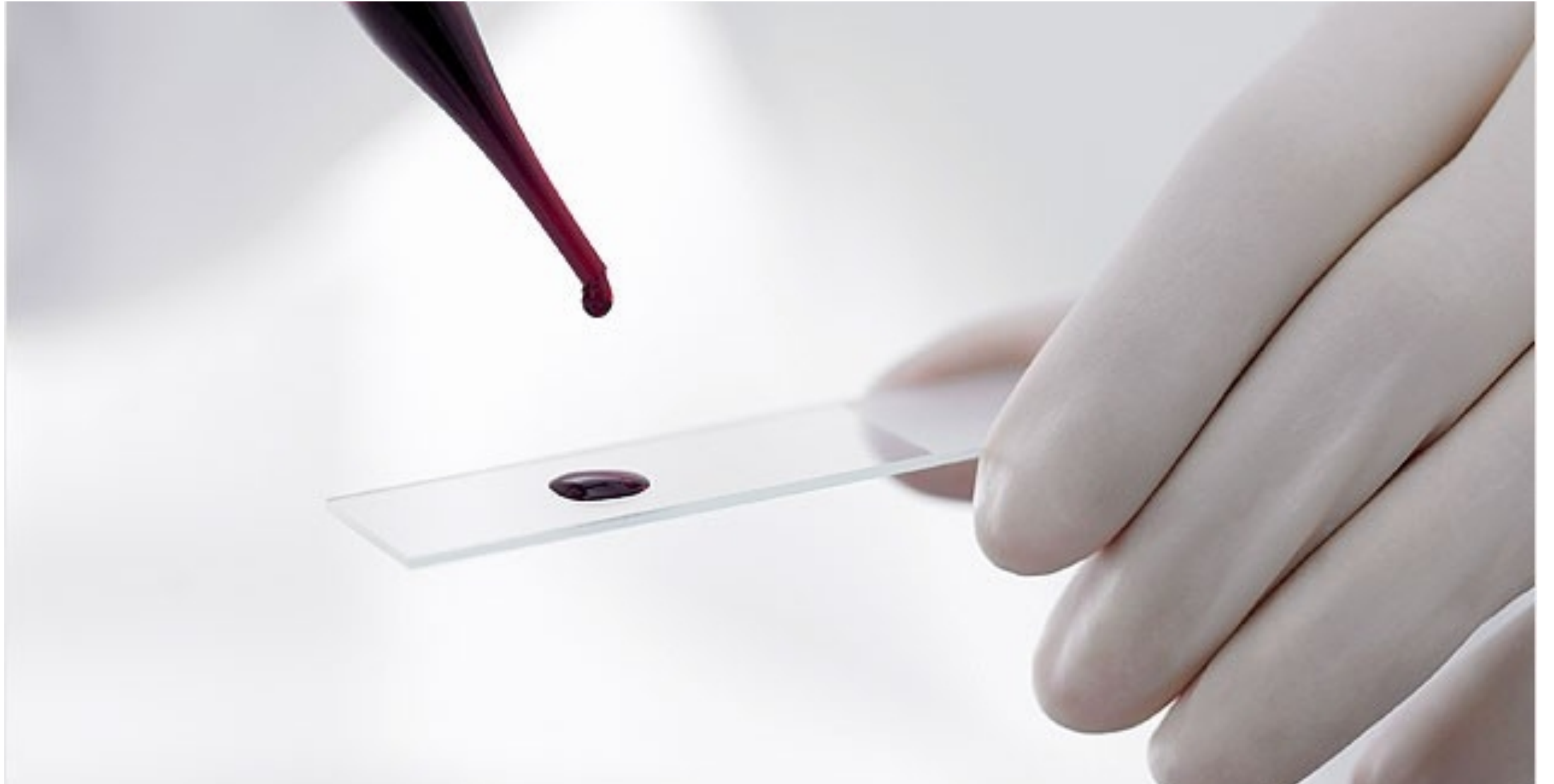
May-Grunwald
Giemsa

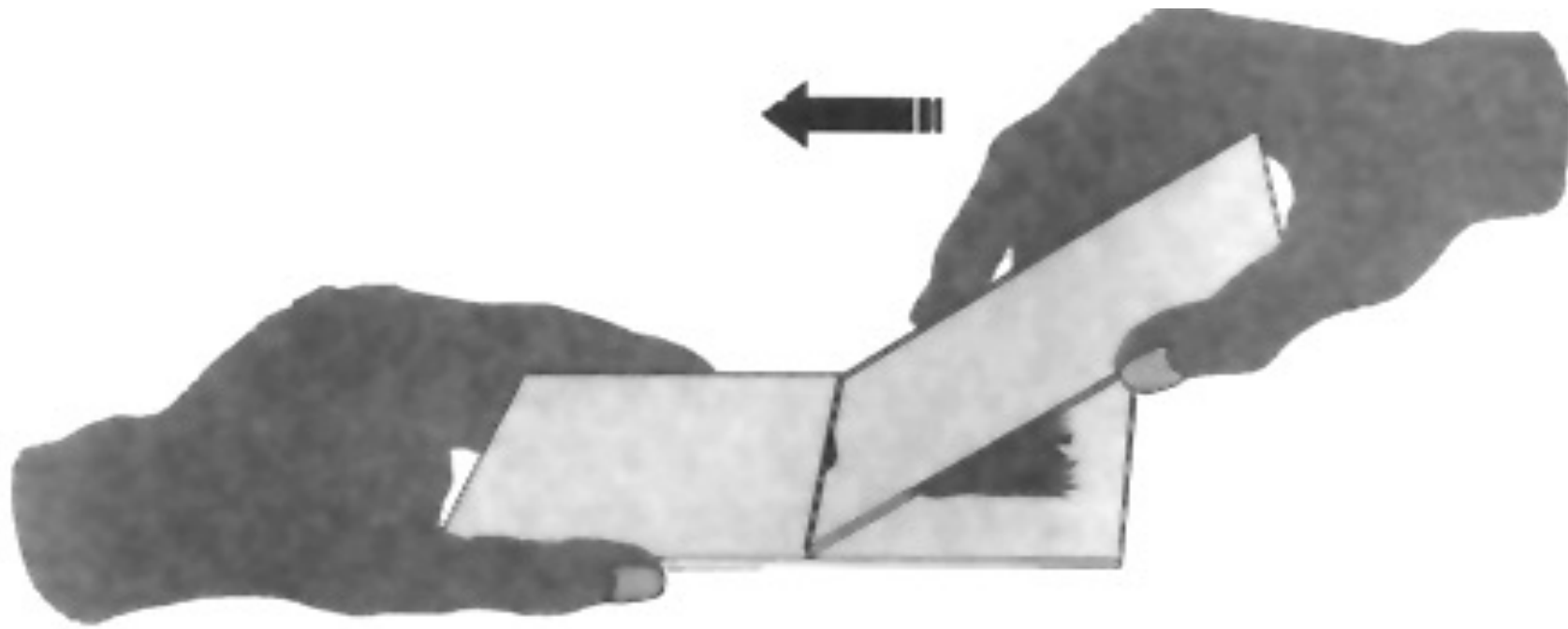


• Giemsa Stain

• General consideration

- Giemsa stain has various azure compounds with **eosin** and **methylene blue**
- It is an excellent stain for blood, parasites and for inclusion bodies
- It stains **red granules** well but neutrophilic granules and erythrocytes are poorly stained
- Commercial stock solution are recommended for purchase and are stable indefinitely



