



Hemato-lymphoid system

Practical Part

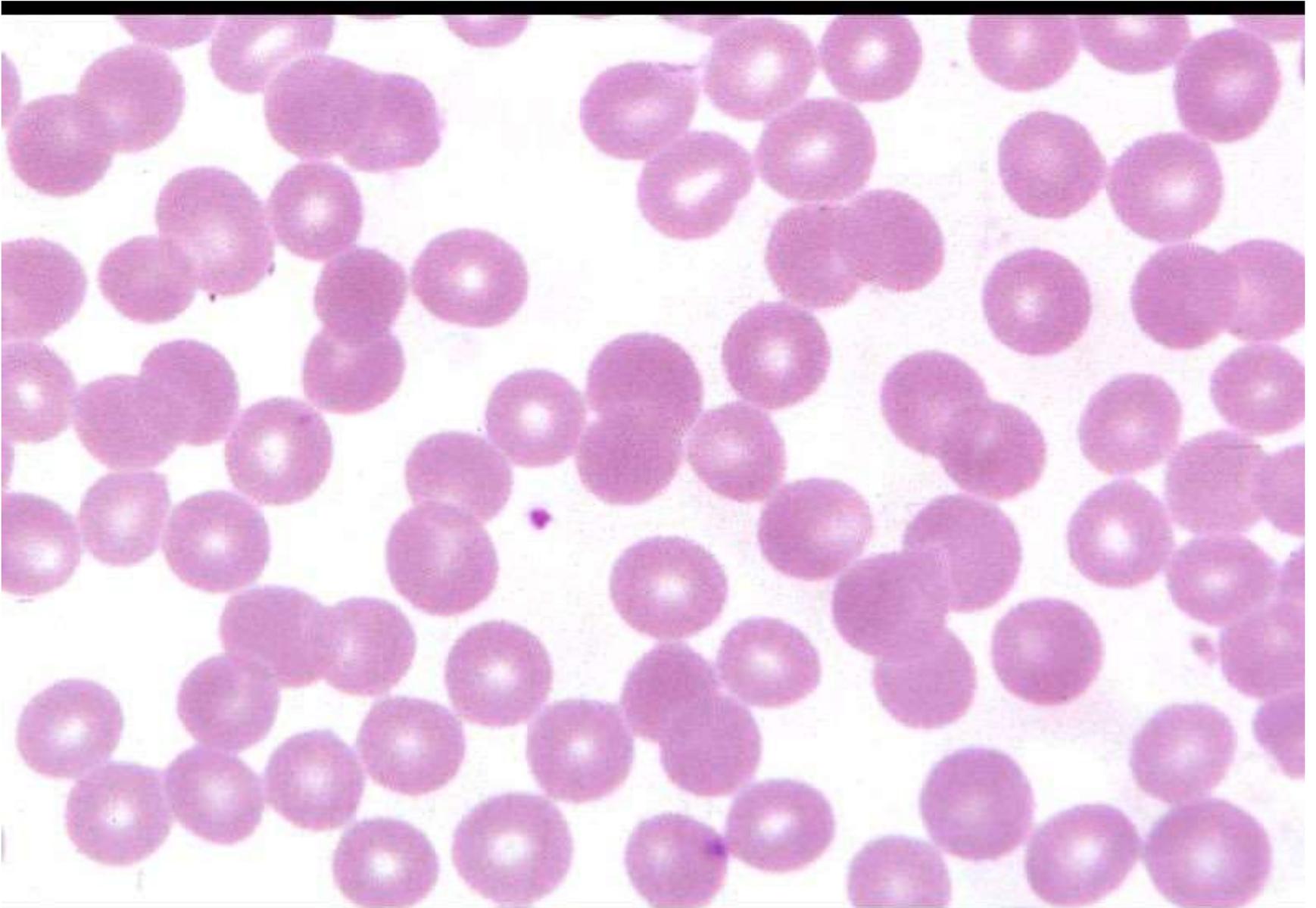
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Blood

Erythrocytes



1) This is a blood film (smear) showing erythrocytes , as you can see these cells are **rounded** with **acidophilic cytoplasm** , the center area is likely stained (pale) because of the shape of these cells (**biconcave shape**) .

So at center there is **less amount of hemoglobin** —————→ **less acidophilic** .

This center area **occupies 1/3 of the cell volume (1/3 of its diameter)** and this the normal erythrocytes (**normochromic erythrocytes**) .

2) If you take a blood film and you see **rounded** red blood cells but **without center pale area** this indicates that these cells are **spherical in shape (Spherocytes)** , and these cells contain **more hemoglobin than normal** in relation to the cell volume so we call them (**hyperchromic erythrocytes**)

3) If you take a blood film and you see that the cells **have pale area in the center but this area is enlarged** "more than 1/3 of cell volume" , we call these cells (**hypochromic erythrocytes**) **because they have lesser amount of hemoglobin** .

- We have abnormal shapes of erythrocytes like (sickle cells , poikilocytes "tear drop shape" , ovalocytes) and we call the condition that we have abnormal shapes of RBCs (Poikilocytosis) .

1) The **normal size** of RBCs is **between 6-9 μm** in diameter \longrightarrow **Normocytic erythrocytes**

2) If you take blood film and see all erythrocytes are **smaller than 6 μm** \longrightarrow **Microcytic erythrocytes**

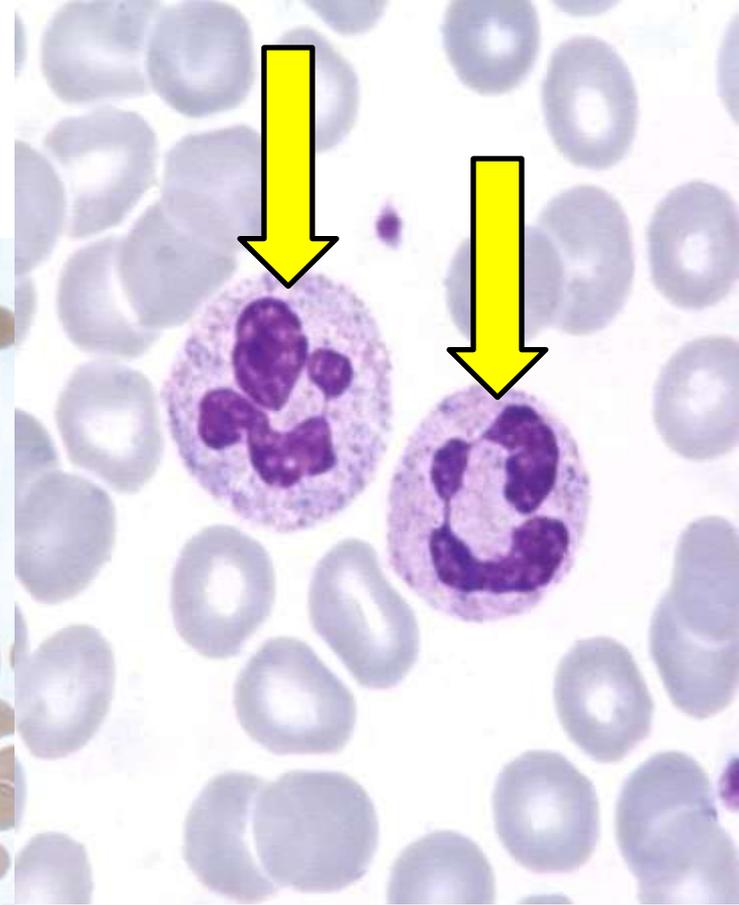
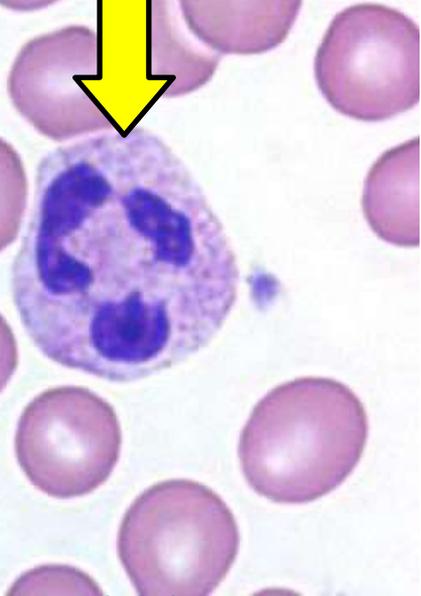
3) If you take blood film and see all erythrocytes are **more than 9 μm** \longrightarrow **Macrocytic erythrocytes**

4) If you take blood film and see **different sizes of erythrocytes** \longrightarrow **Anisocytosis**

* Anisocytosis : different sizes of RBCs

* Poikilocytosis : abnormal shapes of RBCs .

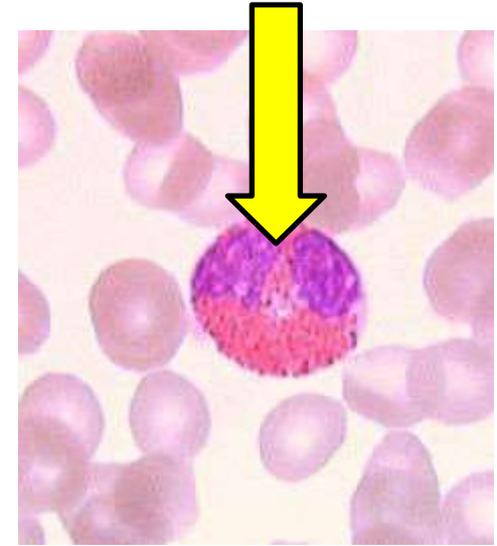
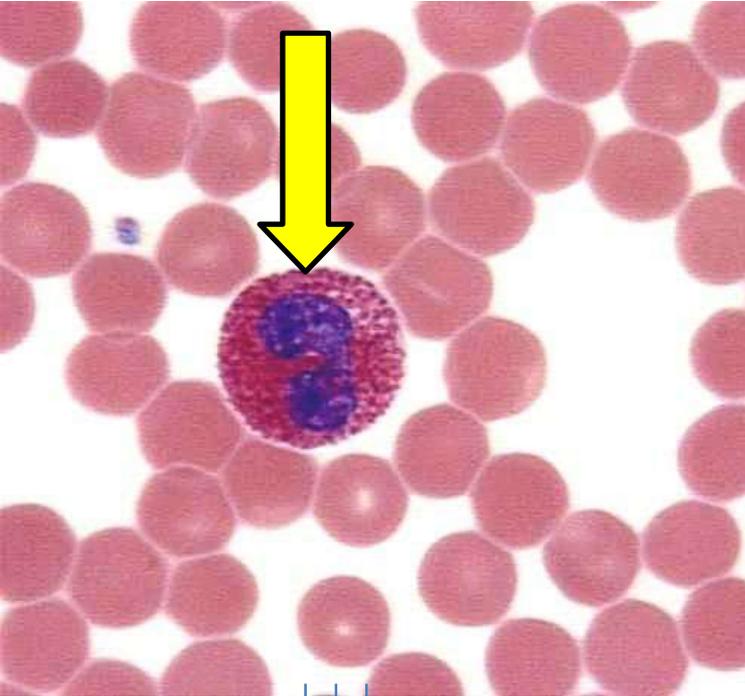
Neutrophils



This shows a neutrophil in a blood smear. The neutrophils are 12-14 μm diameter, and so **look bigger than the surrounding red blood cells**. There is a **single nucleus**, which is **multilobed**, and can have **between 2 and 5 lobes**, and cytoplasm contains tiny small granules that stained light pink or light purple

- These cells are **the most common type of WBCs in peripheral blood**.
- Mainly they identified by their multilobed nucleus.
- Neutrophils are **the first WBCs to leave the bloodstream and enter the connective tissue in large numbers**.
- They involved in **acute infections and acute inflammation (especially during bacterial infections)**.

