



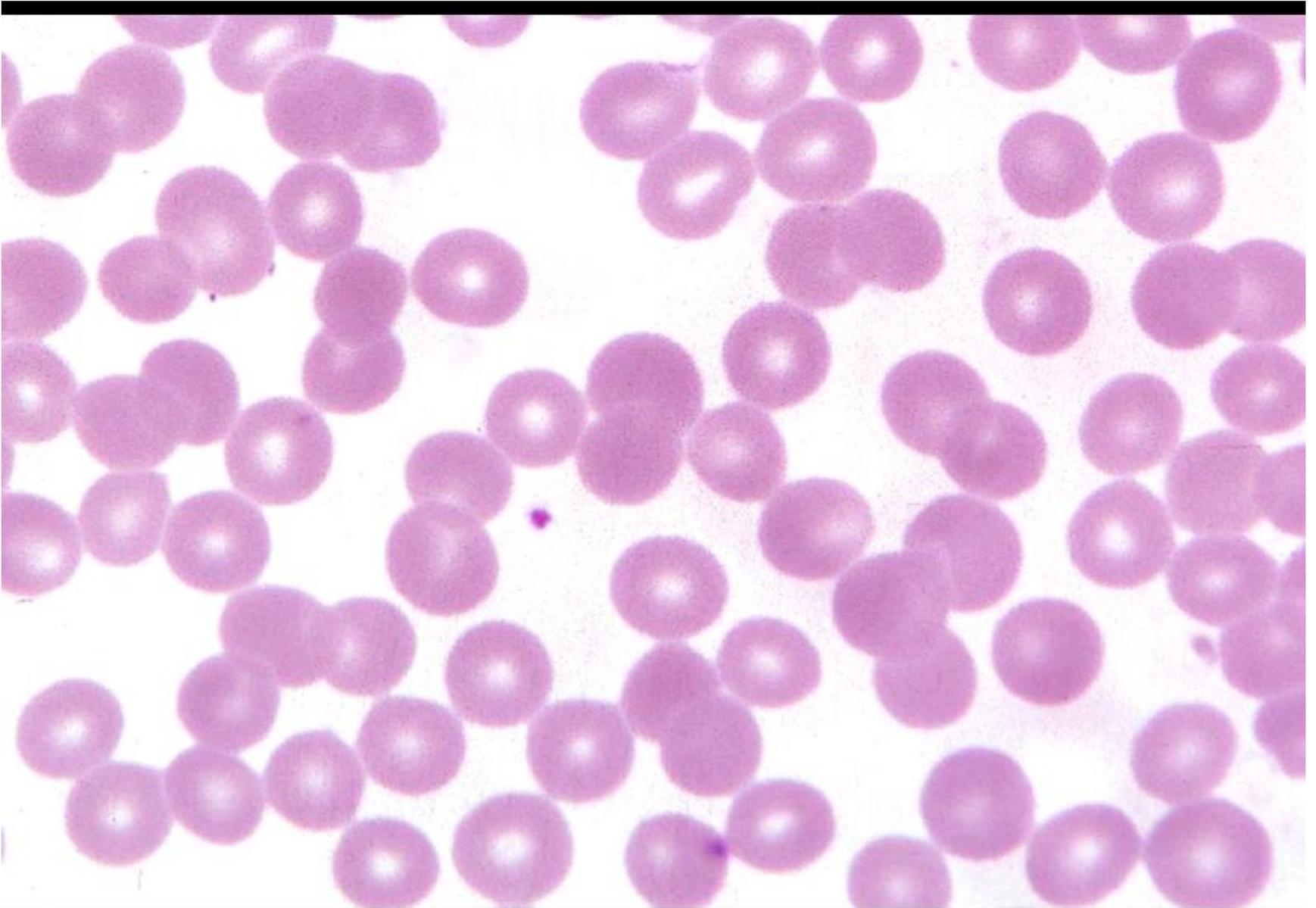
Hemato-lymphoid system

Practical Part

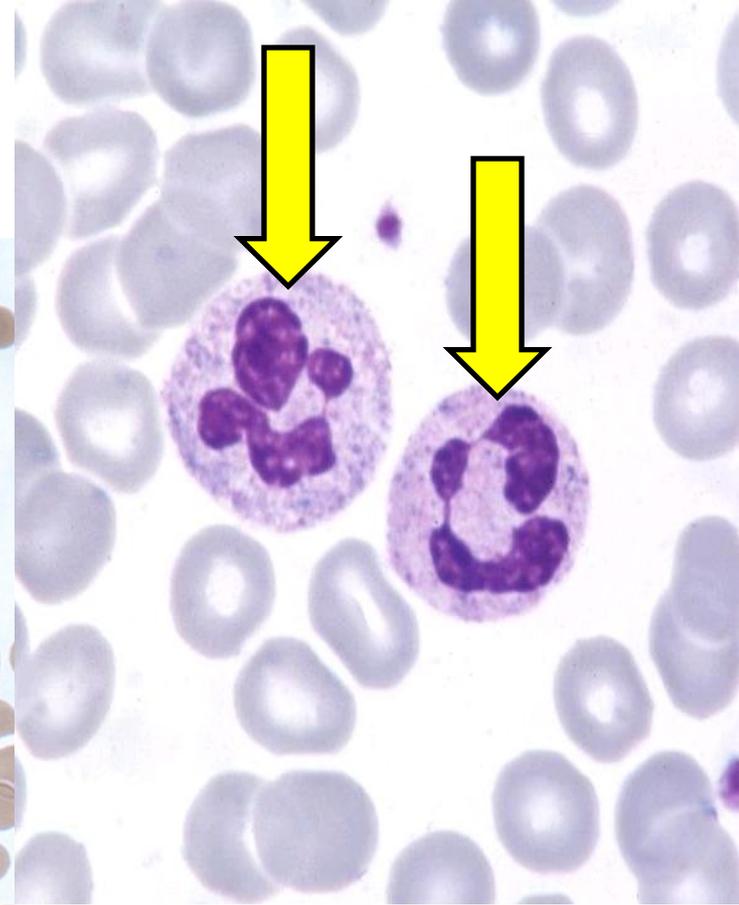
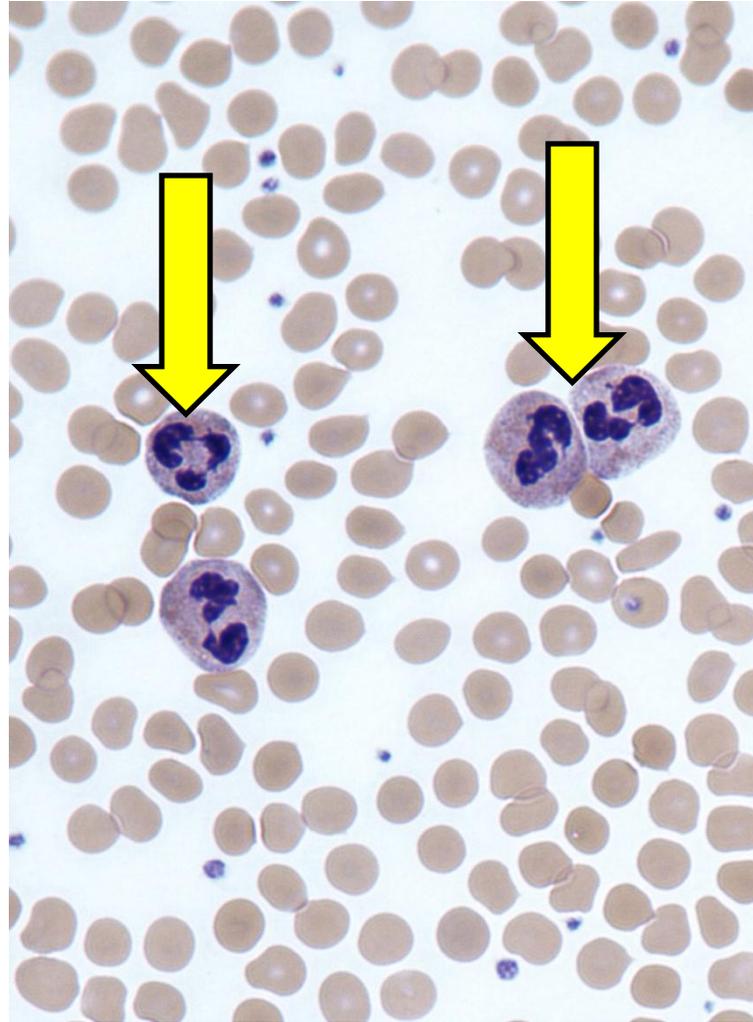
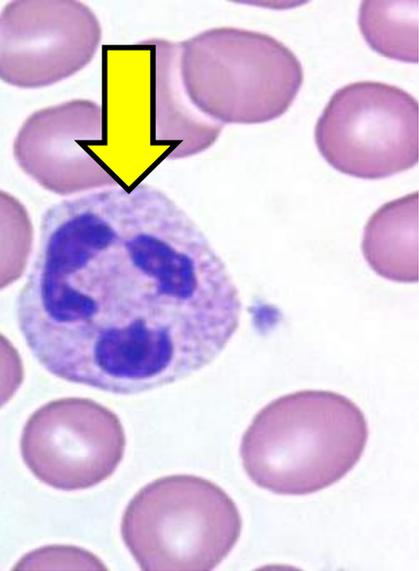