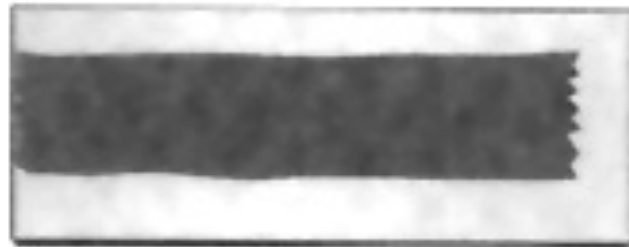


CORRECT



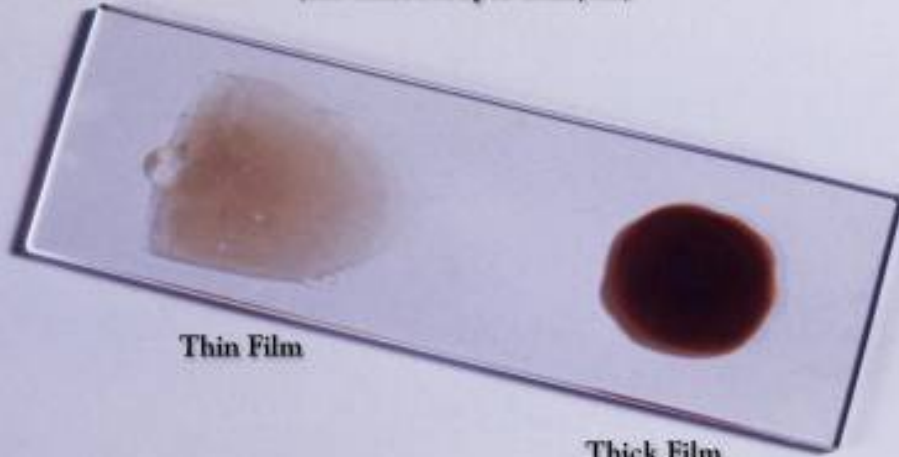
Note tailing off

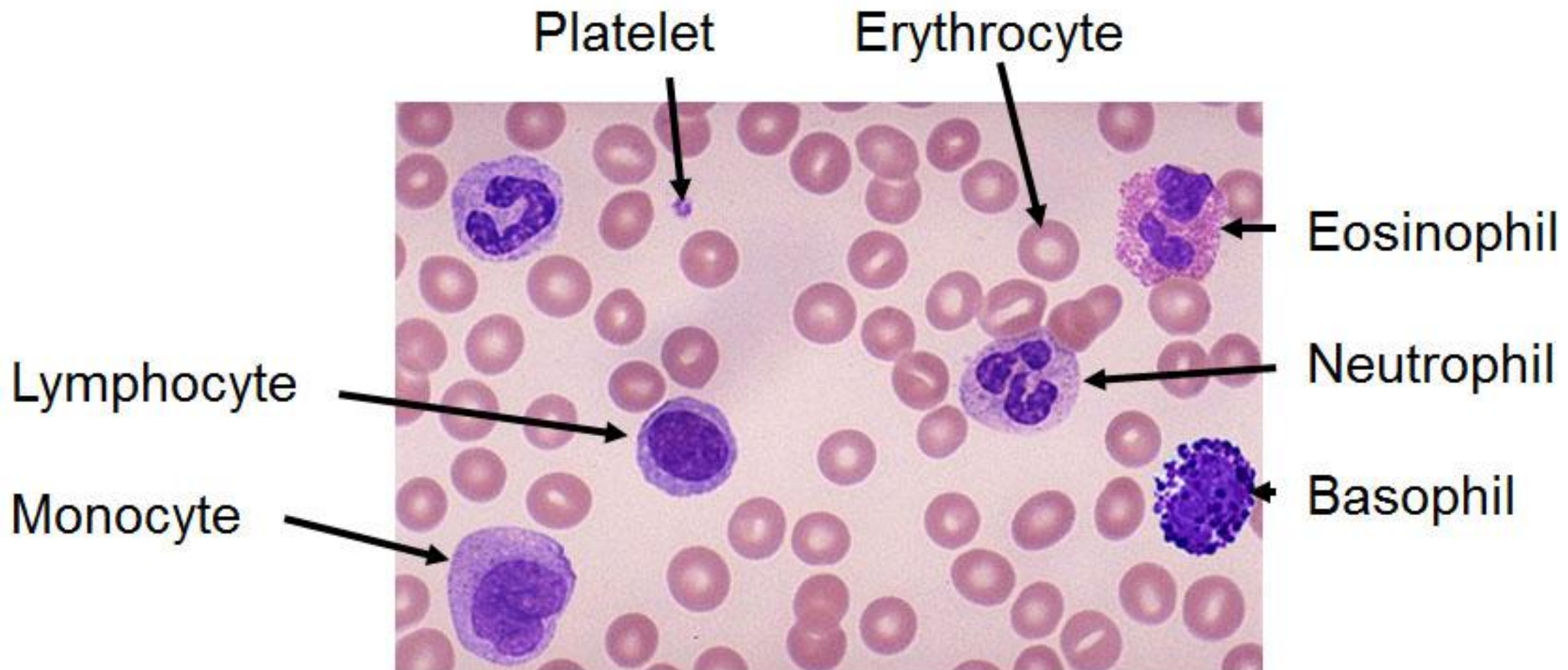
INCORRECT



Spread the sample on the slide

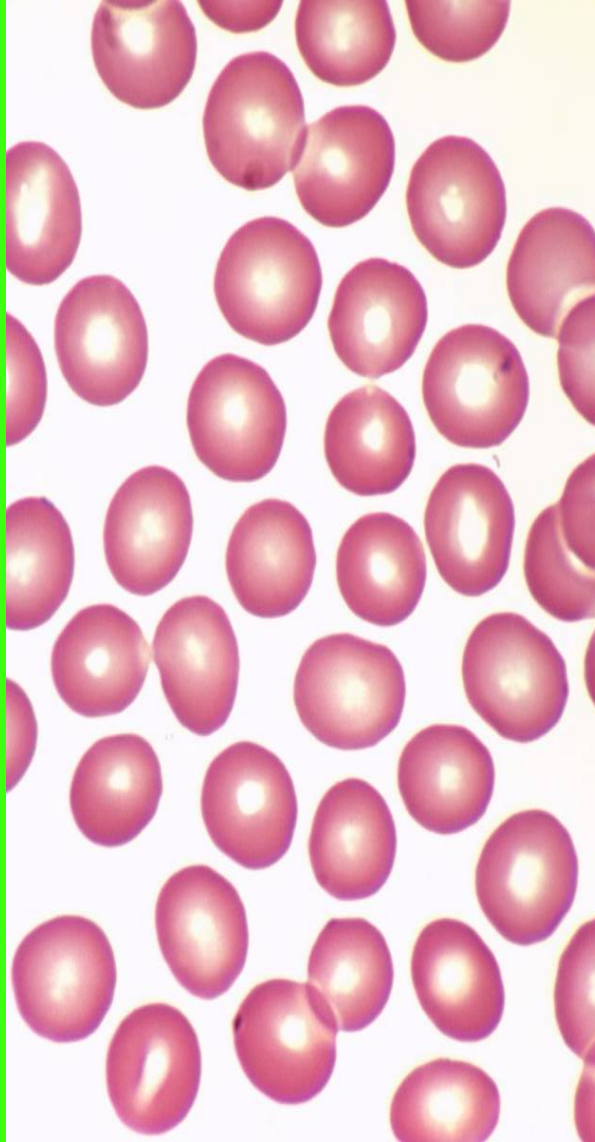
Blood Films
Good Quality Smears
(for microscopic analysis)