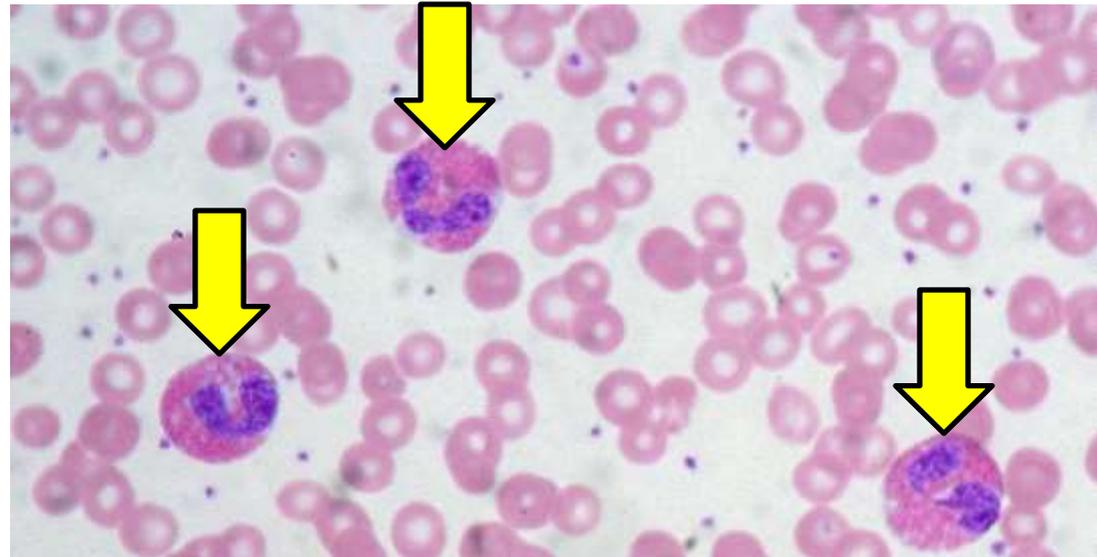
Eosinophils



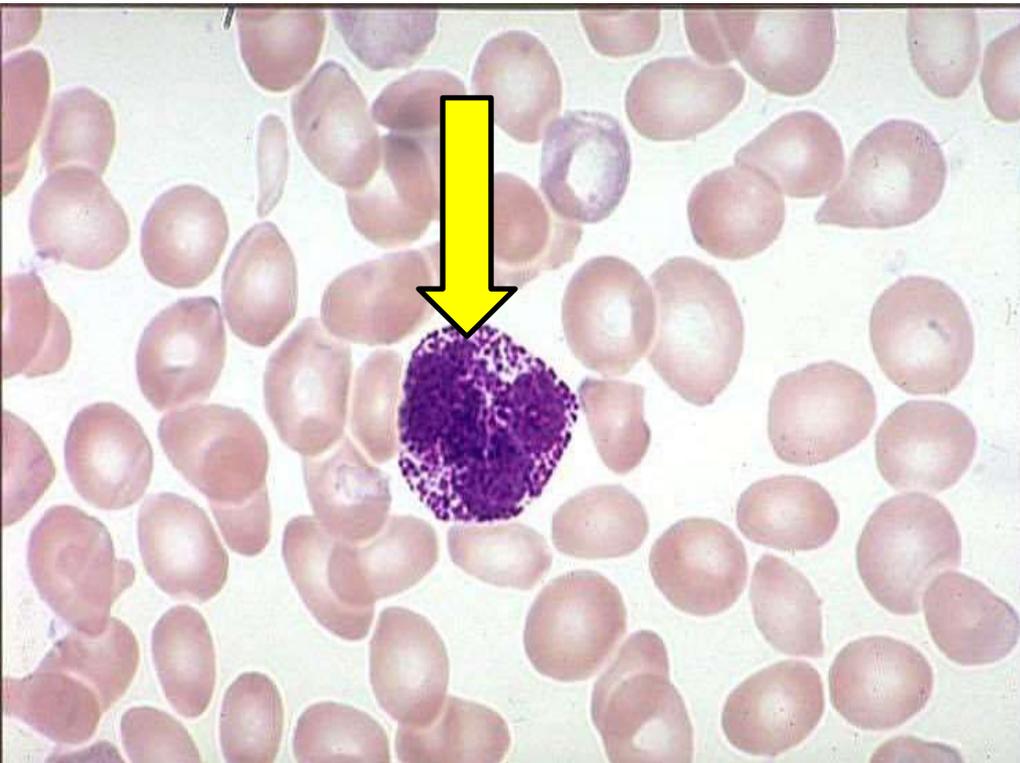
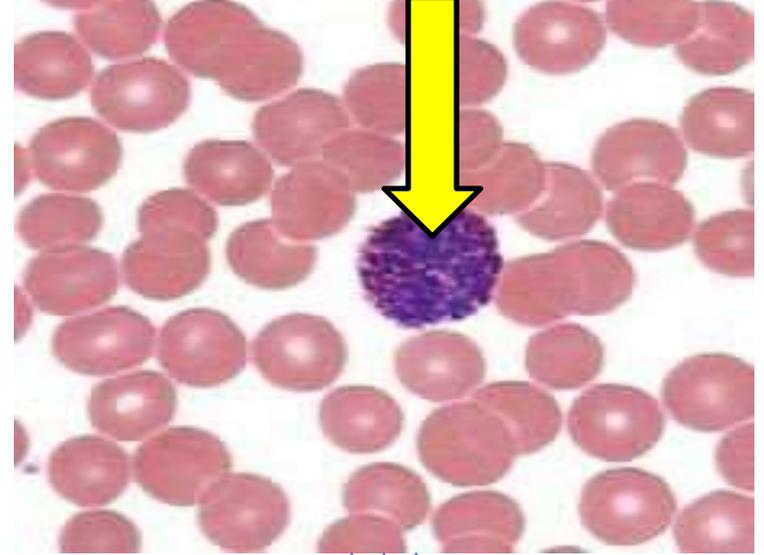
This shows an eosinophil in a blood smear. You can see that eosinophil has **a bilobed nucleus**.

These cells have **large acidophilic specific granules** - these stain **bright red, or reddish-purple**.

They involved in **parasitic infections** .



Basophils



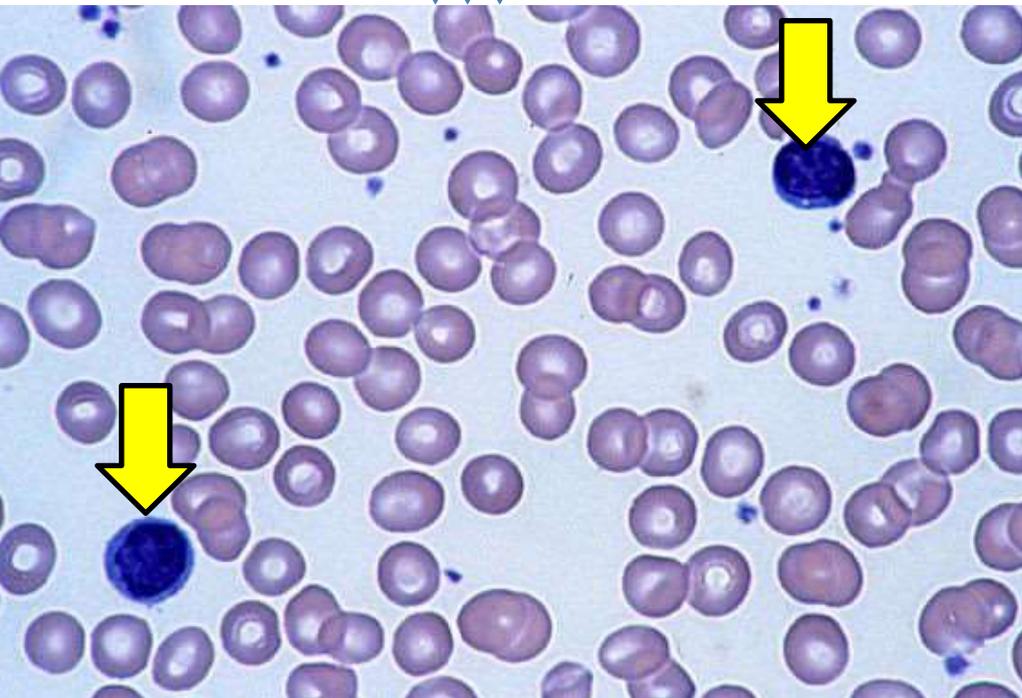
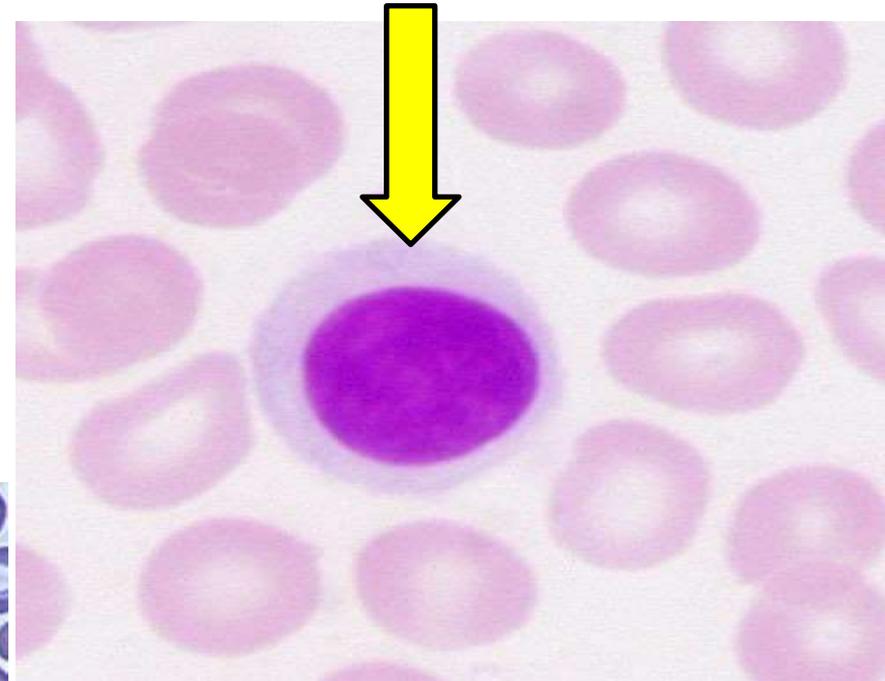
This shows a basophil in a blood smear . The basophil contains **lots of deep blue staining granules (basic)** and a **bilobed irregular nucleus (S shape)** , that is often difficult to see .

Mainly involved in **allergic reactions** .

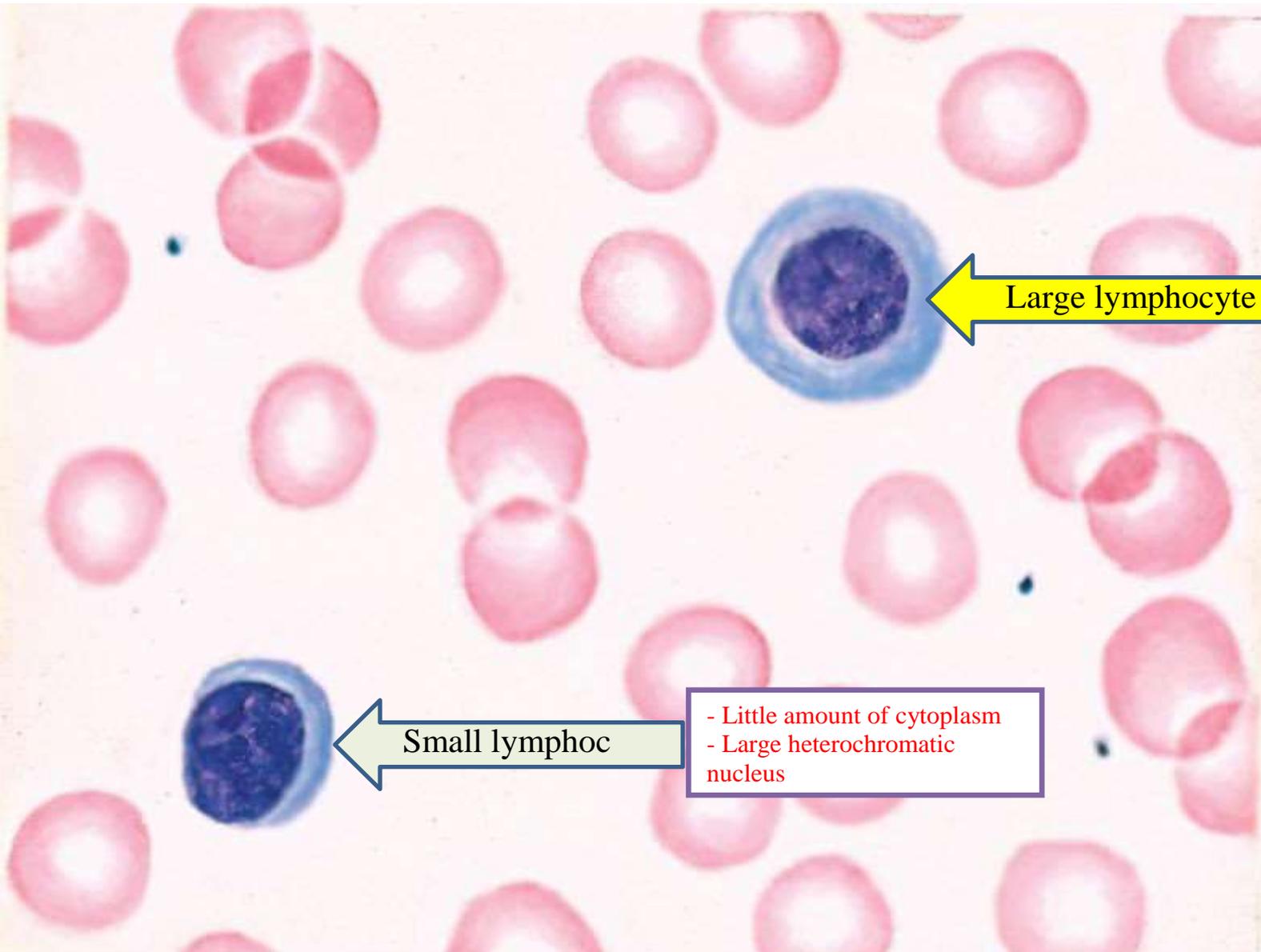
This shows lymphocytes in a blood smear. Most of the lymphocytes are **small**; a bit bigger than red blood cells, at about 6-9 μ m in diameter. Lymphocyte has a **small spherical nucleus with dark staining condensed chromatin**. **Not much cytoplasm can be seen, and it is basophilic (pale blue/purple staining).**

Under the light microscope, we **can NOT** differentiate between the B and T lymphocytes "same morphology"

Lymphocytes



The rest of lymphocytes (around 10%) are larger. These **larger cells have more cytoplasm and more euchromatic nucleus. Larger lymphocytes are commonly activated lymphocytes**