Dr. Heba Kalbouneh
Associate Professor of Anatomy and Histology

Blood

Erythrocytes

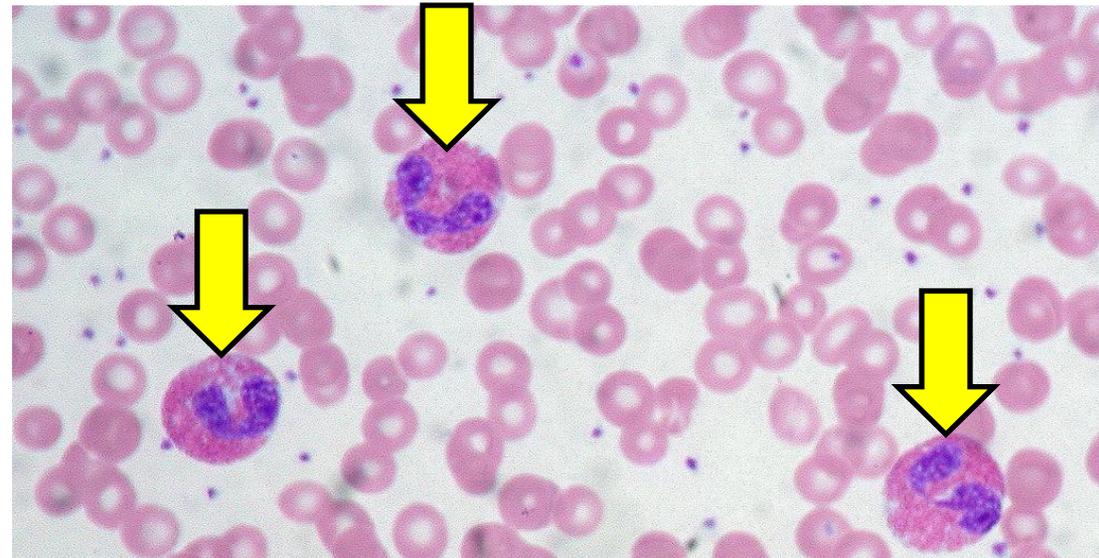
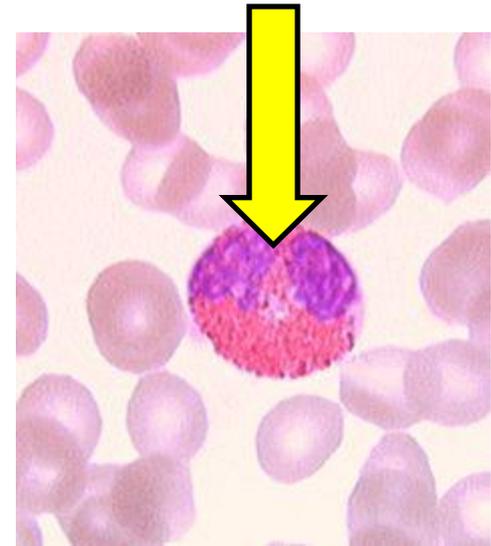
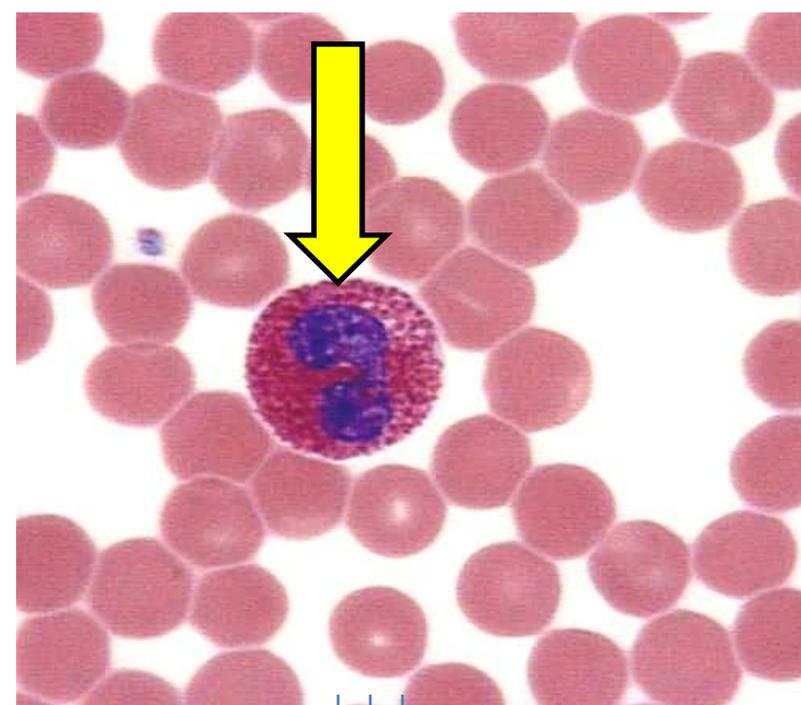