Red Blood Cells

- They are formed in the marrow under the control of the amount of oxygen (erythropoietin)
- Each cell contains 1 Hb molecule to which 4 atoms of iron are linked and reversibly 4 oxygen molecules
- They cannot reproduce or repair damage
- They have an average life of 120-130 days
- On the cell surface they have cytoplasmic proteins (blood groups)



- Post haemorrhagic **anemia**
- Haemolytic anemia
- **Anemia** deficiency of vitamins (B12), folic acid and iron
- Marrow disorders (aplastic)
- Thalassemia (Mediterranean **anemia**)
- Fetal erythroblastosis

ANEMIA

an insufficient supply of healthy red blood cells needed to carry oxygen to the body



Anemia

COMMON CAUSES

- Iron Deficiency
- Vitamin Deficiency
- Chronic Diseases
- Bone Marrow Diseases
- Hemolytic Anemia
- Sickle Cell Anemia

SYMPTOMS

- Weakness and unexplained fatigue
- Shortness of Breath
- Dizziness
- Irregular or Fast Heart Rate
- Headache
- Cold Hands or Feet
- Chest Pain
- Yellow Skin
- Pale Skin

Based on Mean Cell Volume (MCV)

- Normal MCV : 76-96 fL (femtolitres)

Low MCV
MICROCYTIC
ANAEMIA

Normal MCV
NORMOCYTIC
ANAEMIA

High MCV
MACROCYTIC
ANAEMIA

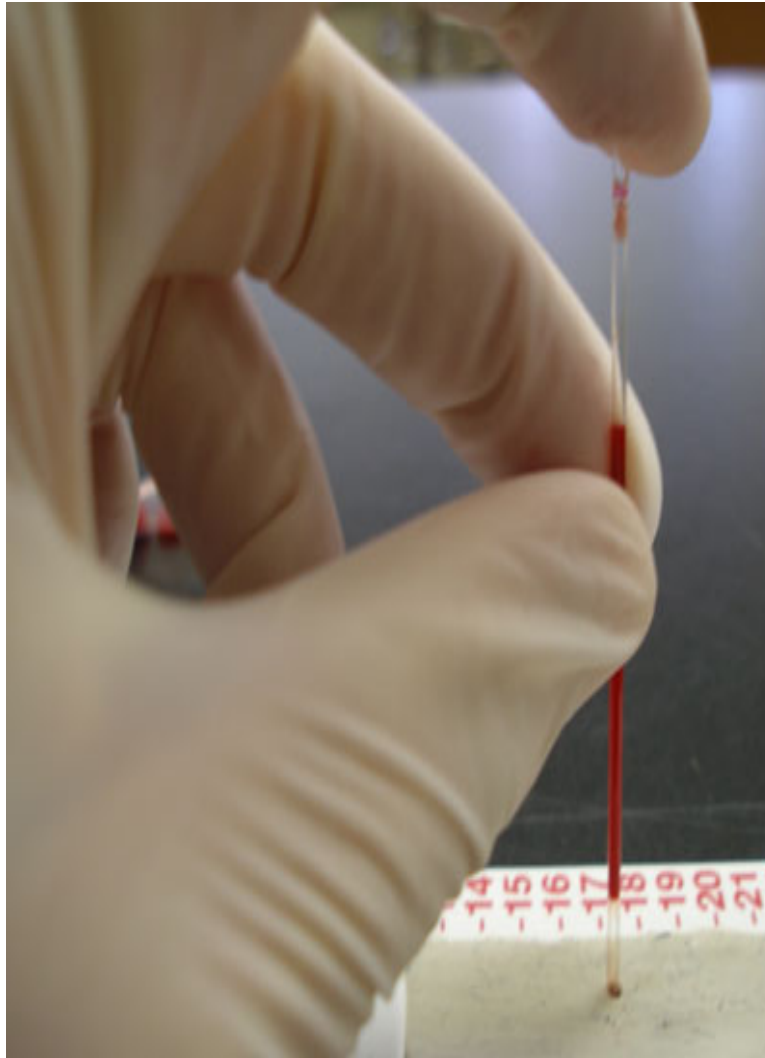
Varying MCV
HAEMOLYTIC ANAEMIA



Hematocrit

Volume percentage (Vol%) of red blood cells in blood

Alcoholism
Diabetes
Acute kidney failure
Peritonitis
Polycythemia
Use of diuretics
Burns
Vomiting
Dehydration



Anemia
Bleeding
Bone marrow aplasia
Lack of iron
Lack of Vit B12
Liver cirrhosis
Cancers
Leukemias