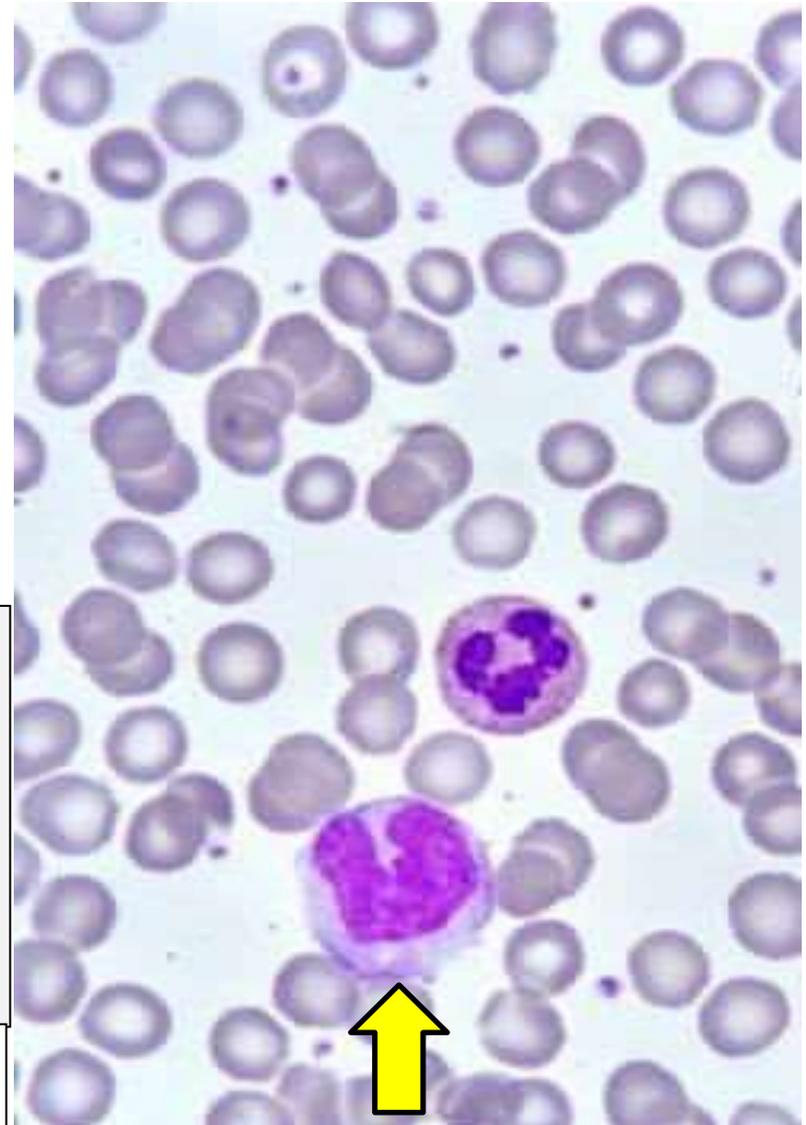
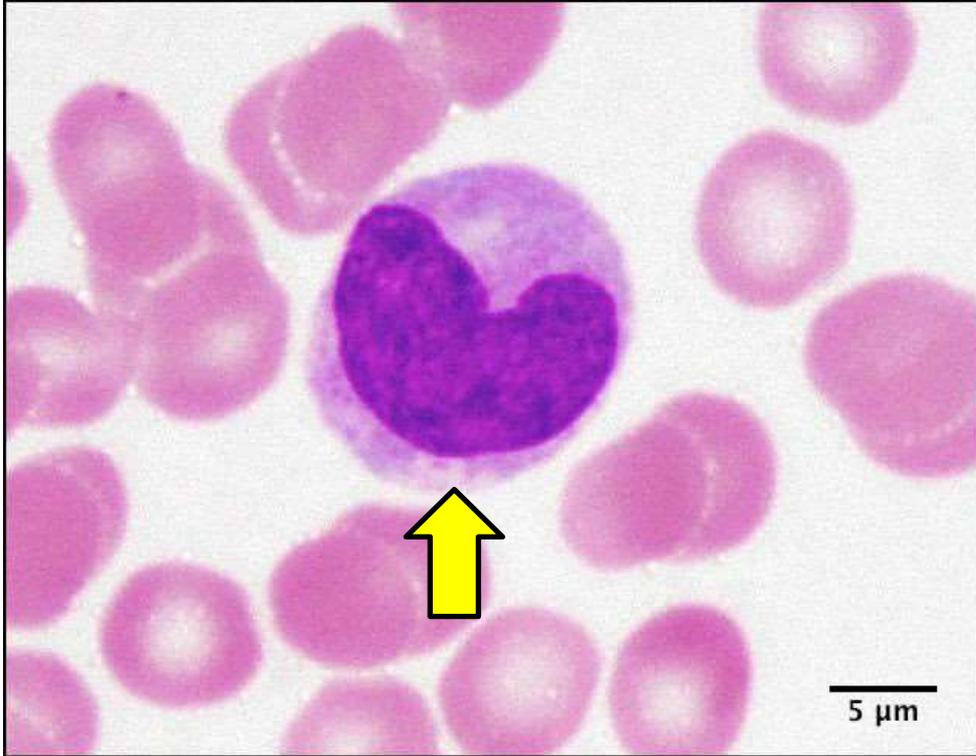
Large lymphocyte

- Large amount of cytoplasm
- more euchromatic nucleus

Small lymphoc

- Little amount of cytoplasm
- Large heterochromatic nucleus

Monocytes



This shows a monocyte in a blood smear. **Monocytes are the largest type of white blood cells**, and can be up to 20μm in diameter. They **have a large eccentrically placed nucleus, which is C or kidney bean shaped**. They have **abundant cytoplasm, and some fine purple granules in cytoplasm (frosted glass appearance)**.

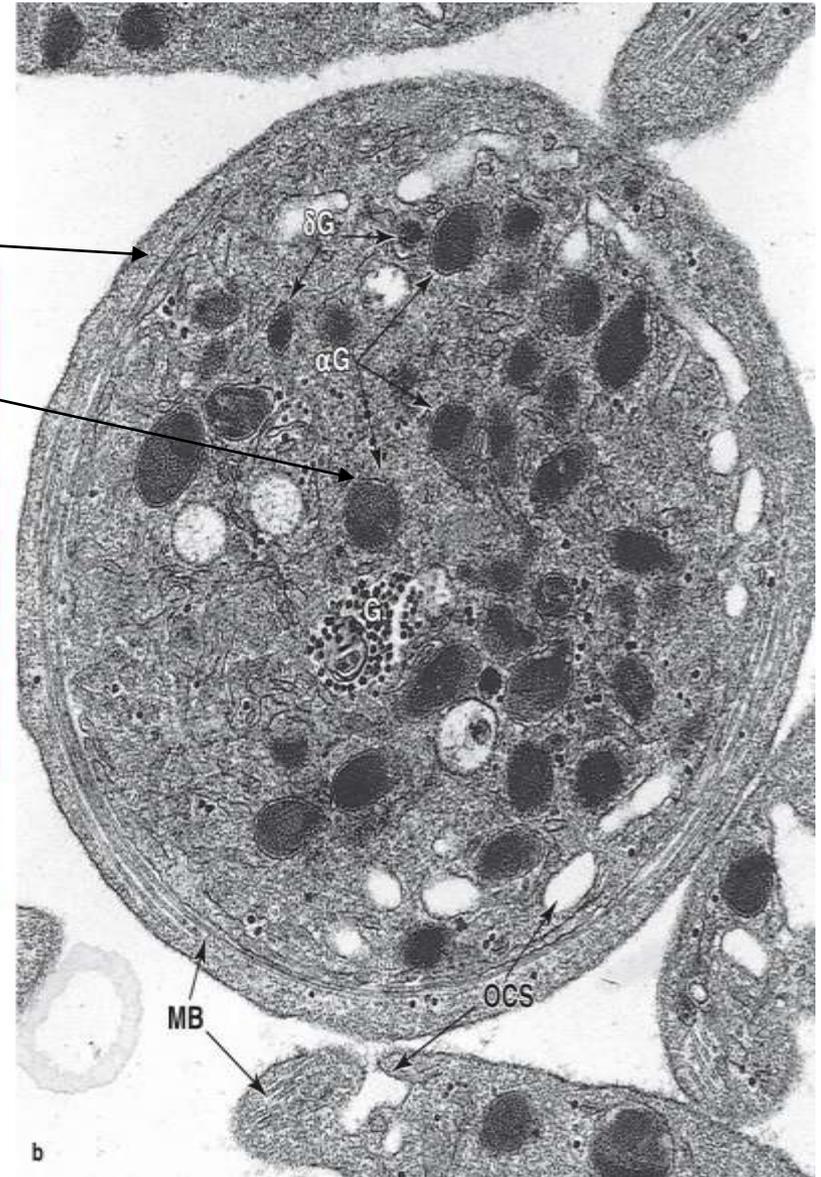
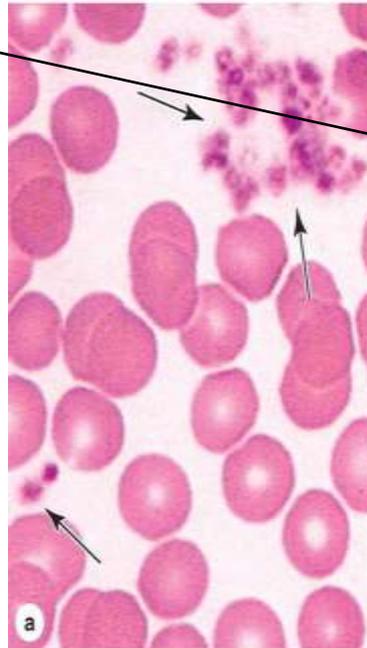
During infection, these cells are the last cells to leave the blood stream and enter connective tissue and become macrophage that phagocytose (the dead cells, the dead bacteria and Ag-Ab complex)

Platelets

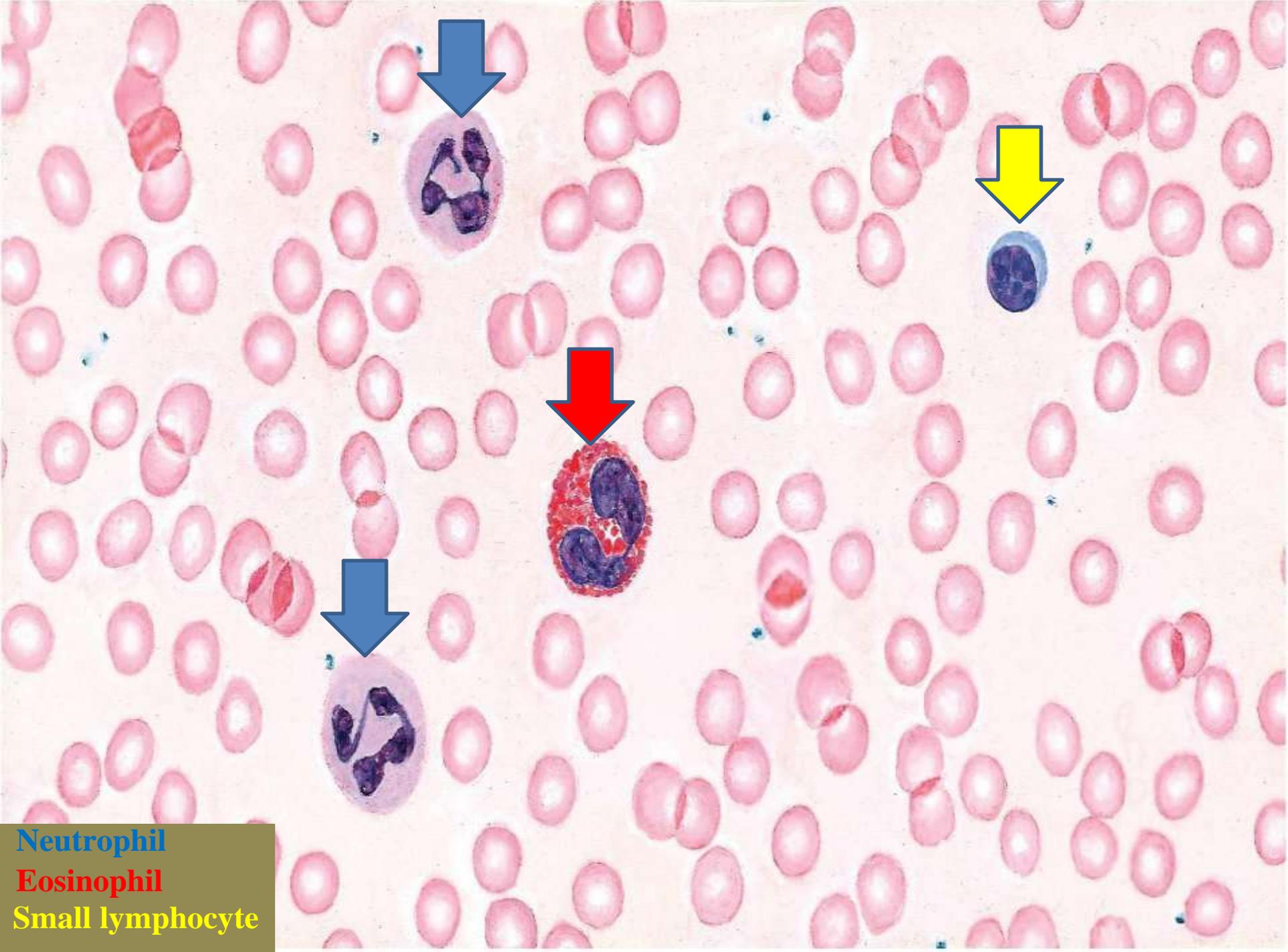
Under LM : They appear in **clumps** because they have **thick glycocalyx** , this facilitate their **aggregation** .