Neutrophils



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.

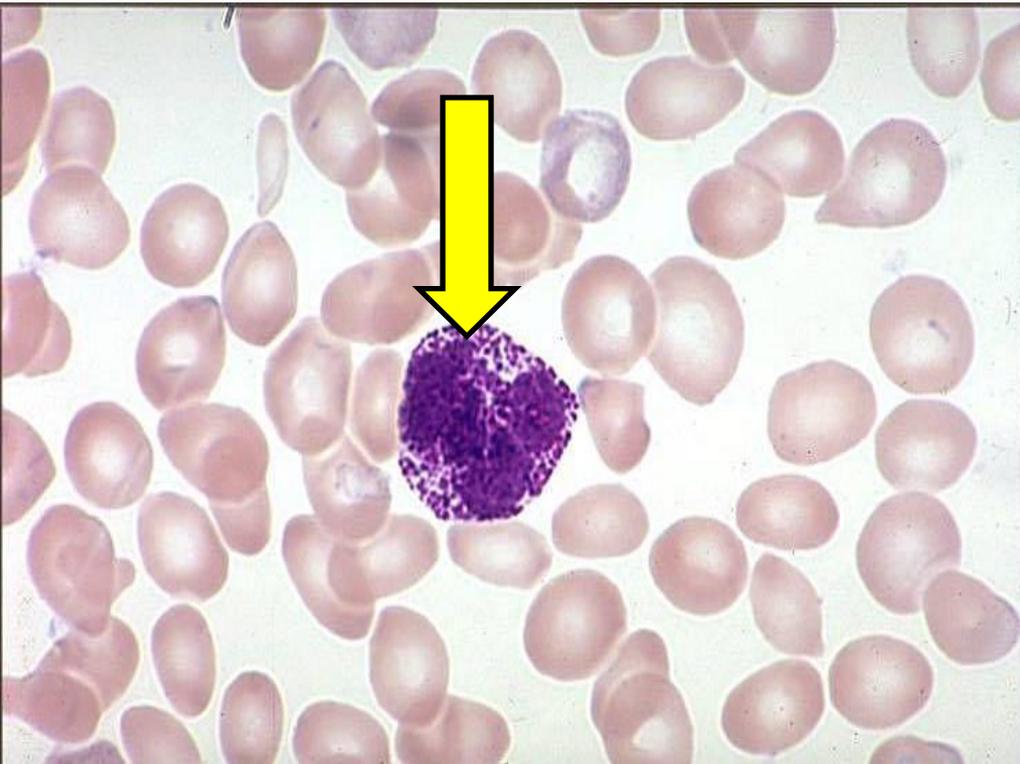
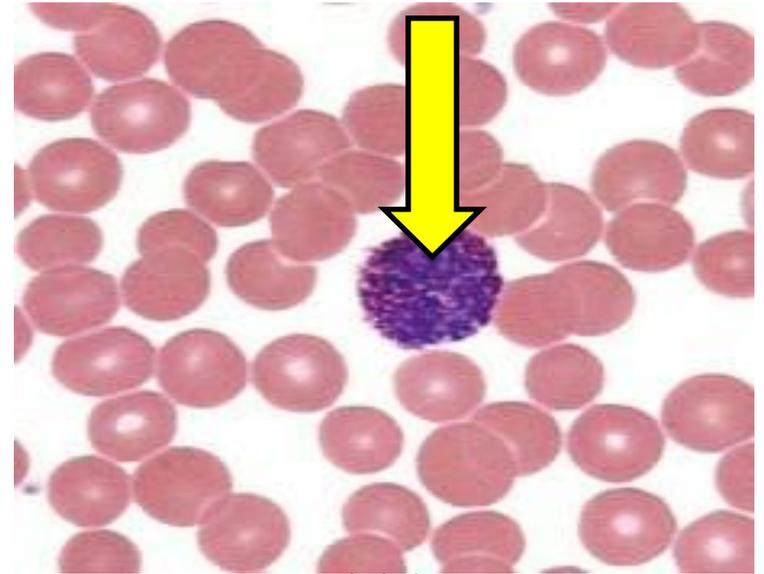
Eosinophils



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.