Hemoglobin

Diarrhea

Dehydration

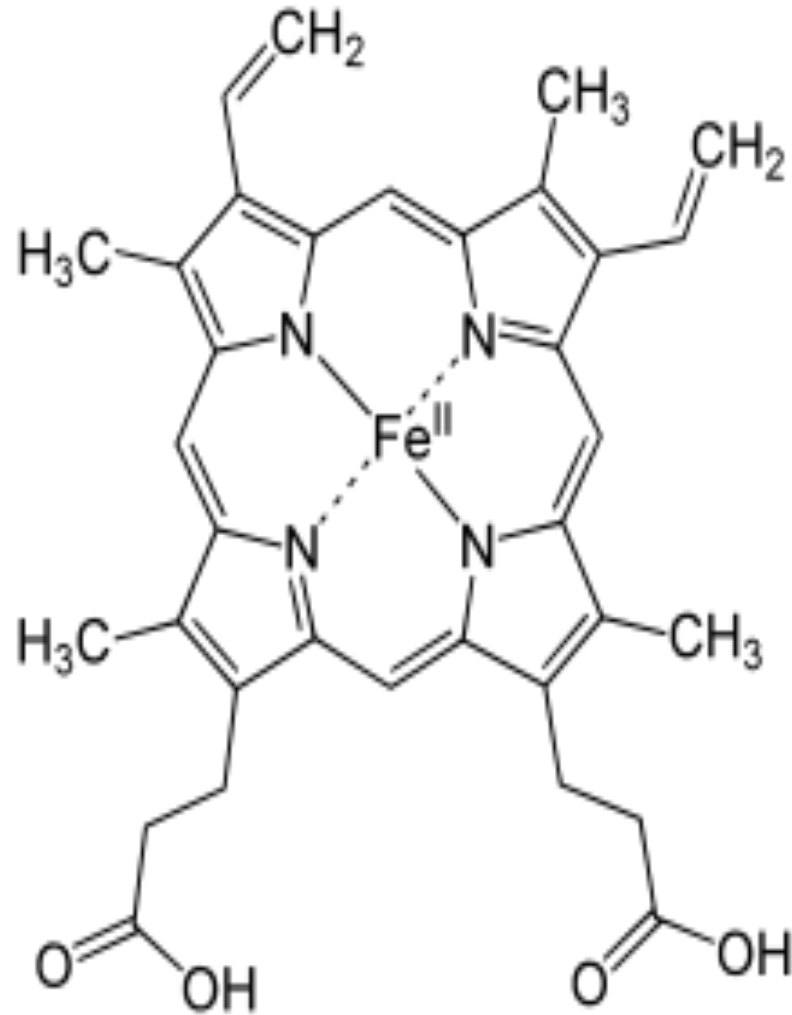
Emphysema

Shock

Polycythemia

Burns

Repeated transfusions



Bone marrow aplasia

iron deficiency

VIT B12

Bleeding

Metrorrhagia

liver diseases

Infections

Cooley's disease

Crohn's disease

Leukemia

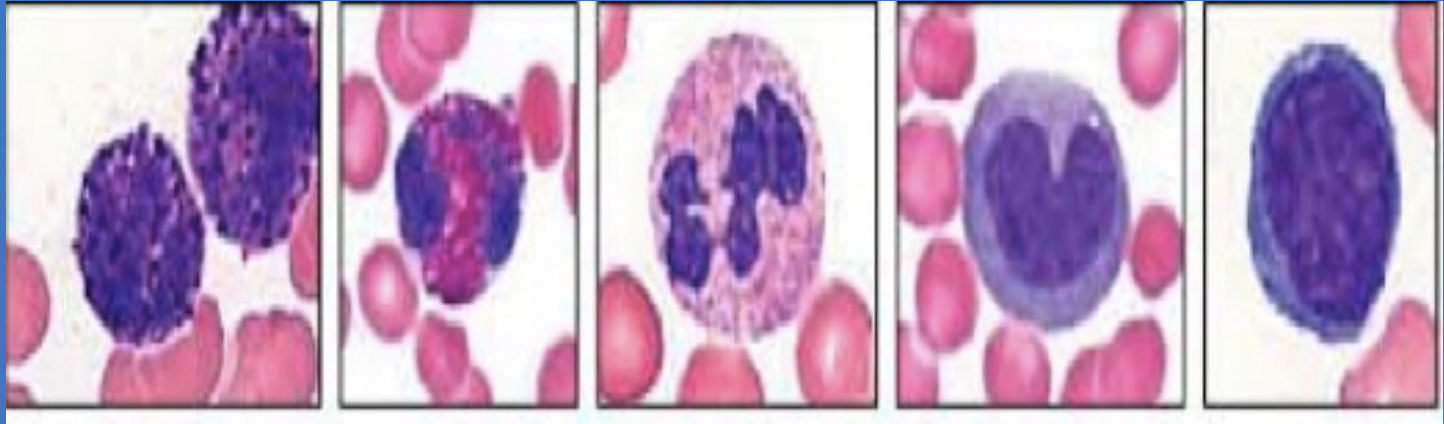
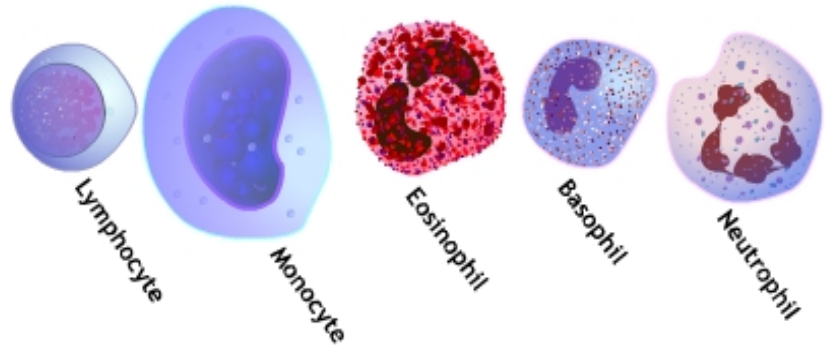
malignant tumors

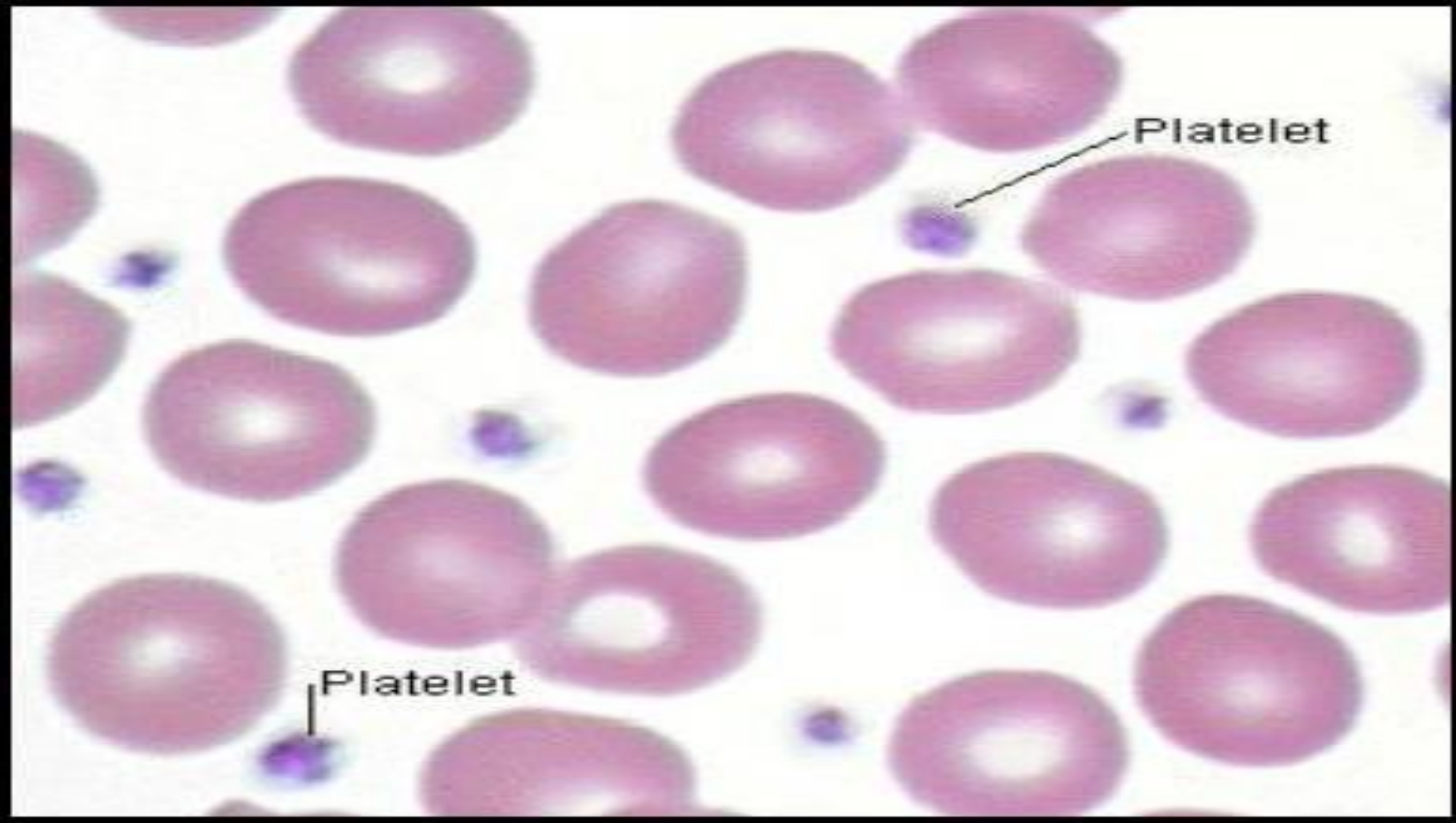
lymphomas

White Blood Cells

- White blood cells (WBCs) also called **leucocytes** are the cells of the immune system
- Are involved in protecting the body against both **infectious disease** and foreign invaders
- Are found throughout the body including the **blood and lymphatic system**
- Are produced and **derived from multipotent cells** in the bone marrow known as hematopoietic stem cells