Under EM : They divided into 2 zones :

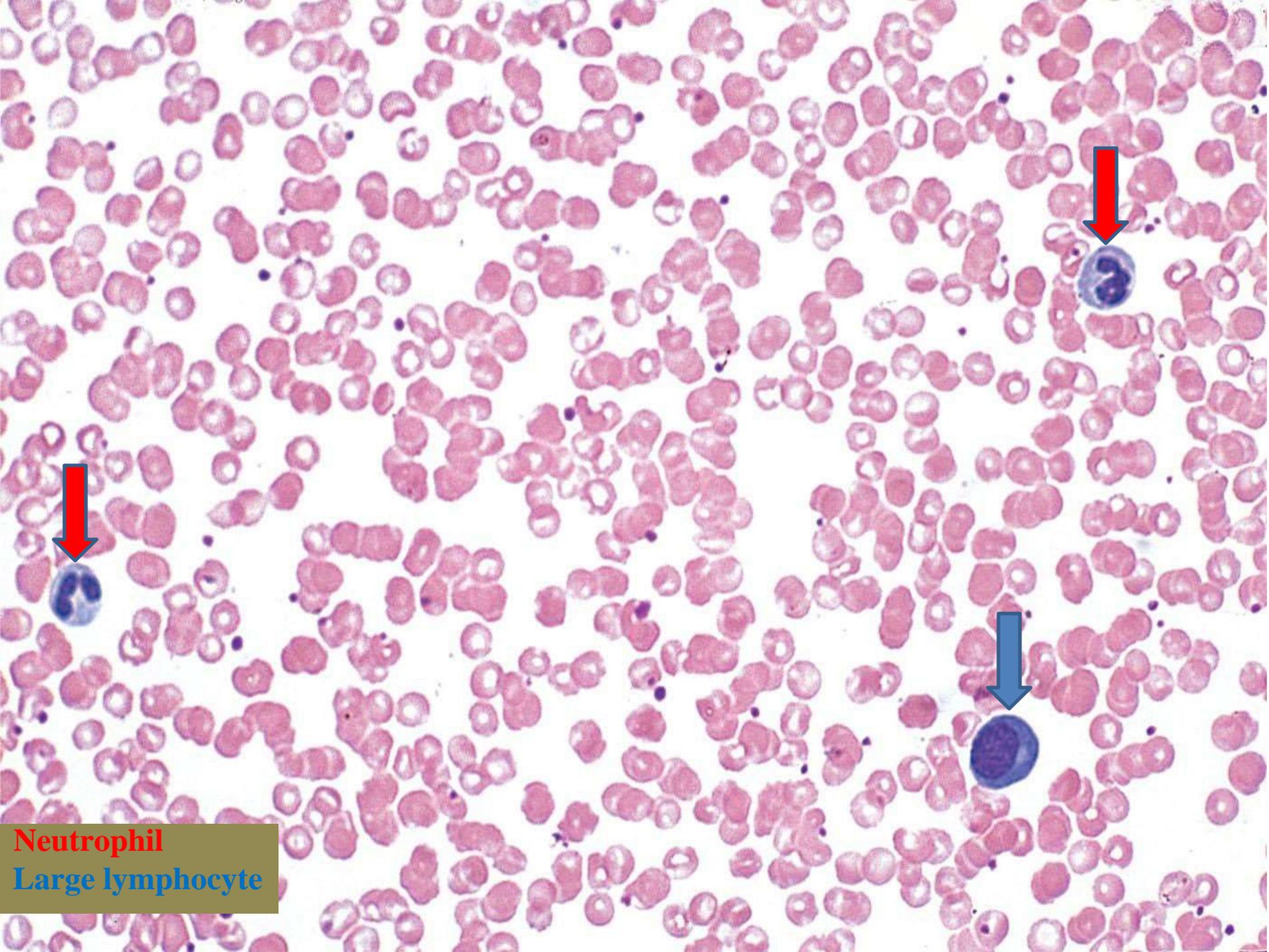
- Outer zone (hyalomere) : contain microtubules + microfilaments
- Inner zone (granulomere) : contain lots of granules . we have many types of granules and they contain mediators involved in blood clot formation .