Basophils

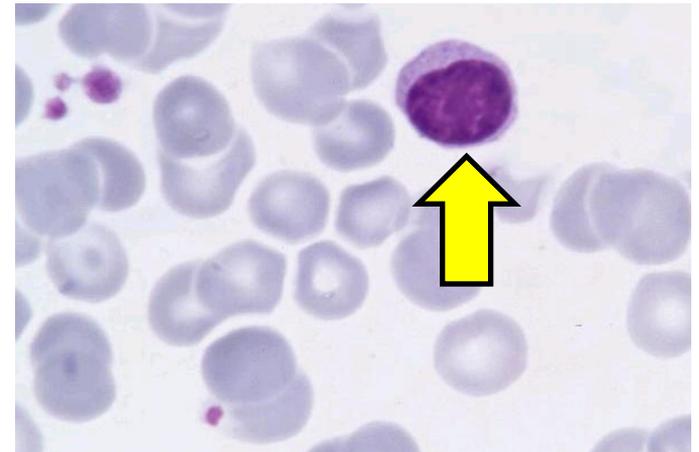
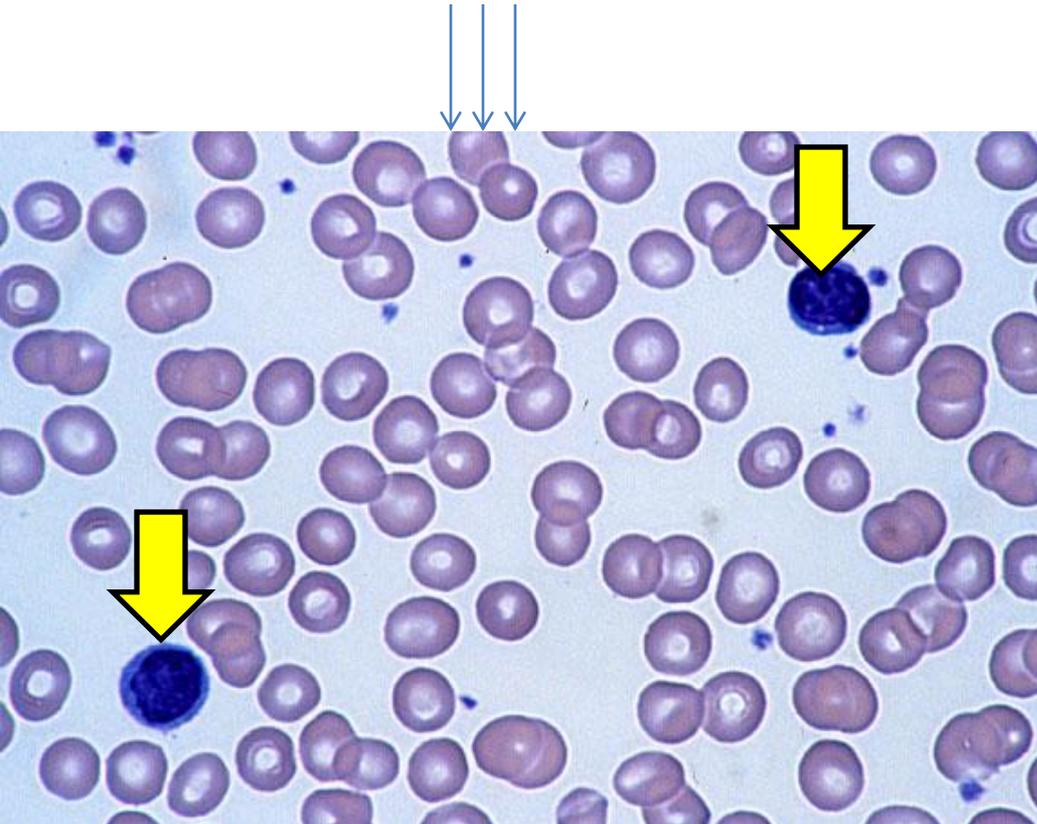
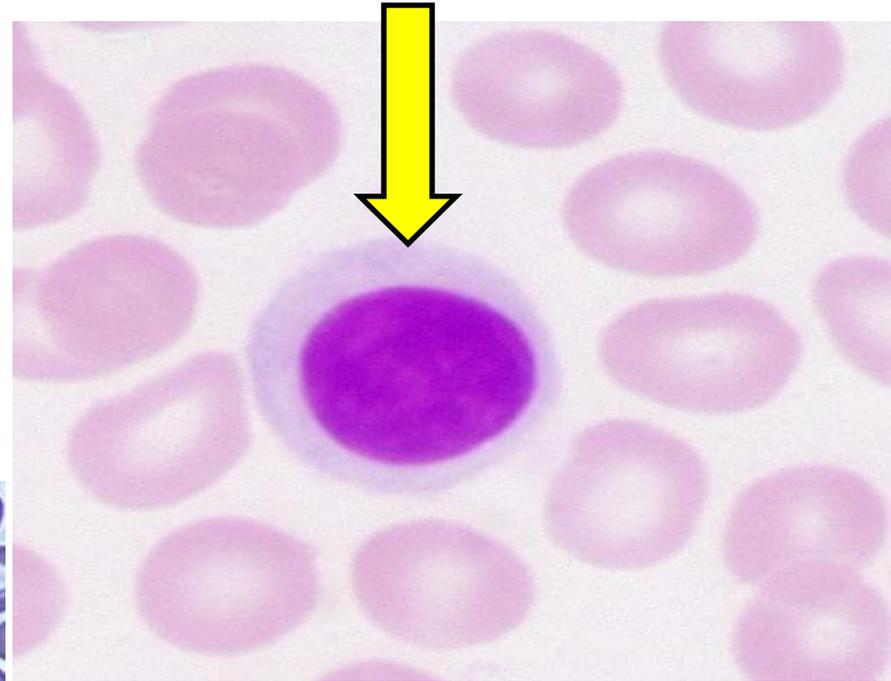


This shows a basophil in a blood smear. The basophil contains lots of deep blue staining granules (basic) and a bilobed irregular nucleus, that is often difficult to see.