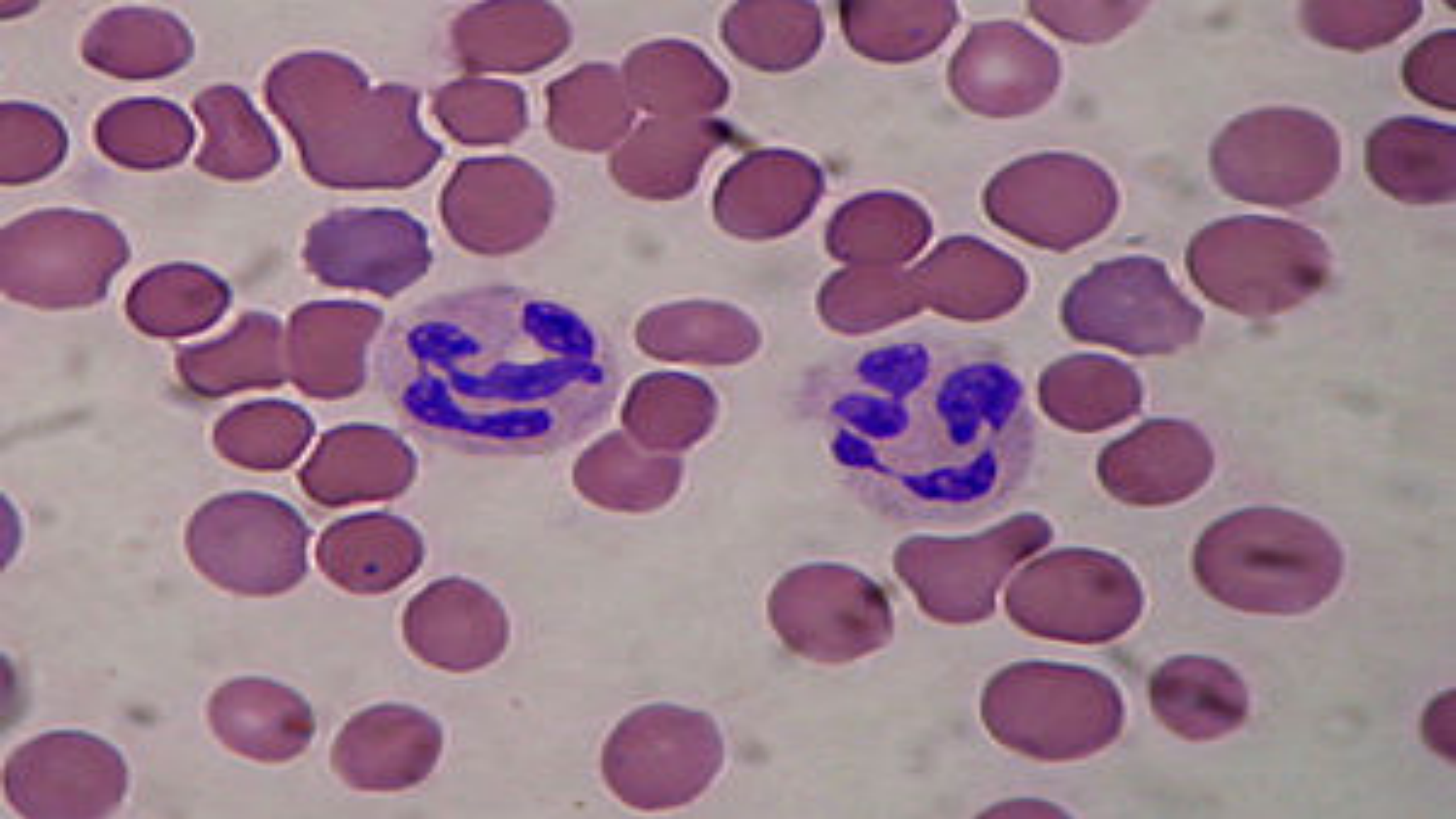
- **An increase** in the number of white blood cells in circulation is called **leukocytosis**
- This increase is most **commonly caused by inflammation**
- Leukocytosis **may affect** one or more cell lines and can be **neutrophilic, eosinophilic, basophilic, monocytosis, or lymphocytosis**