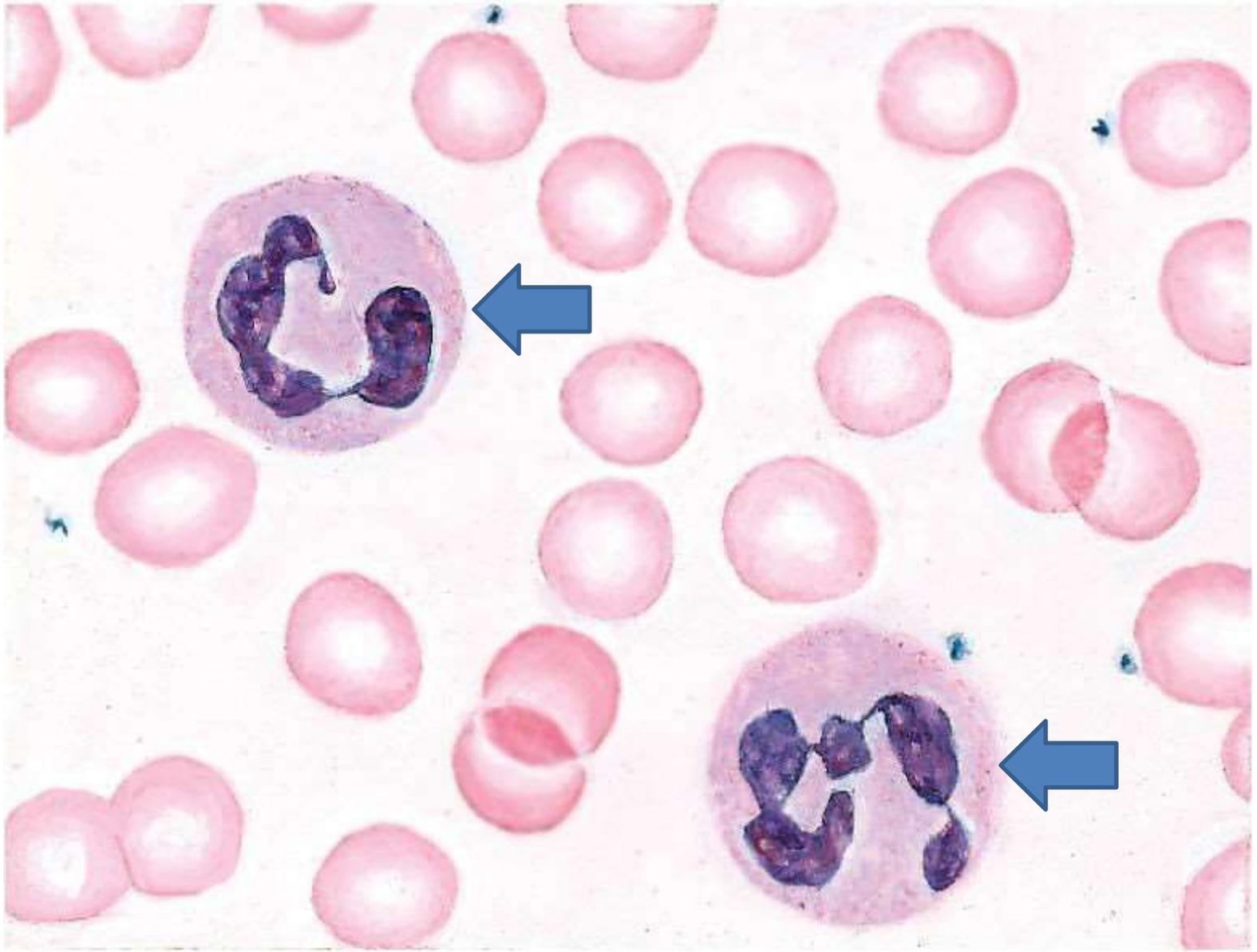
Identify



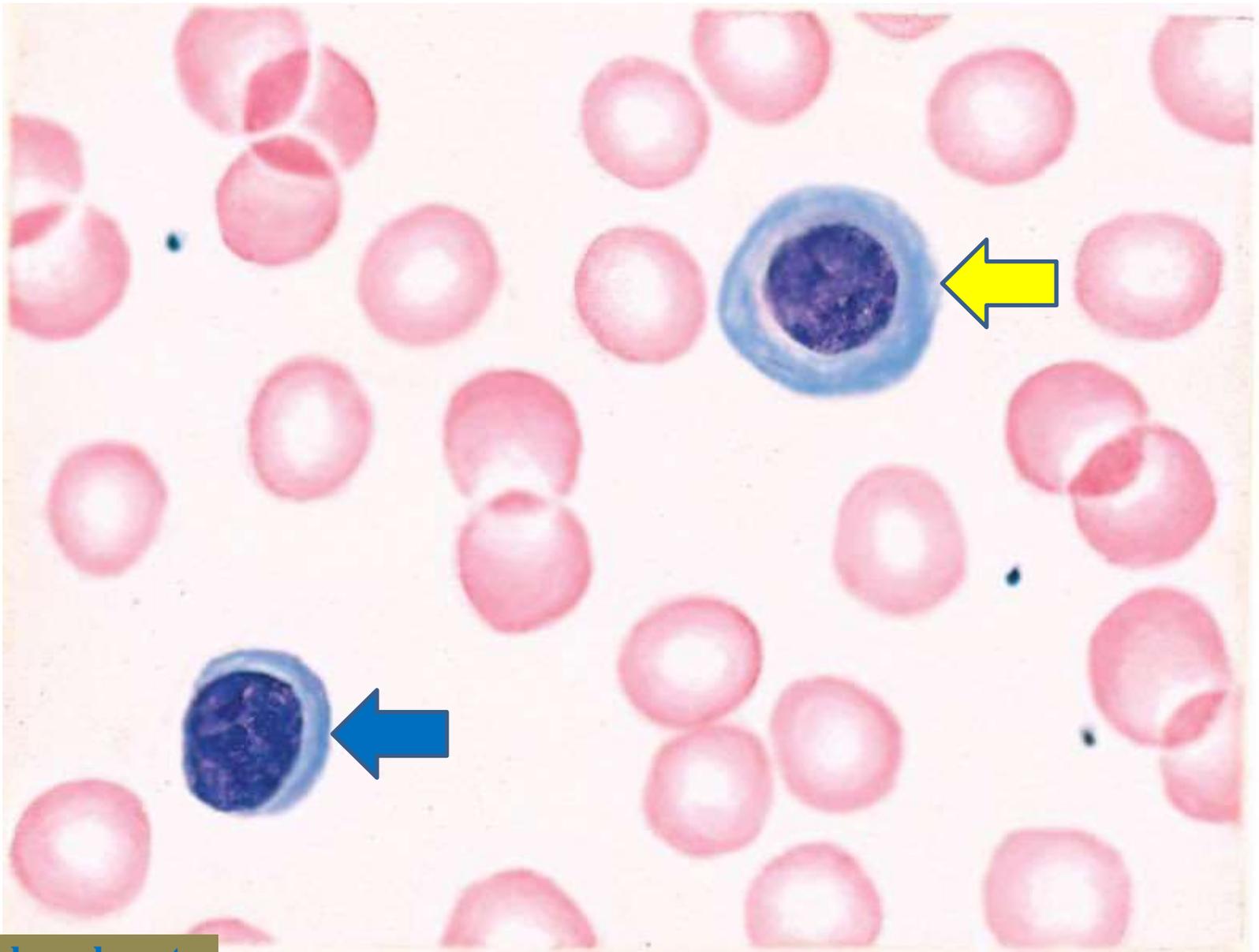
Neutrophil
Eosinophil
Small lymphocyte



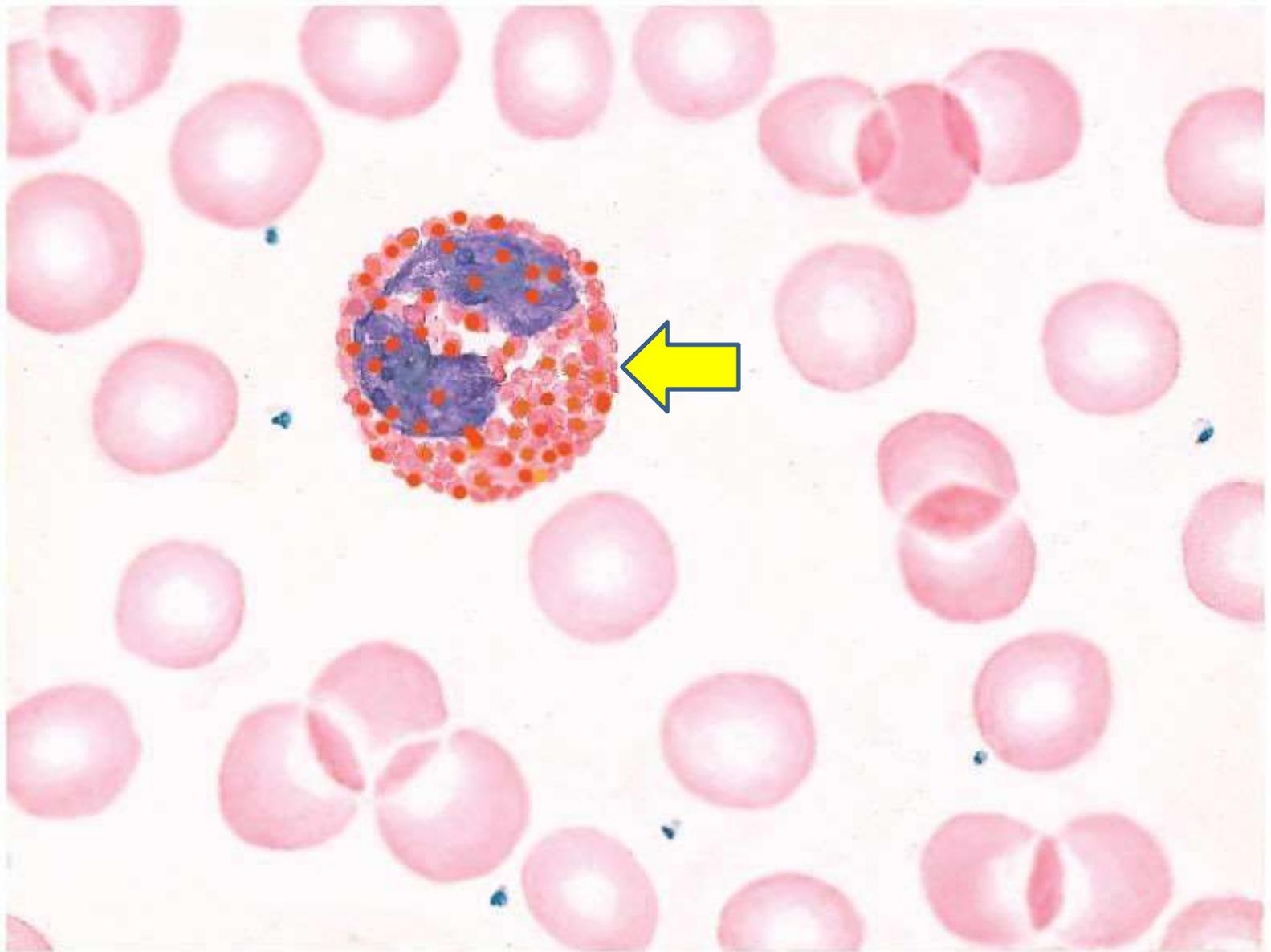
Neutrophil
Large lymphocyte



Neutrophil

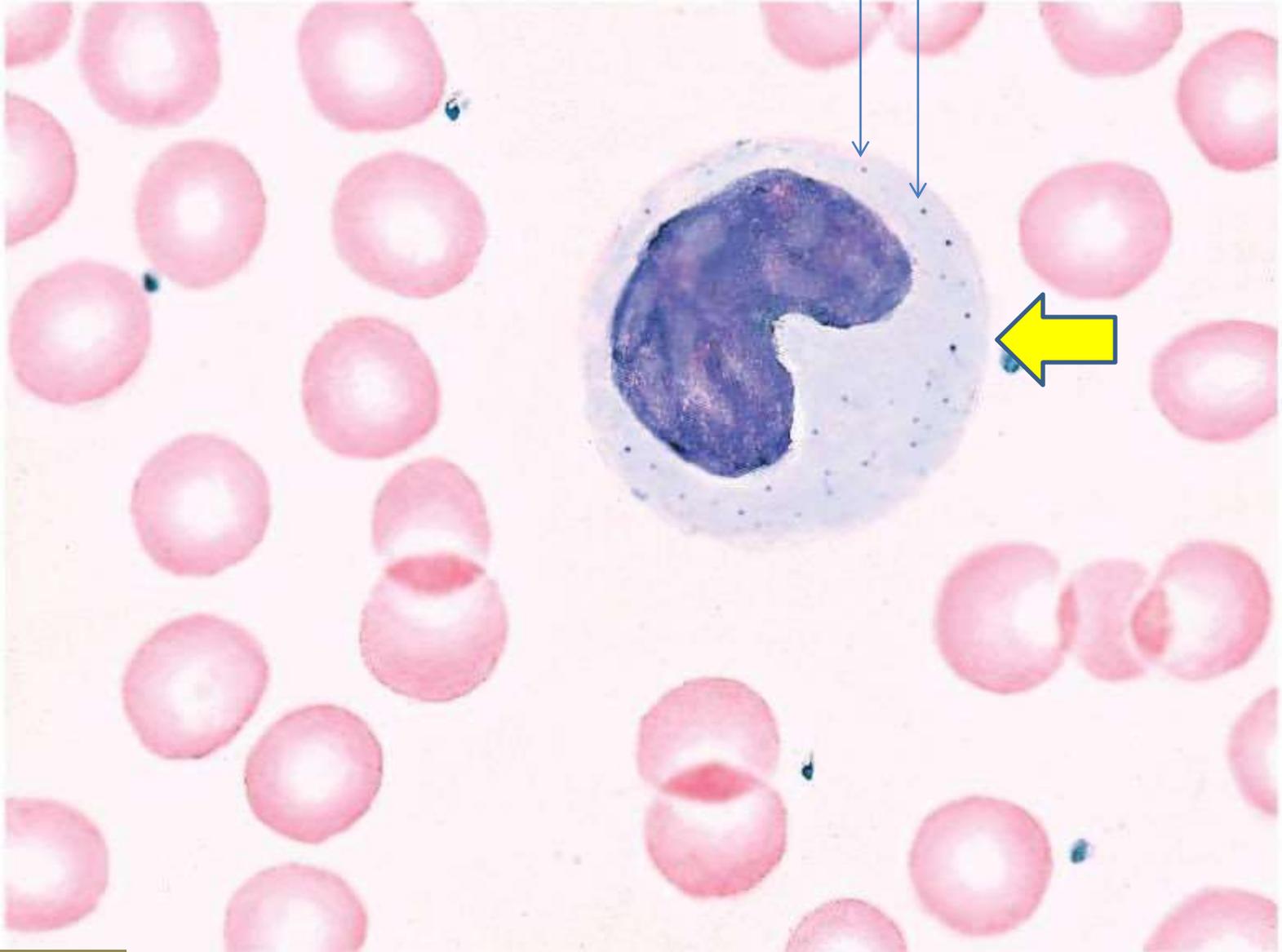


Small lymphocyte
Large lymphocyte

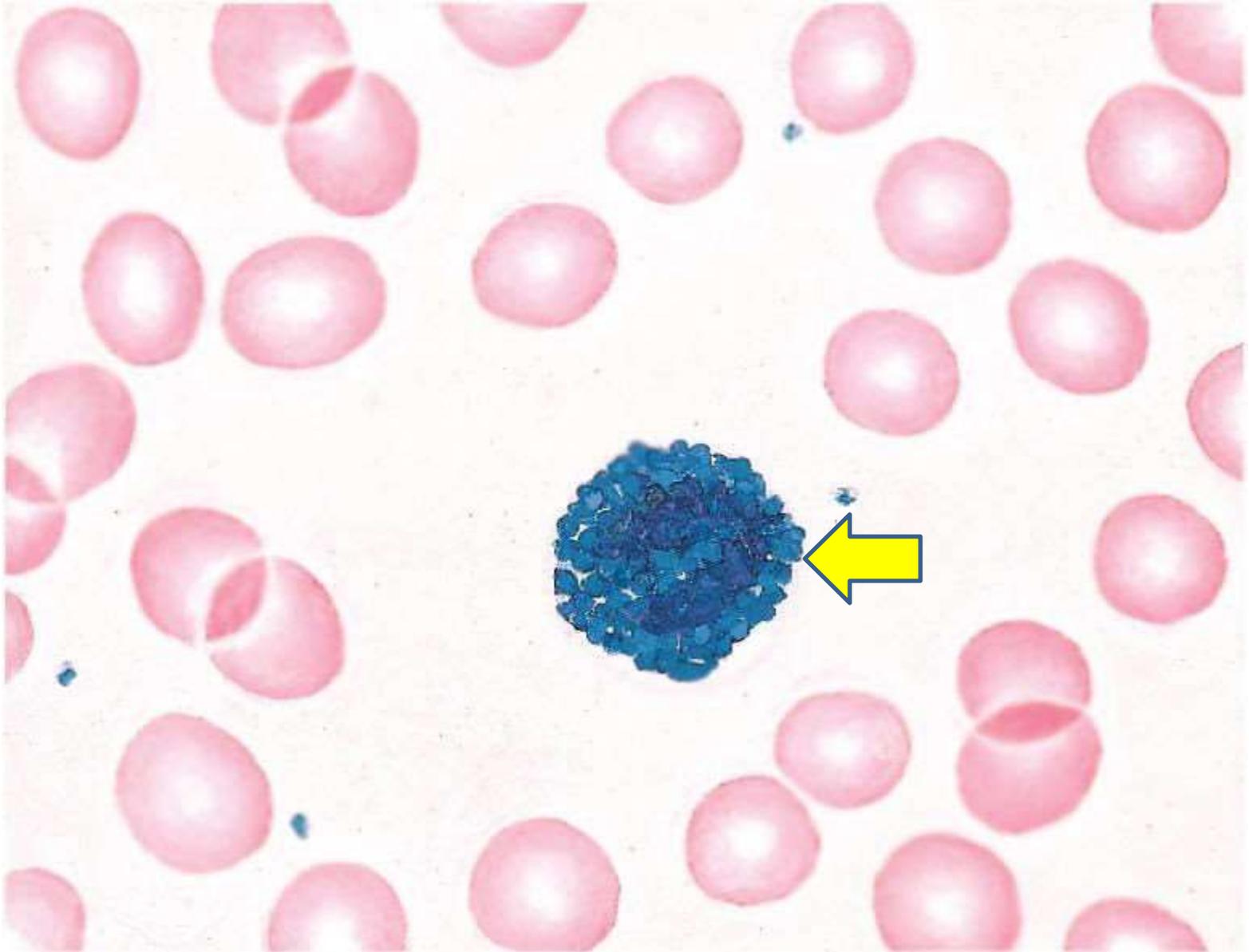


Eosinophil

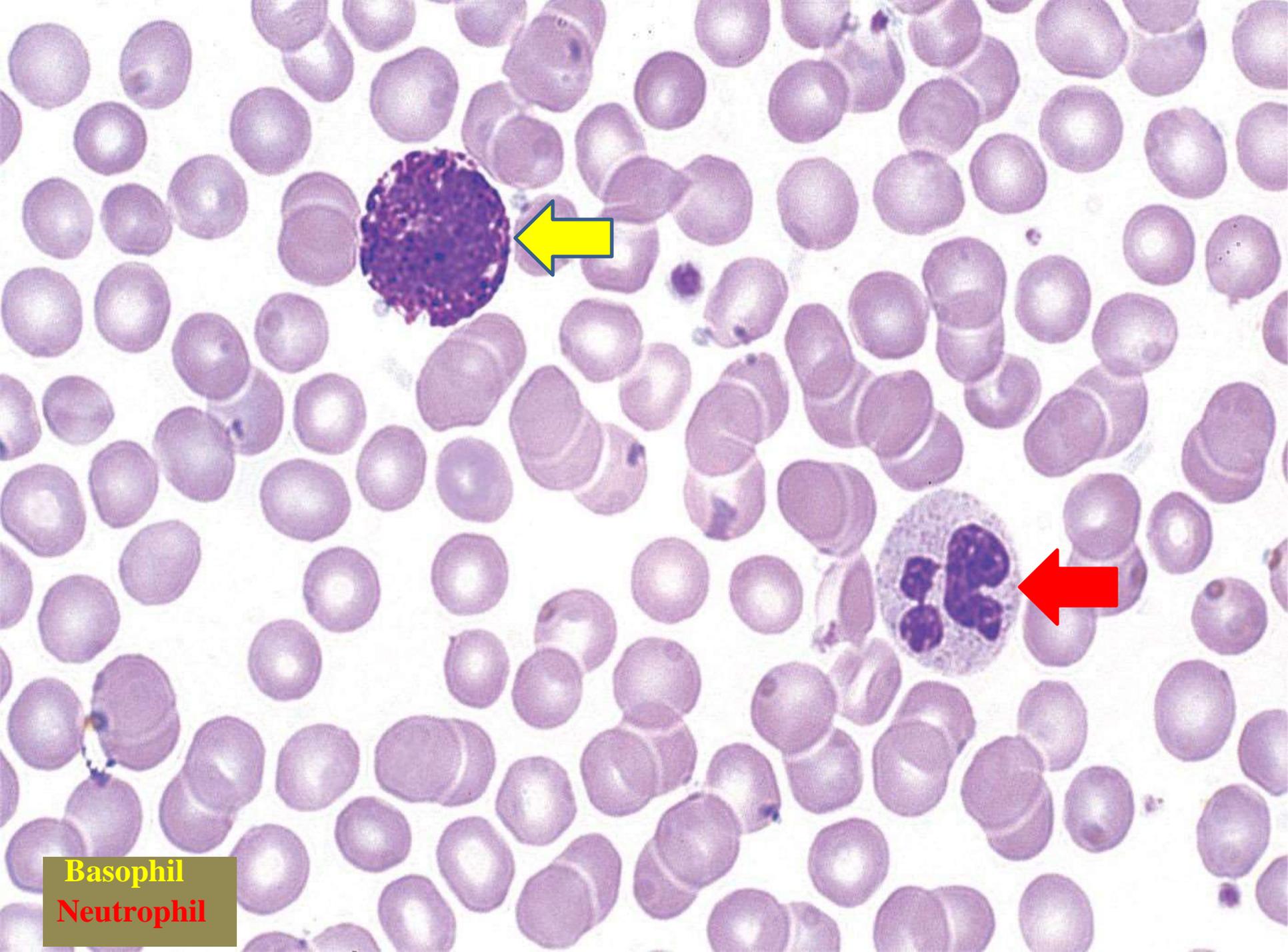
These are azurophilic non specific granules not specific granules