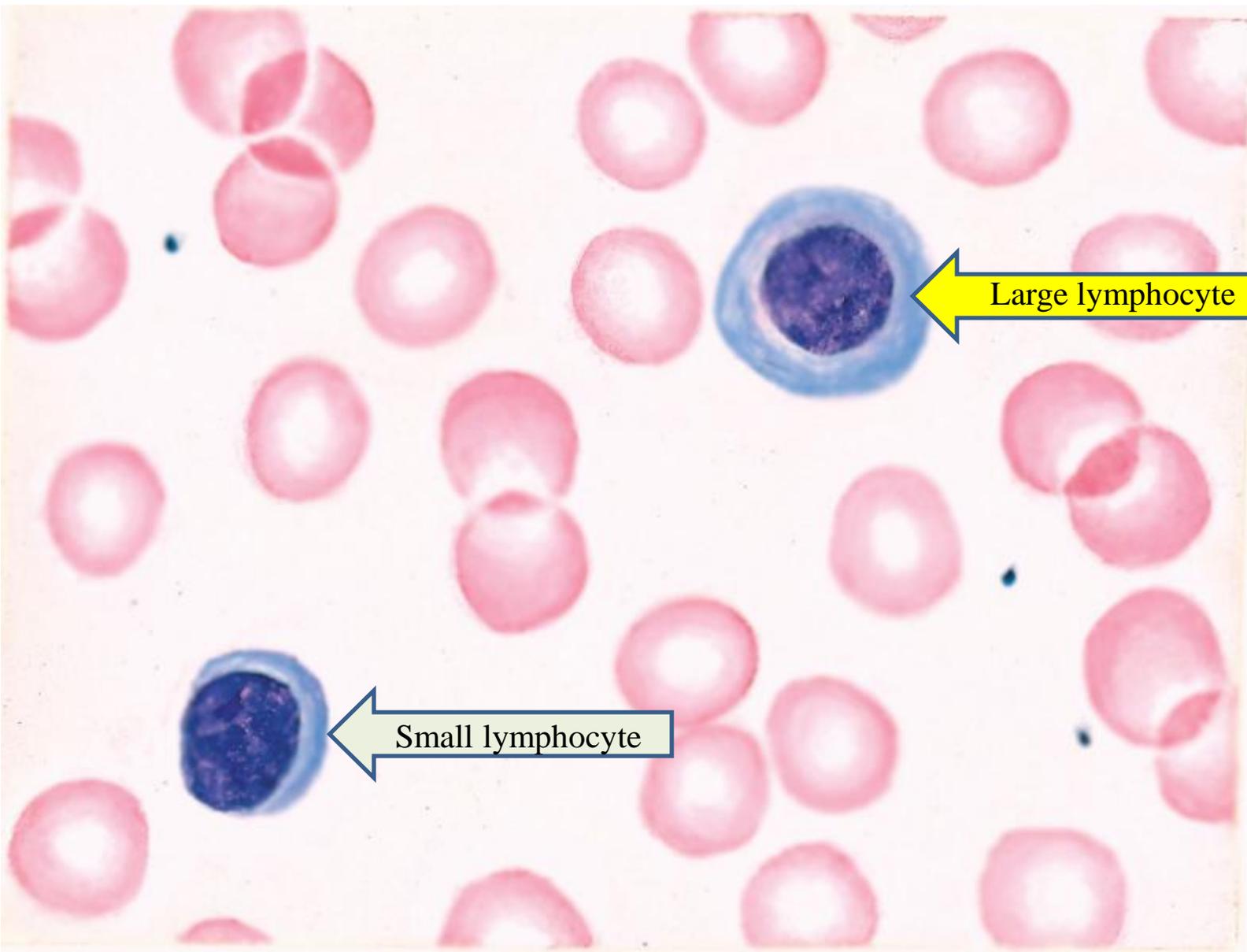
Lymphocytes

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.

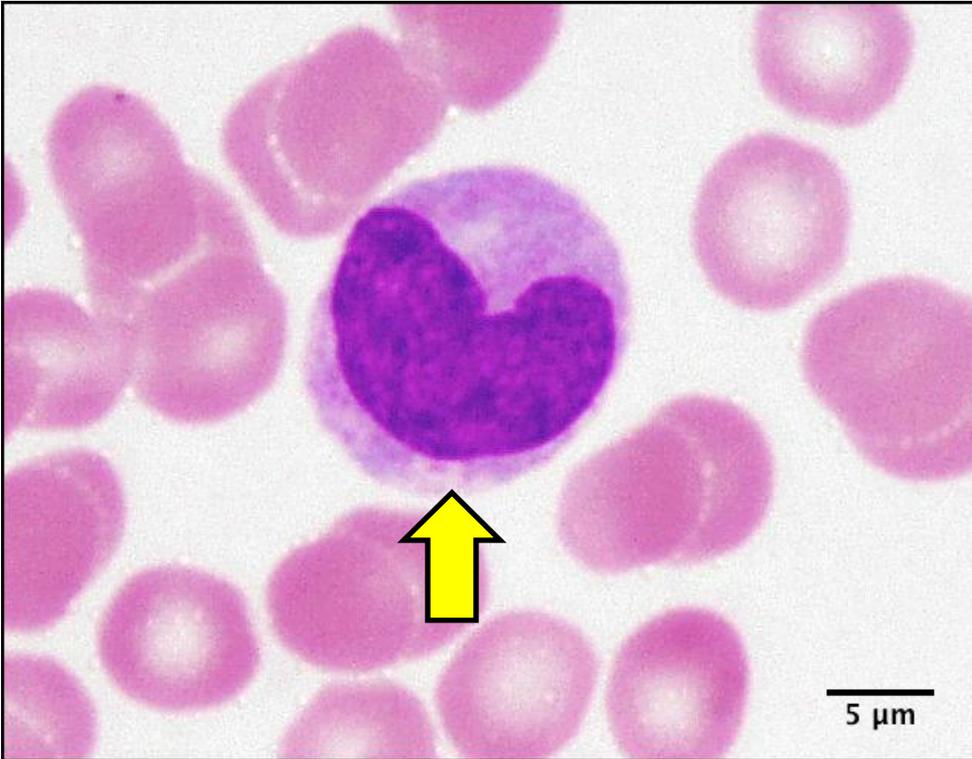
Lymphocyte has a small spherical nucleus with dark staining condensed chromatin. Not much cytoplasm can be seen, and it is basophilic (pale blue/purple staining).