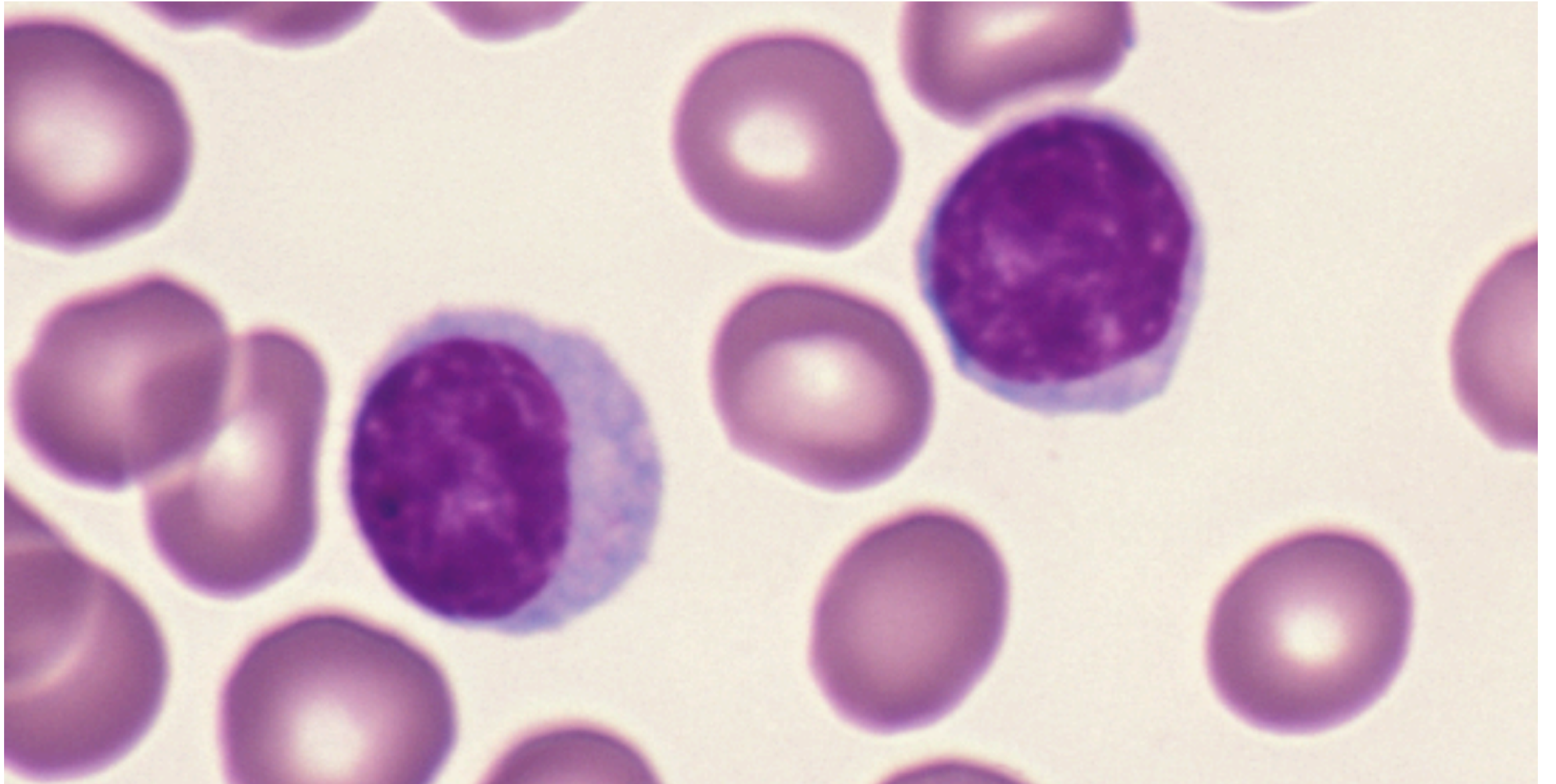


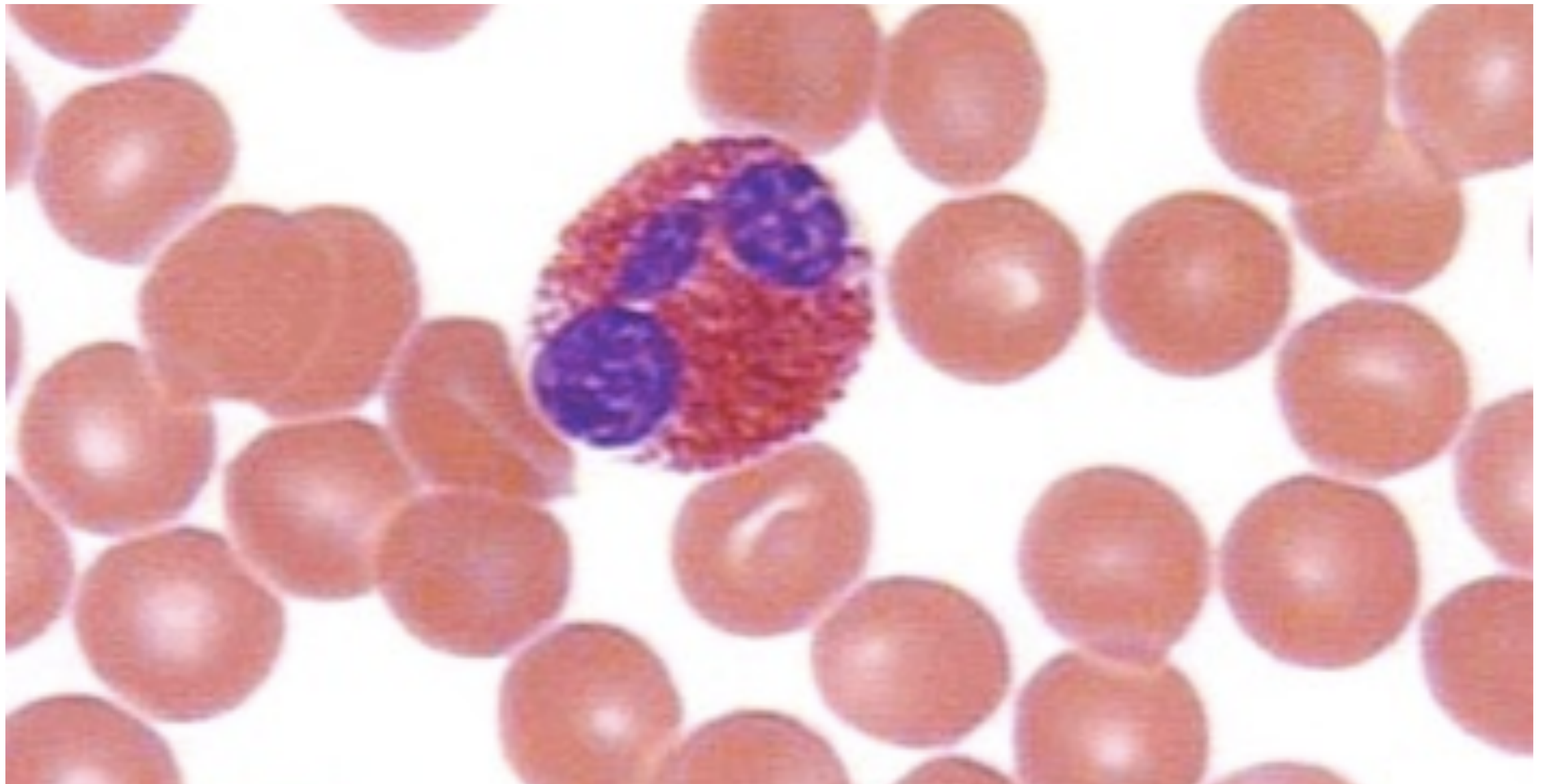


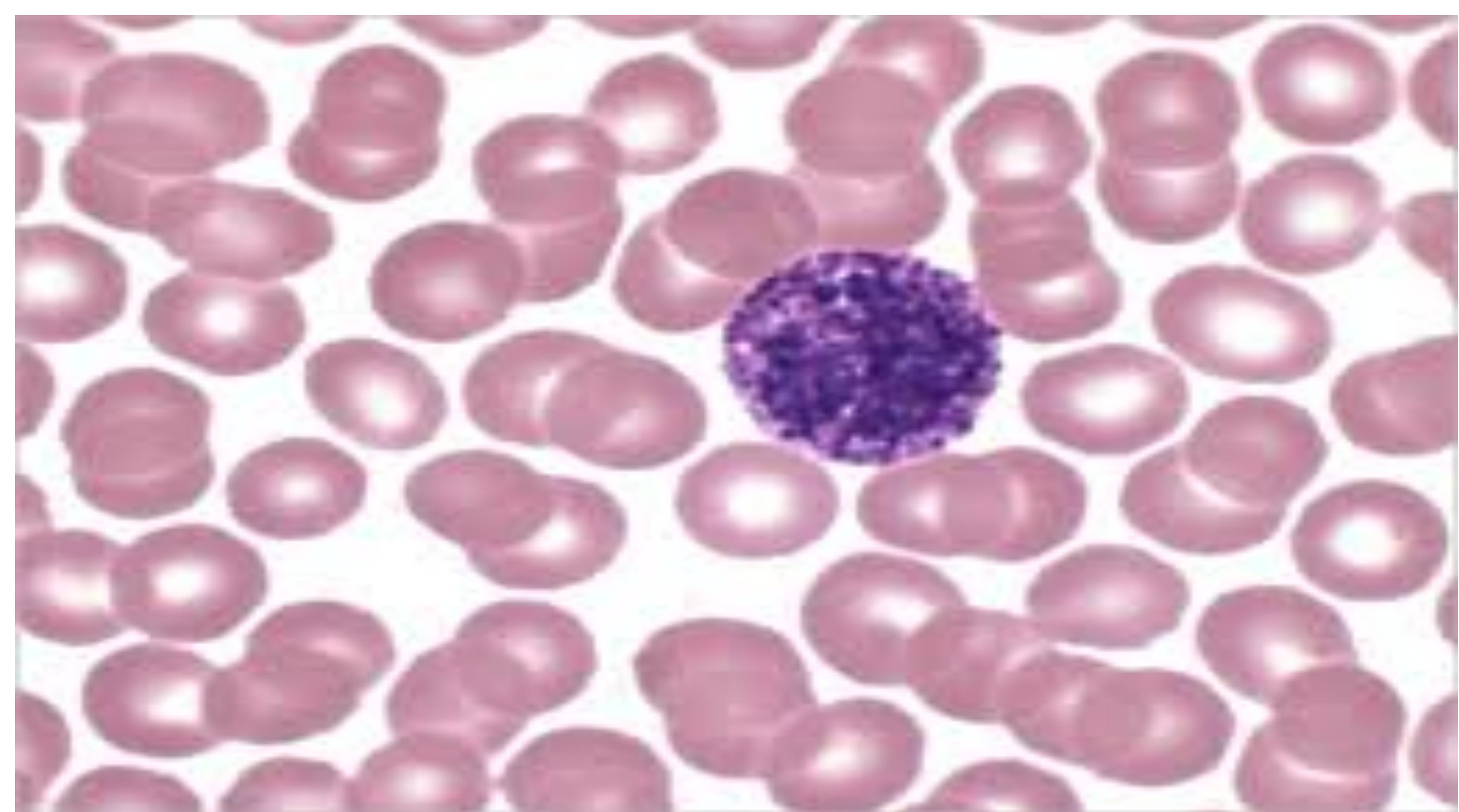
Platelet

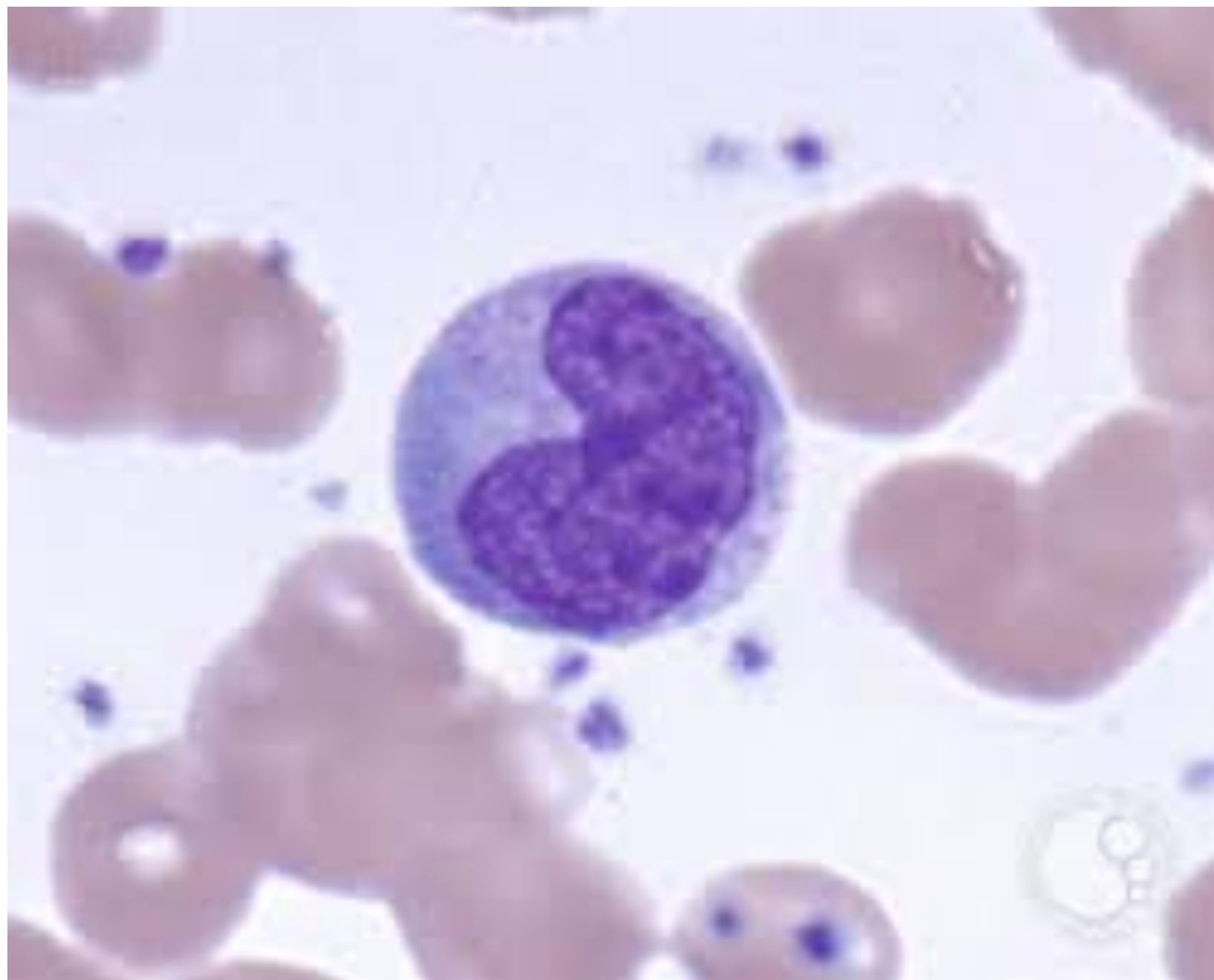
Platelet











Can a WBC count be performed on a sample other than blood?

WBC counts may be performed on many different types of body fluids.

A common reason that this is done is to more directly assess one area of the body that may be infected or inflamed.

For example, if meningitis is suspected, a WBC count may be performed on a sample of cerebrospinal fluid (CSF).

When is it ordered?

The test may be done when someone has general **signs and symptoms of an infection and/or inflammation such as:**

Fever

Chills

Body aches

Pain

Headache

A variety of other signs and symptoms, depending on the site of suspected infection or inflammation

The white blood cell count (WBC) is used as part of a complete blood count (CBC) to:

1-Screen for a wide range of diseases and conditions

2-Help diagnose an infection or inflammatory process

3-May be used to determine the presence of other diseases that affect WBCs such as allergies, leukemia or immune disorders

4-Monitor the body's response to various treatments and/or to monitor bone marrow function (radiotherapy and chemotherapy)

A high white blood cell count, called leukocytosis can result from conditions such as:

1-Infections, most commonly caused by bacteria and some viruses, less commonly by fungi or parasites

2-Inflammation or inflammatory conditions such as rheumatoid arthritis, vasculitis or inflammatory bowel disease

3-Leukemia, myeloproliferative neoplasms

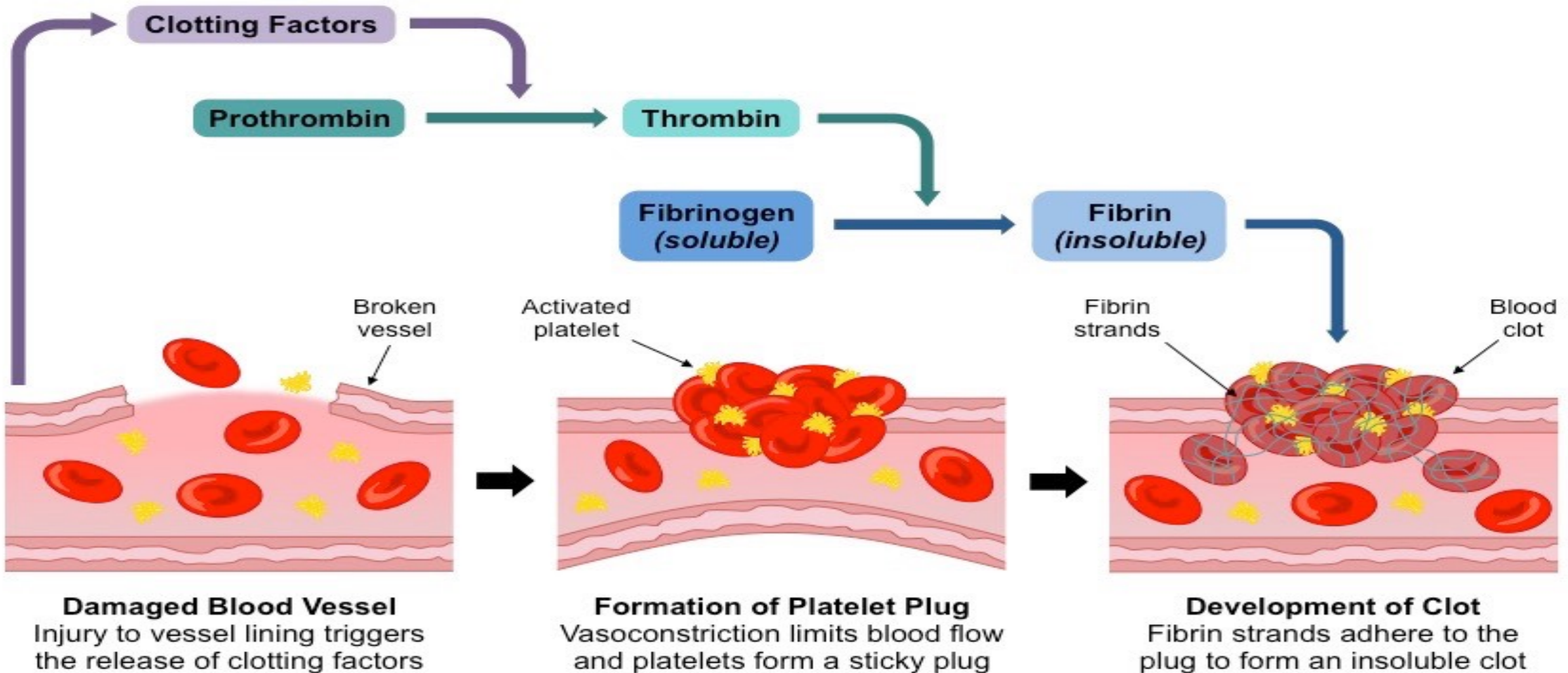
4-Conditions that result in tissue death (necrosis) such as trauma, burns, surgery or heart attack