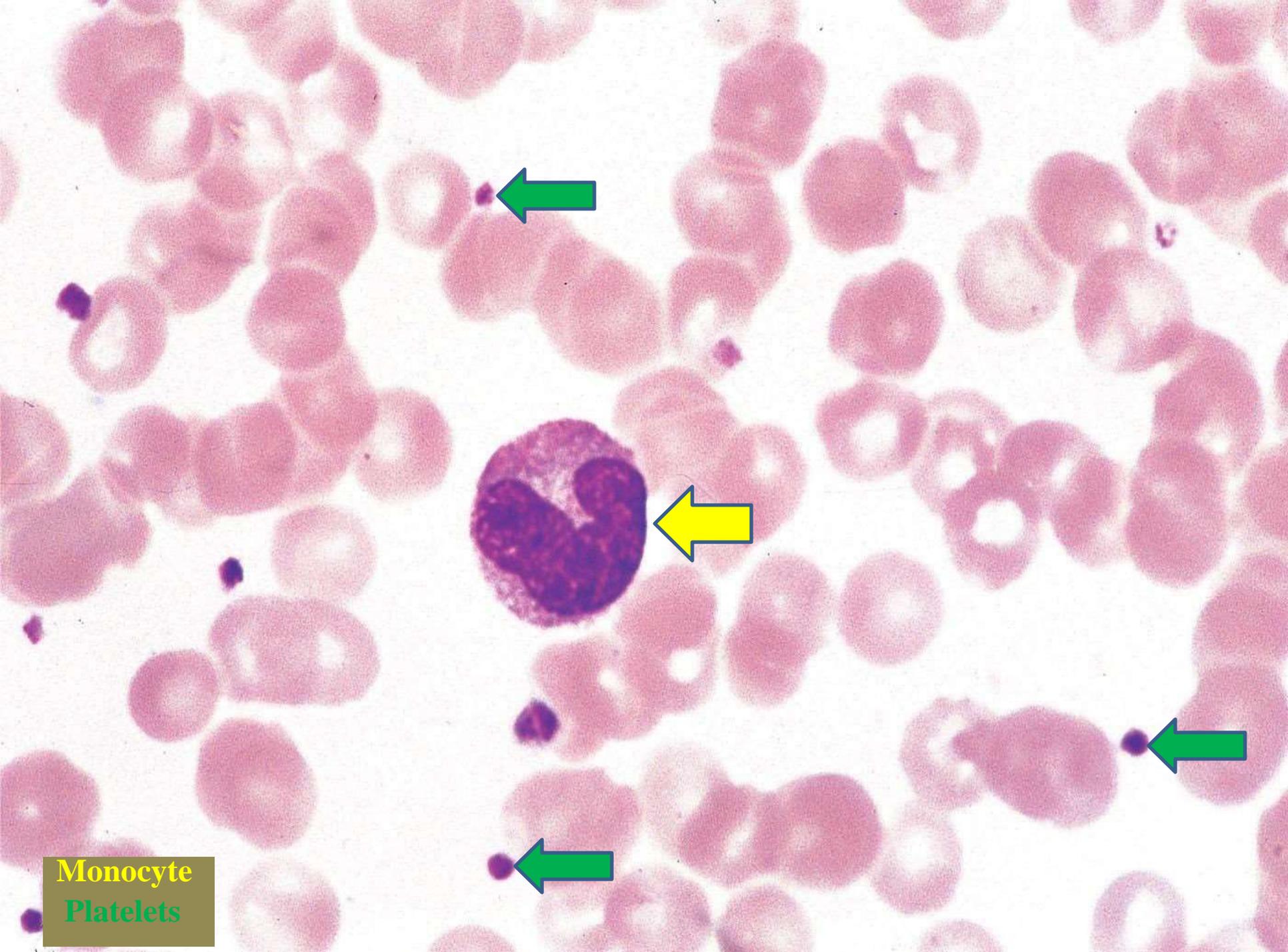
Monocyte



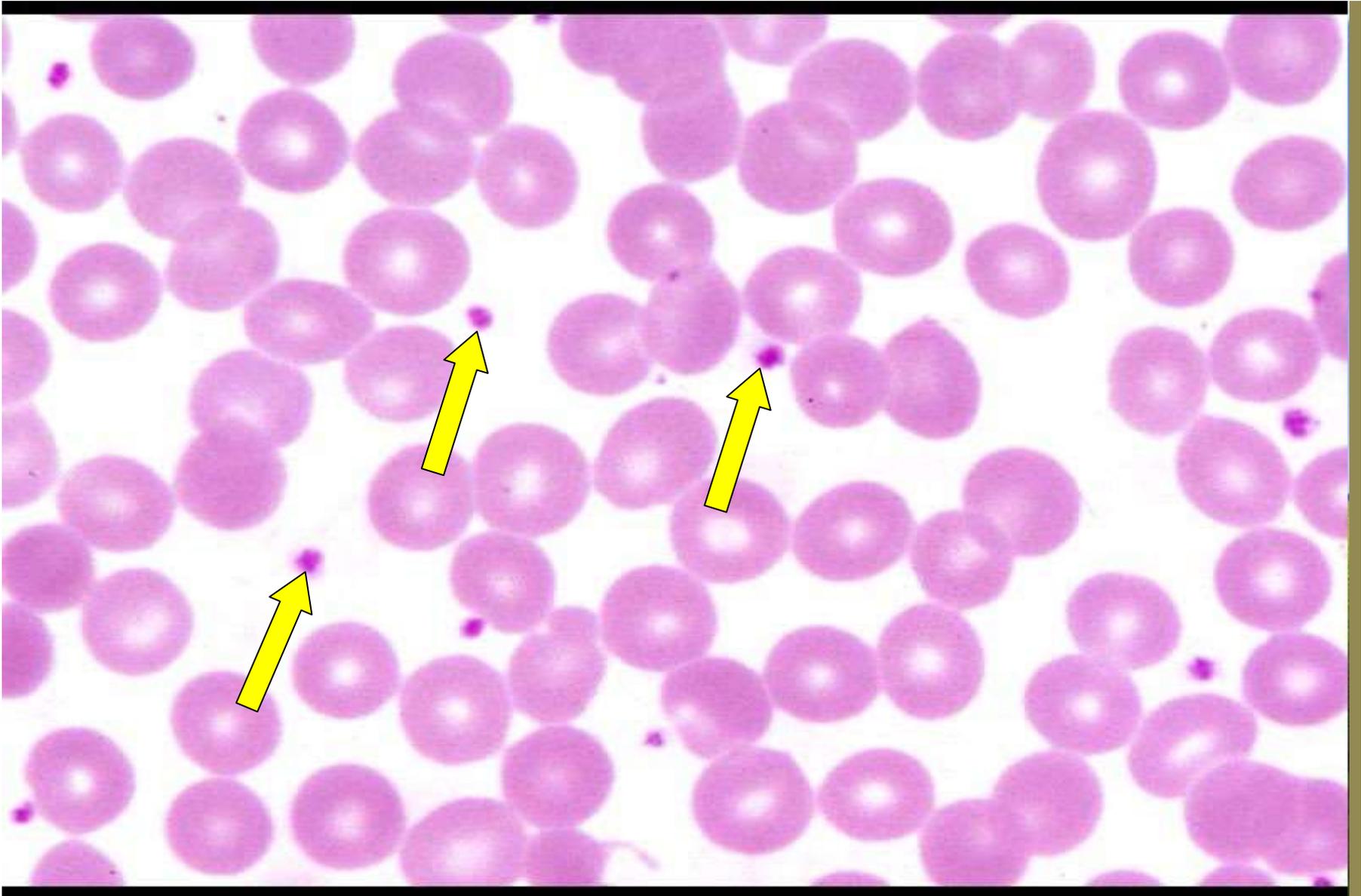
Basophil



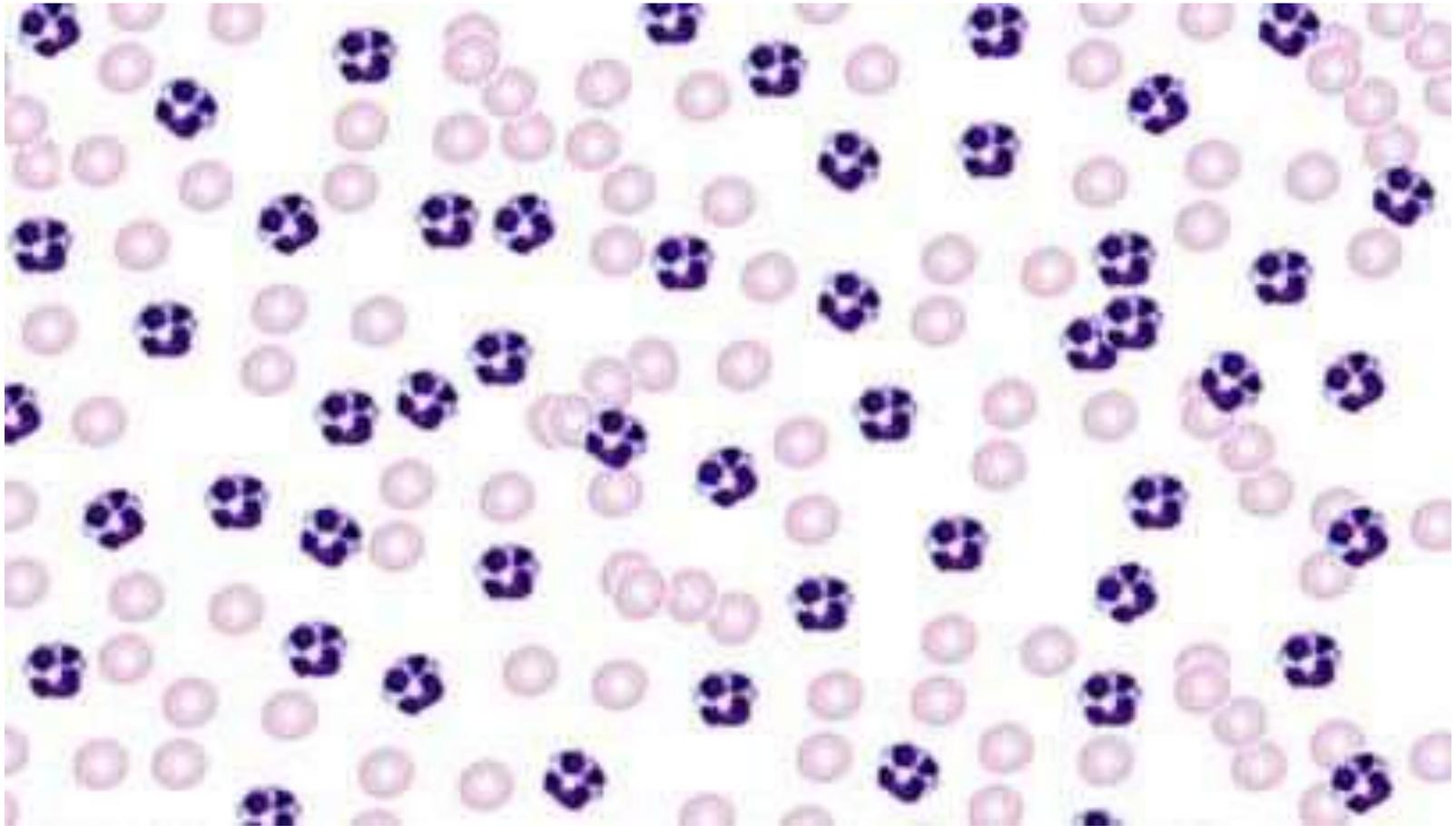
Basophil
Neutrophil



Monocyte
Platelets



Platelets



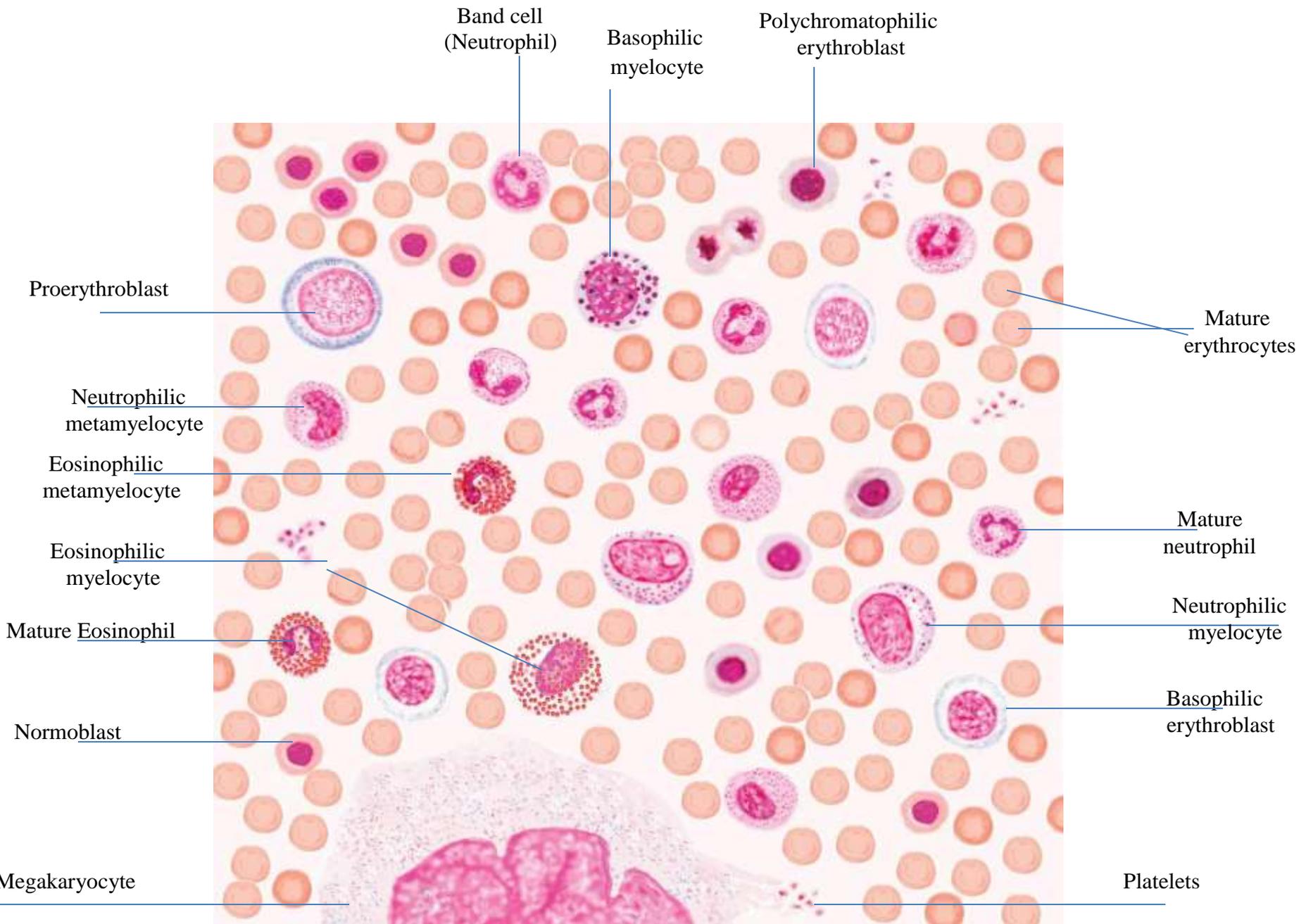
Don't Worry, Be Happy! 😊

Bone marrow

Red bone marrow consists of hematopoietic cords (blood forming cells) and blood sinusoids supported by a reticular tissue.