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

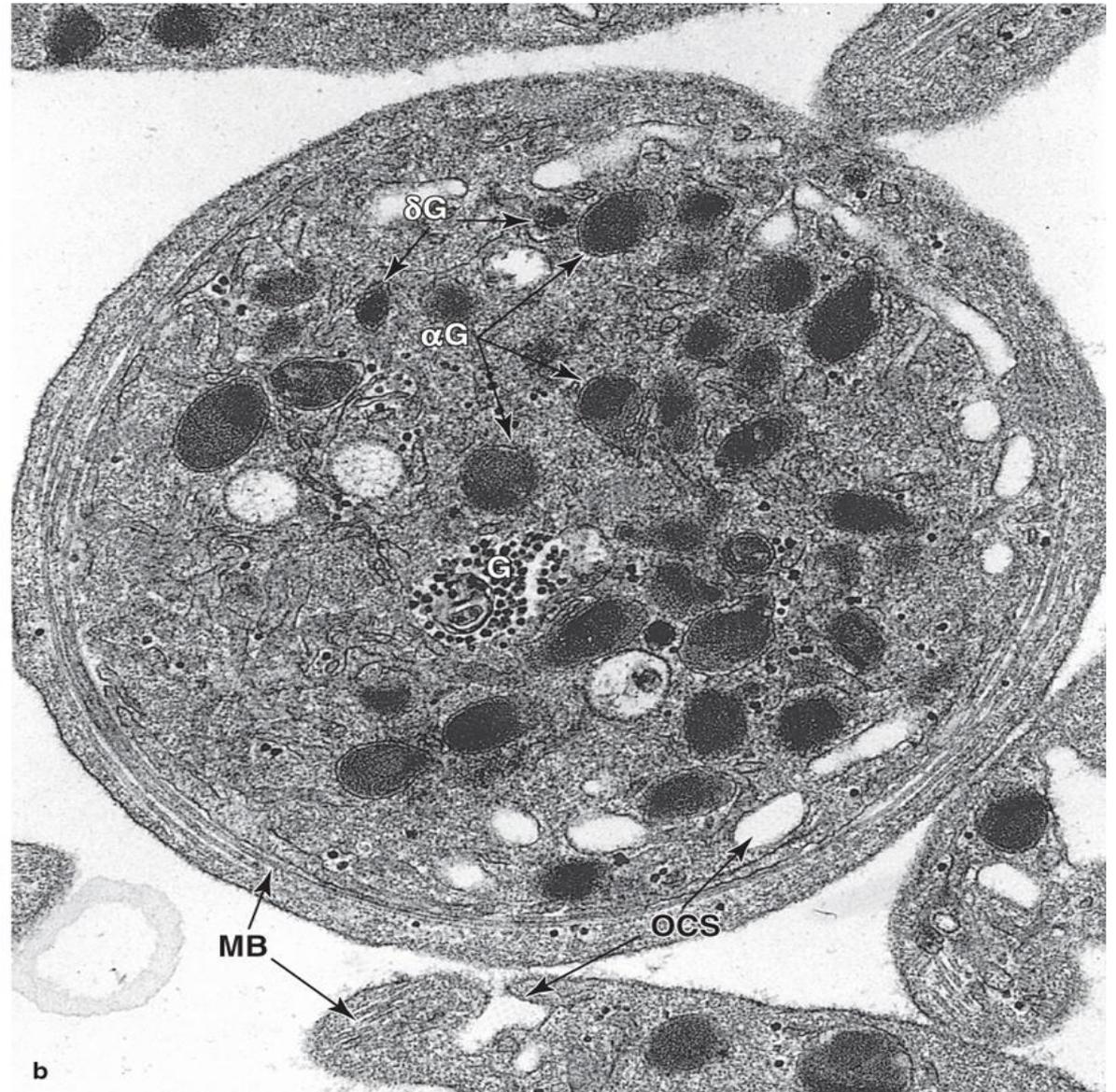
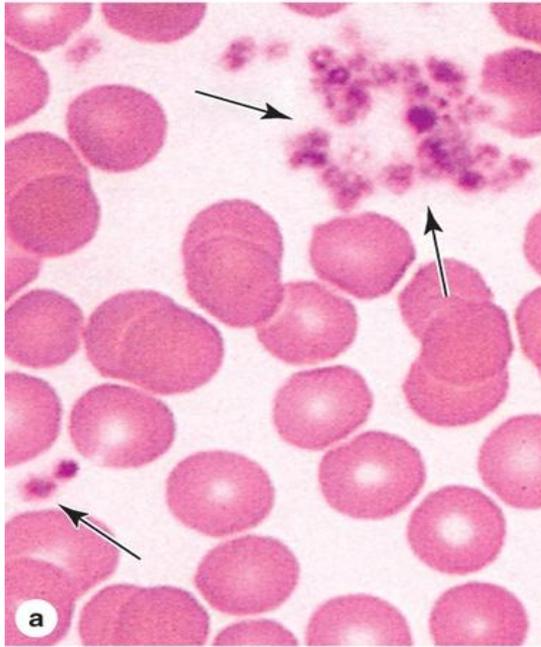