5-Allergic responses (allergies, asthma)

Coagulation- key points

- Hemostasis requires the **interaction** of **platelets, coagulation** and **fibrinolytic factors, endothelium, proinflammatory and anti-inflammatory mediators** and **leukocytes**
- Clot formation is typically initiated by **vascular injury** in which a **platelet plug forms and is reinforced with fibrin**
- Clot formation is **balanced** by plasmin-mediated **fibrinolysis** and other **fibrin degradation products**

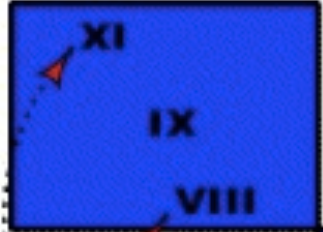
Coagulation



CLOTTING FACTORS AND RELATED COAGULATION TESTS

INTRINSIC SYSTEM

XII

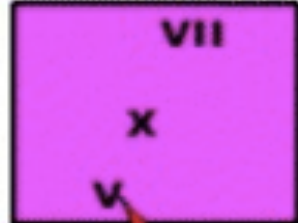


aPTT

Monitor
Heparin Therapy

EXTRINSIC SYSTEM

Tissue Factor +



PT

Monitor
Coumadin Therapy

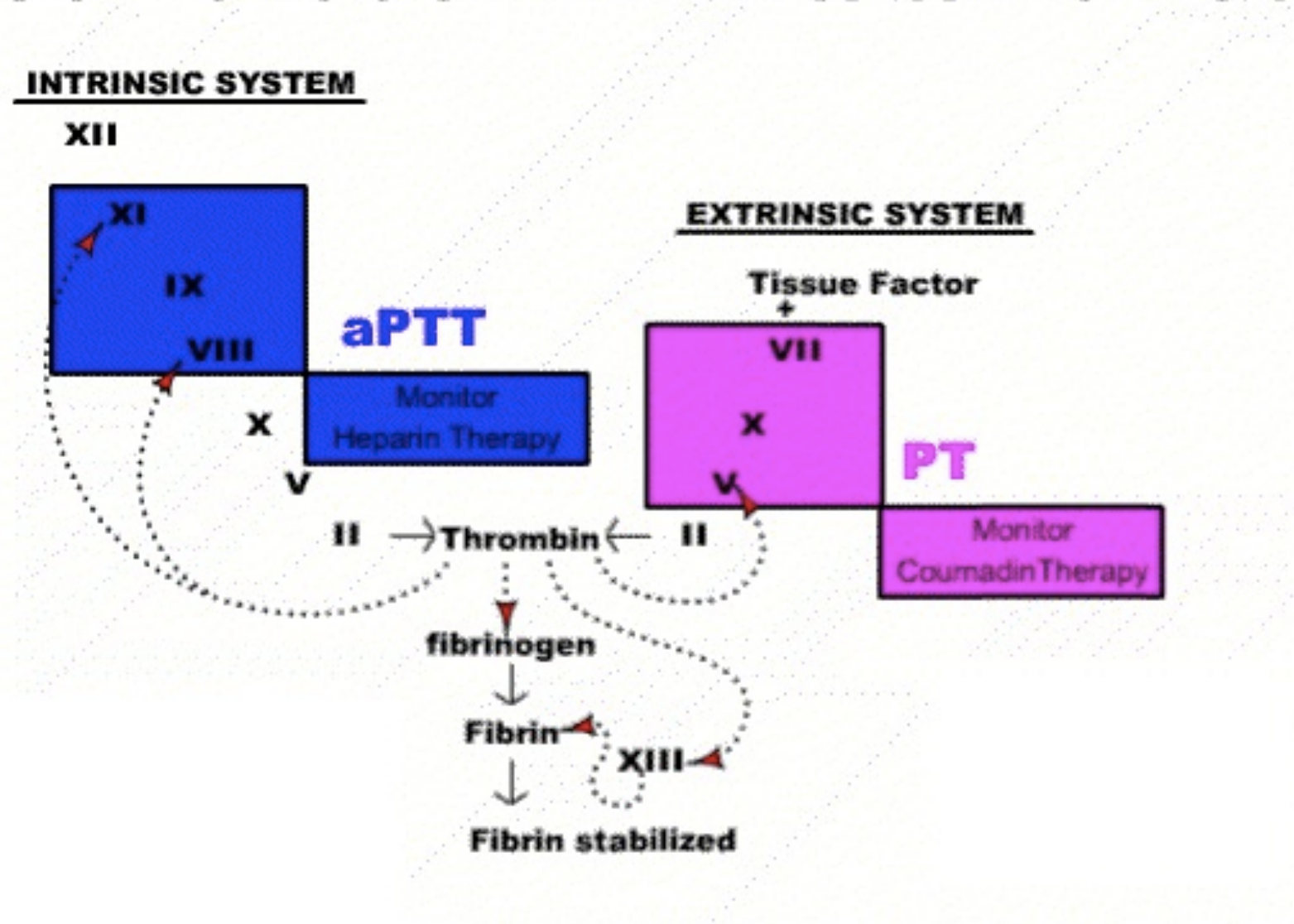
II → Thrombin ← II

fibrinogen

Fibrin

XIII

Fibrin stabilized



Coagulation disorder pattern	Platelet count	BMBT	APTT	PT	TT	FDP
Disseminated intravascular coagulation-CID	Decr	Incr	Incr	Incr	Incr	Incr
Thrombocytopenia	Decr	Incr	Norm	Norm	Norm	Norm
Von Willebrand's	Norm	Incr	Norm	Norm	Norm	Norm
Liver insufficiency (vK defic)	Norm	Norm	Incr	Incr	Norm	Norm
<ul style="list-style-type: none"> -Buccal mucosal bleeding time (BMBT) -Activated partial thromboplastin time (APTT) -Prothrombin time (PT) -Thrombin time (TT) -Fibrinogen degradation products (FDP) 						

International Normalized Ratio

- An INR of 1.0 means that the patient PT is normal.
- An INR greater than 1.0 means the clotting time is elevated.
- INR of greater than 5 or 5.5 = unacceptable high risk of bleeding, whereas if the INR=0.5 then there is a high chance of having a clot.
- Normal range for a healthy person is 0.9–1.3, and for people on warfarin therapy, 2.0–3.0, although the target INR may be higher in particular situations, such as for those with a mechanical heart valve.