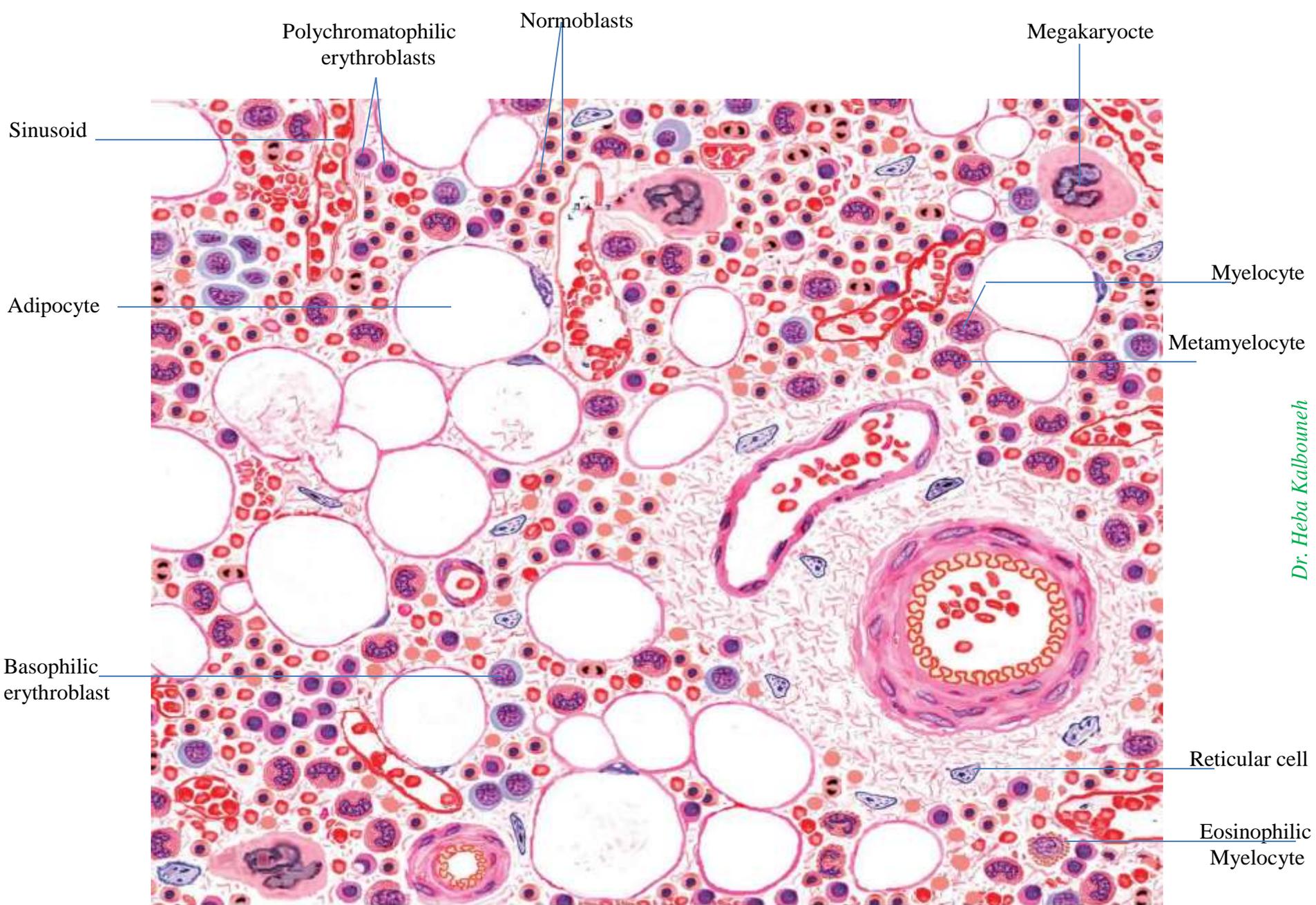
While yellow bone marrow consists mainly of adipocytes





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Red Bone Marrow (Giemsa stain)



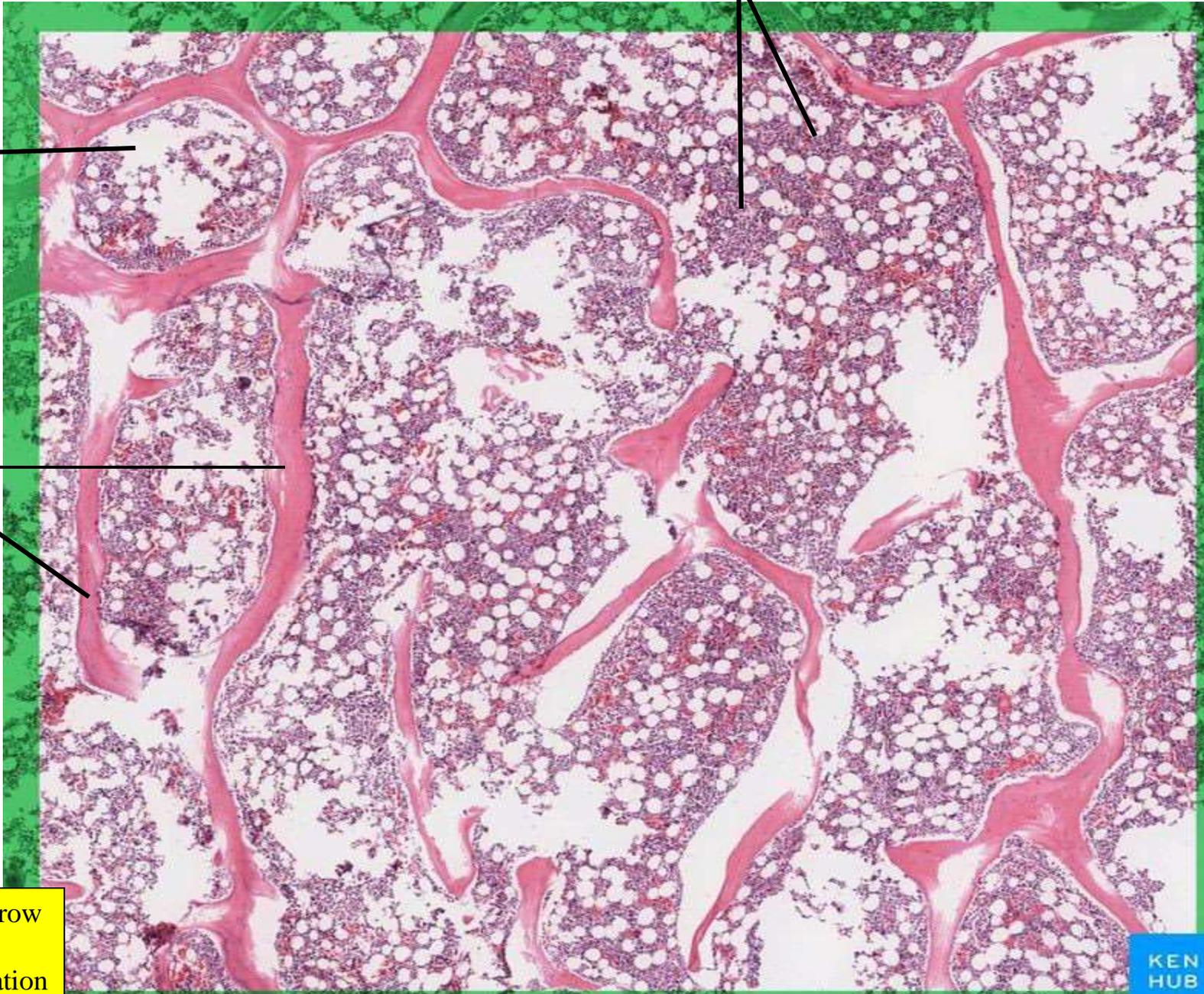
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Red Bone Marrow (H&E)

Hematopoietic cords

Adipocytes

Trabeculae of spongy bone



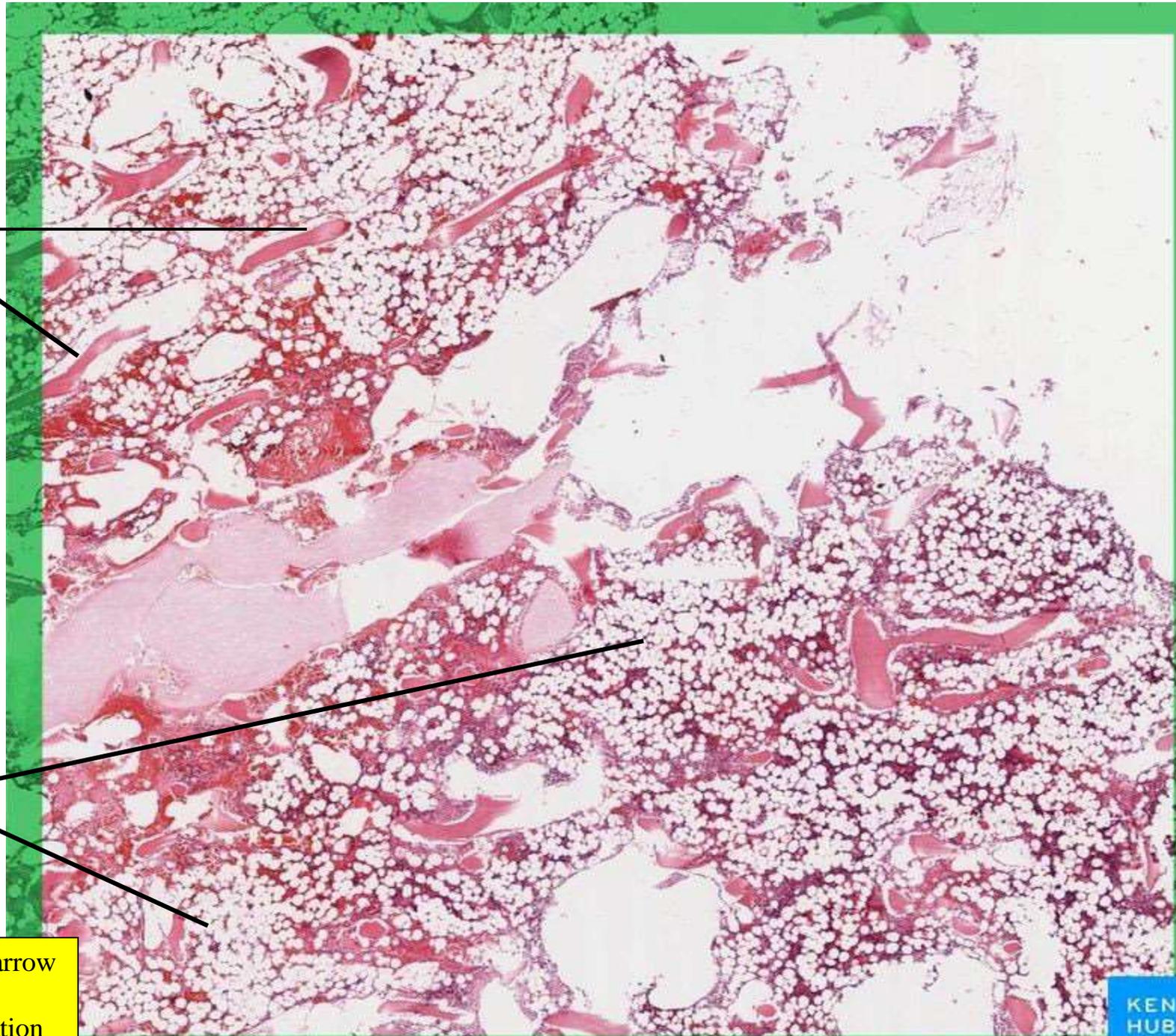
Red Bone Marrow
H&E
Low magnification



Trabeculae of spongy bone

Adipocytes

Yellow Bone Marrow
H&E
Low magnification



Thymus

Note that the gland is organized into numerous lobules.

Each lobule contains a dark-staining outer cortex and inner medulla. Also note the capsule that extends into the thymus to form the interlobular septa (trabeculae) that separate the lobules. The capsule and septa contain blood vessels, lymphatics and nerves.

Note also that thymus has no lymphoid follicles

Precursor cells for T lymphocytes migrate from bone marrow , enter the thymus and populate mainly in outer part of lobule (cortex)
They go through different stages of development and differentiation , thymic education and training and move toward the medulla and end up with mature T cells ready to leave the thymus and enter bloodstream .