Monocytes

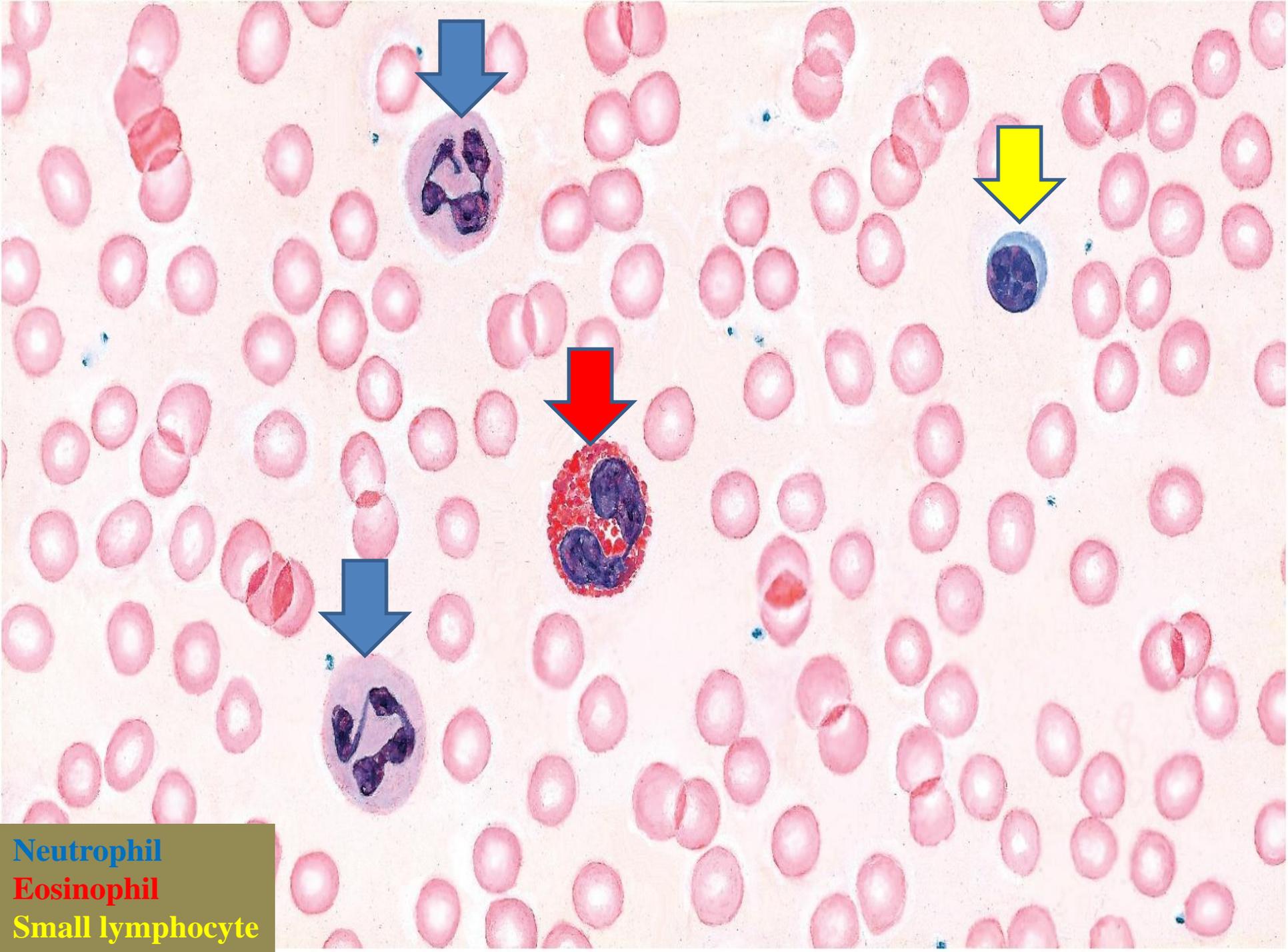


This shows a monocyte in a blood smear. Monocytes are the largest type of white blood cells, and can be up to 20μm in diameter. They have a large eccentrically placed nucleus, which is C or kidney bean shaped. They have abundant cytoplasm, and some fine purple granules in cytoplasm (frosted glass appearance).