Trabecula

Cortex

Medulla

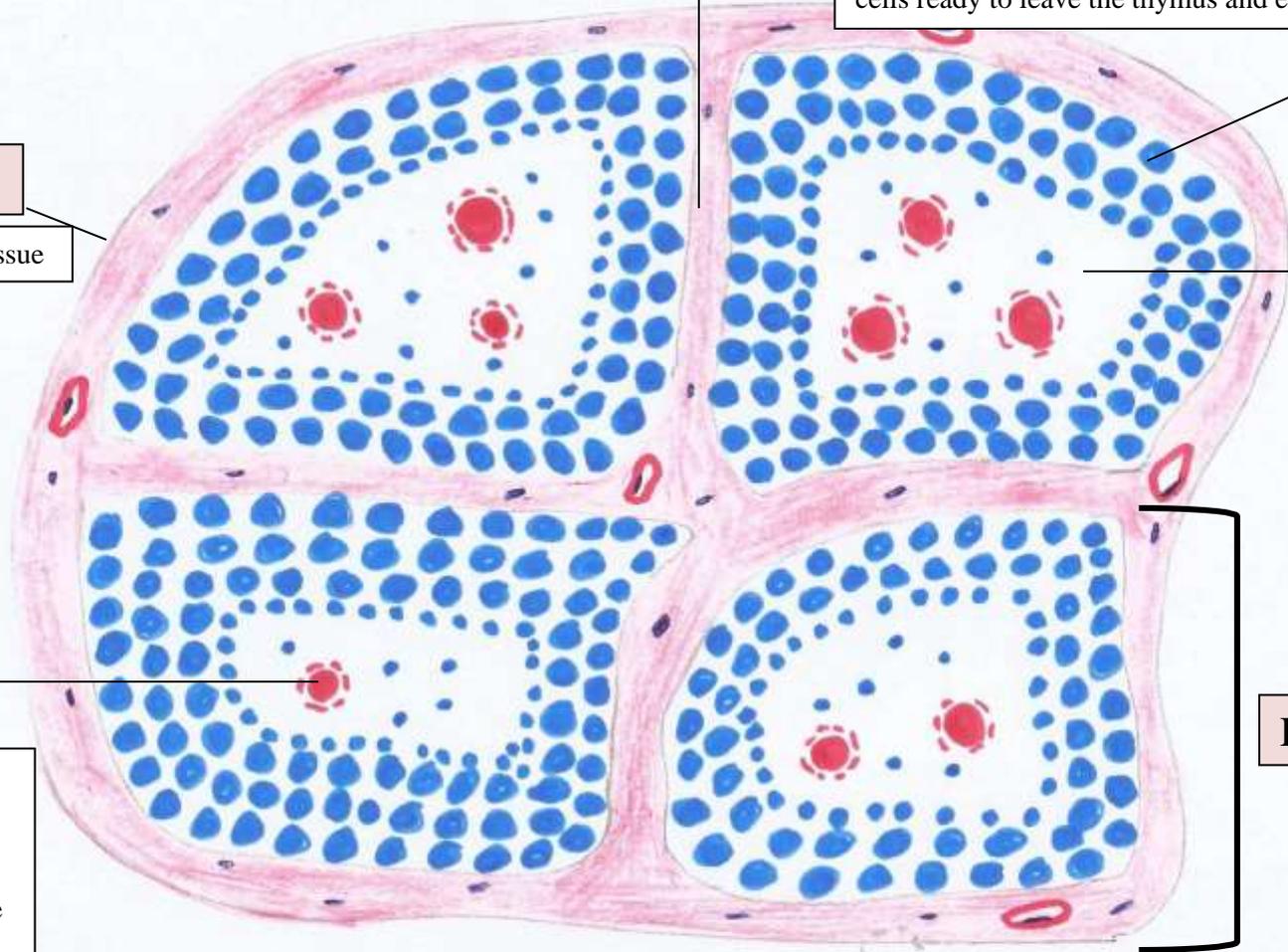
Capsule

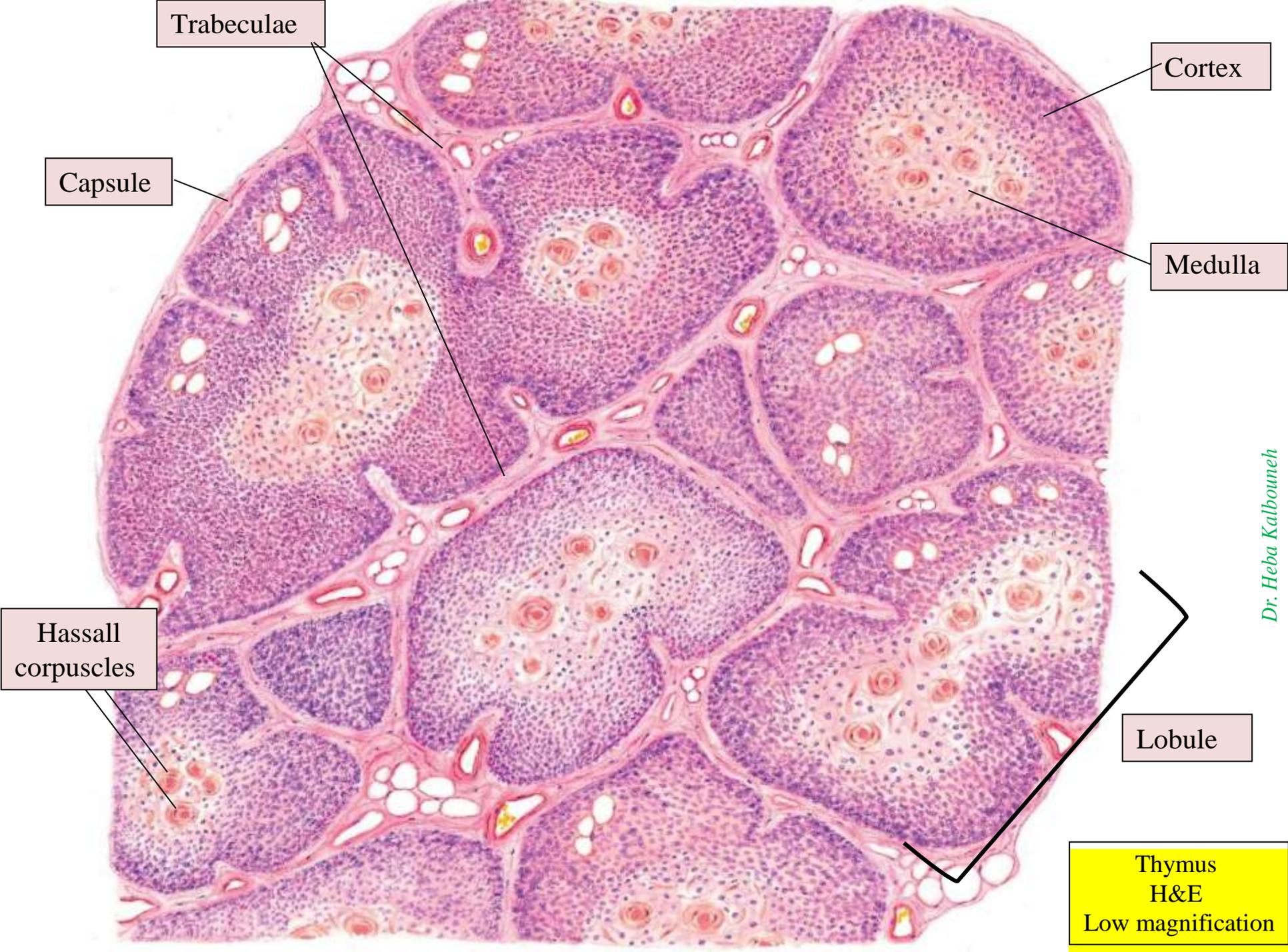
Dense connective tissue

Hassall corpuscle

Lobule

specific for inner medulla, composed of flat epithelial cells with a core of keratinization. There are thymic epithelial cells inside cortex and medulla with many processes, connected by desmosomes, and they protect the developing T cells during their thymic education.





Trabeculae

Cortex

Capsule

Medulla

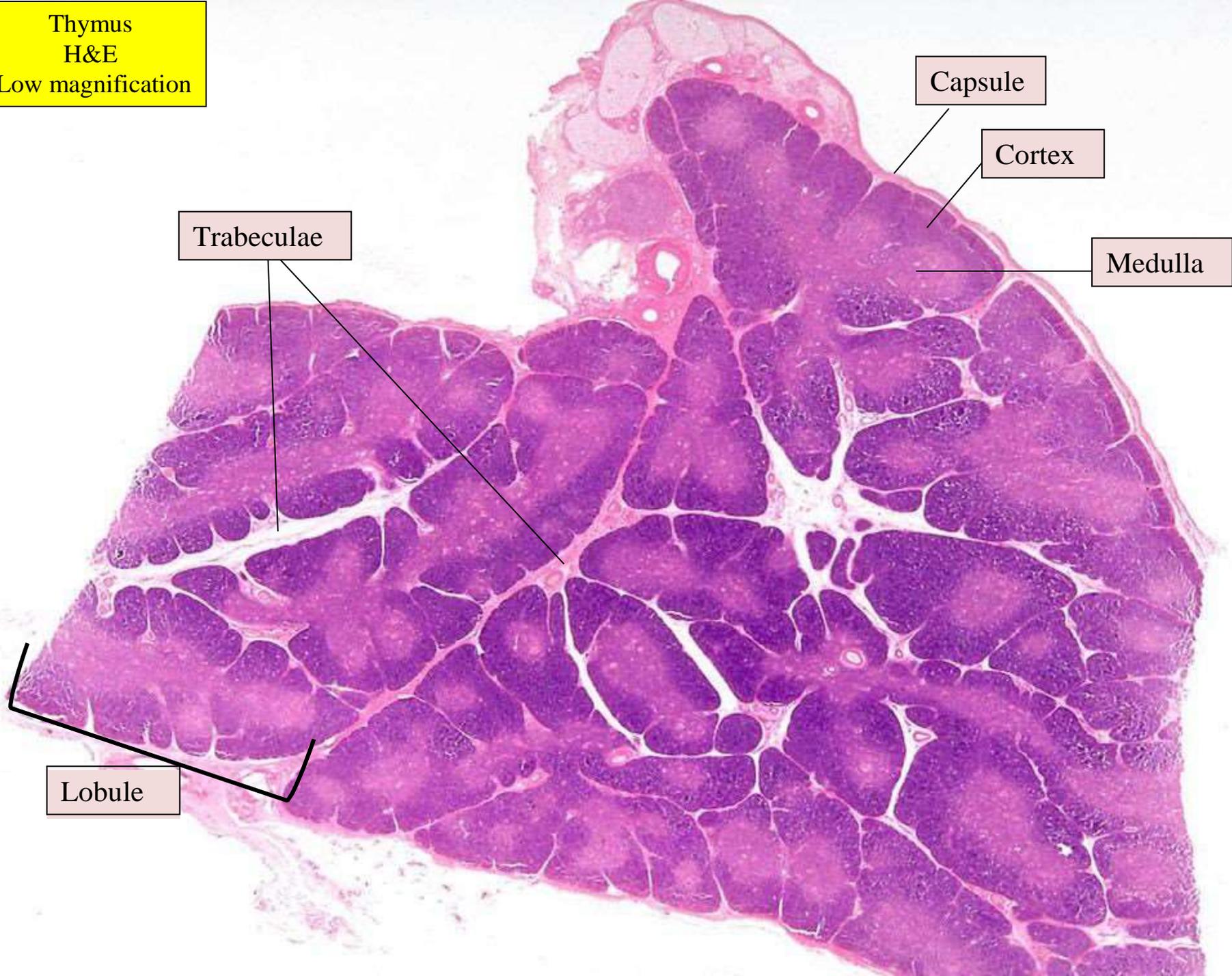
Hassall corpuscles

Lobule

Thymus
H&E
Low magnification

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Thymus
H&E
Low magnification



Capsule

Cortex

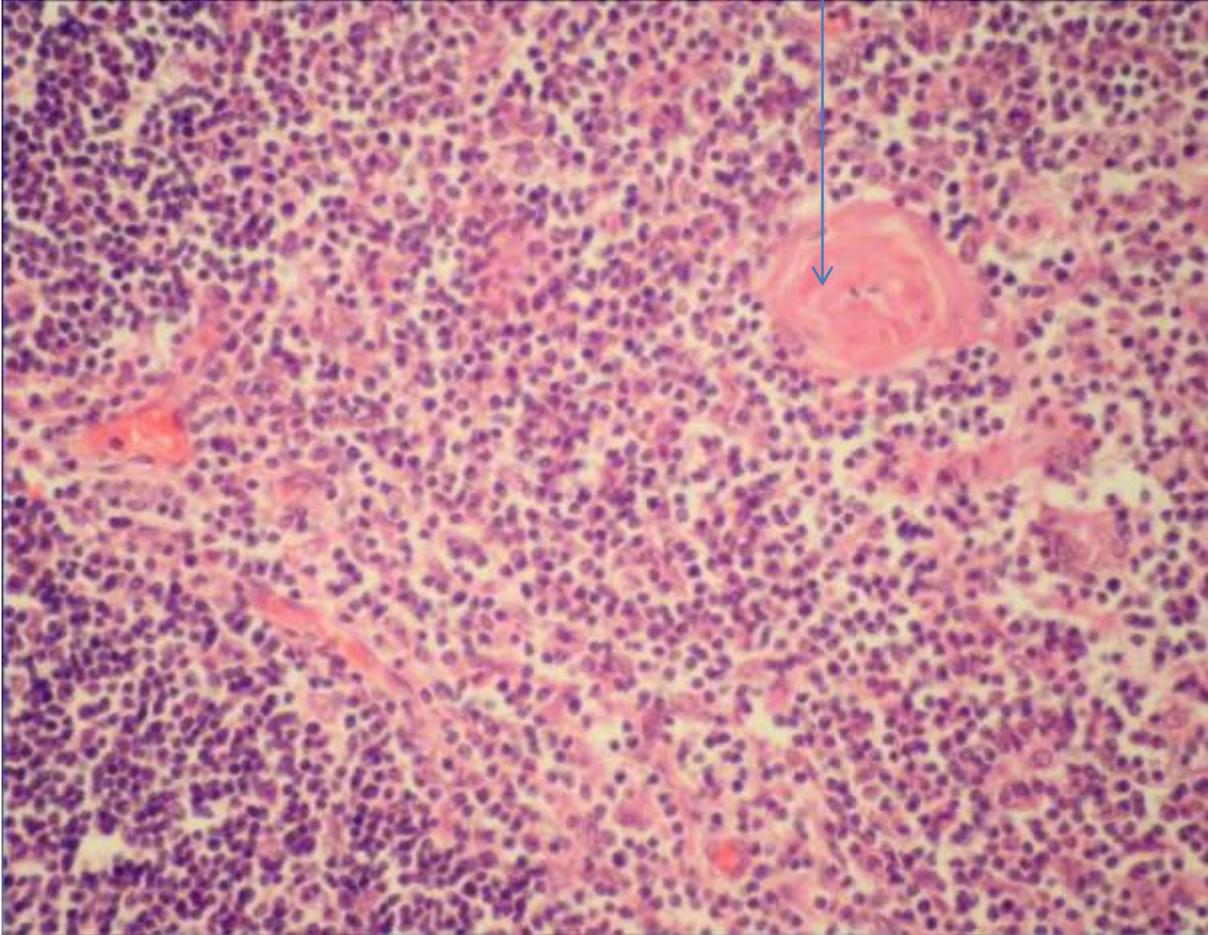
Medulla

Trabeculae

Lobule

Thymic medulla
H&E
High magnification

Hassall
Corpuscle in medulla



Involution in Thymus

H&E

Low magnification

In this section we can see high numbers of fat cells inside thymic tissue and deposition of fat takes place in thymus after puberty time , the thymus start to shrink in size and replaced by fatty tissue and we call this (Involution in Thymus)