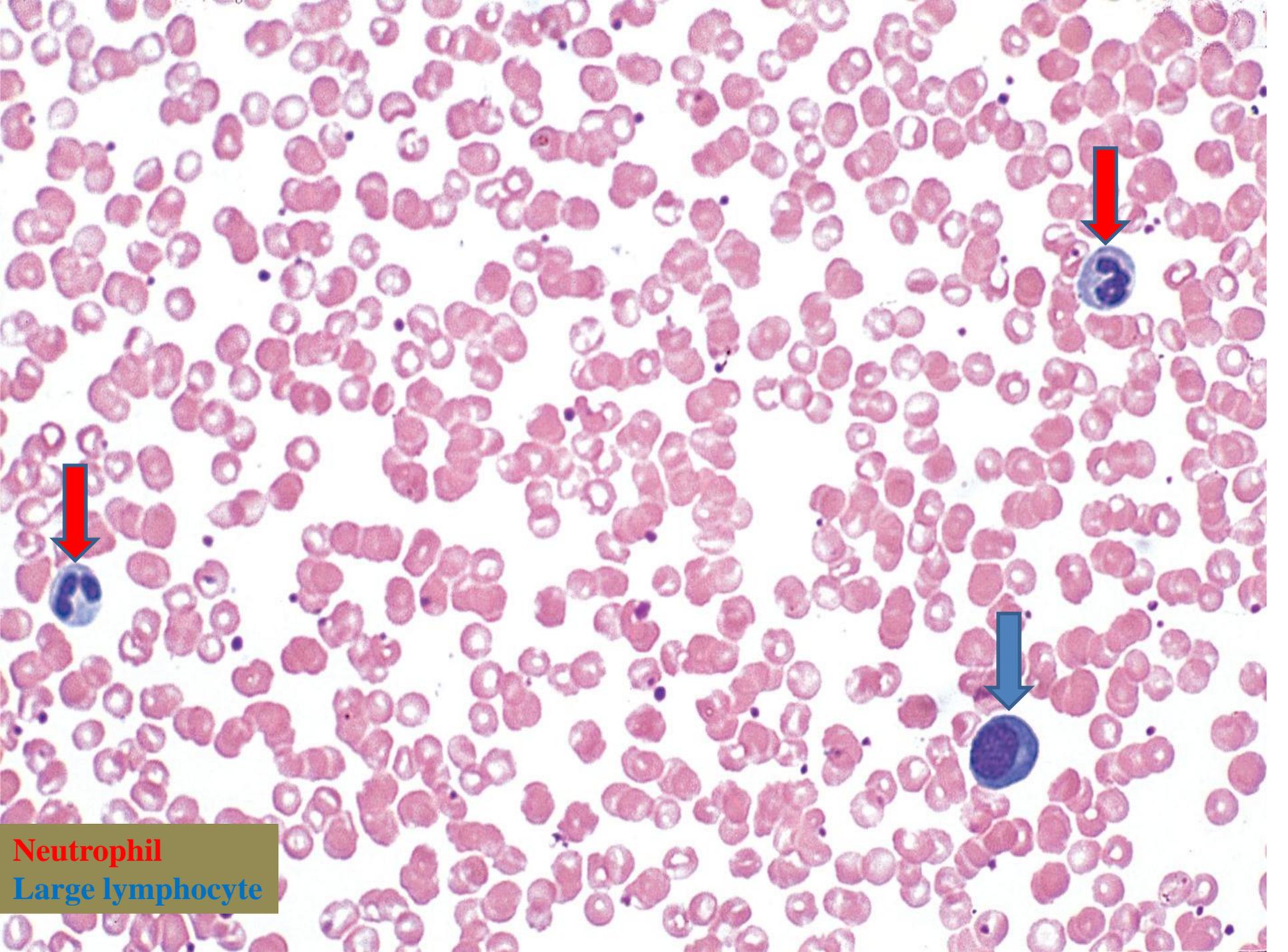
Platelets



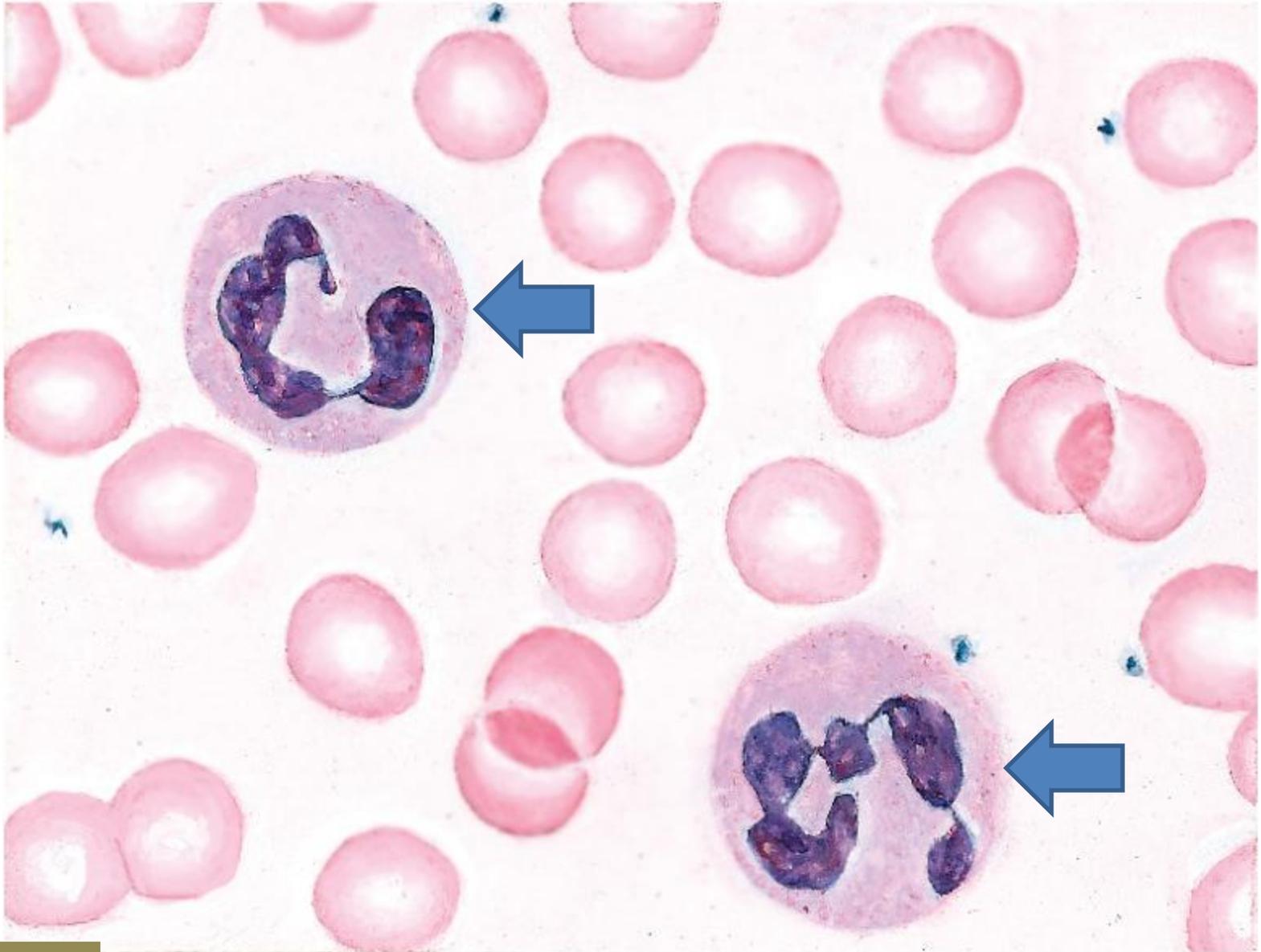
Identify



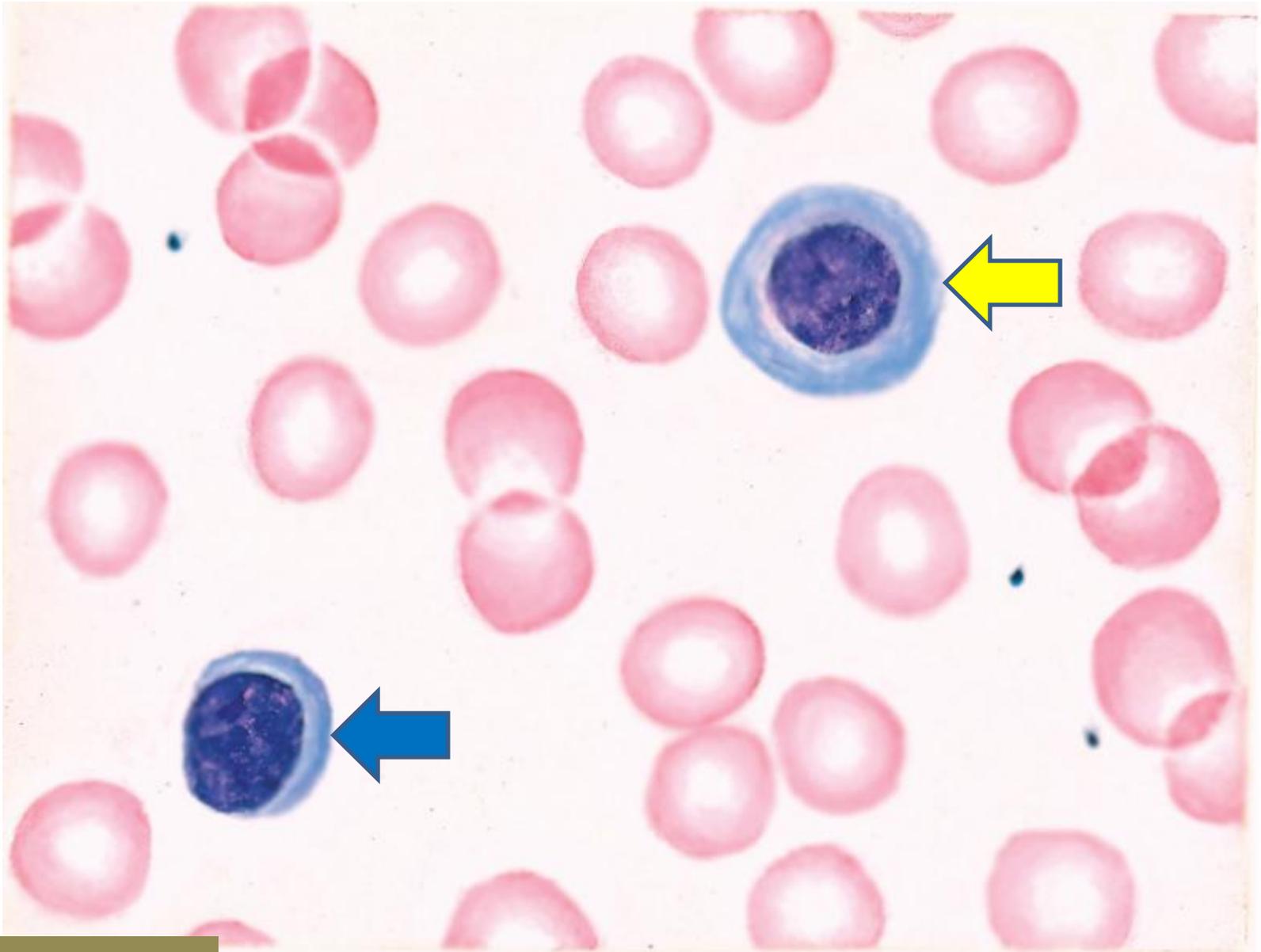
Neutrophil
Eosinophil
Small lymphocyte



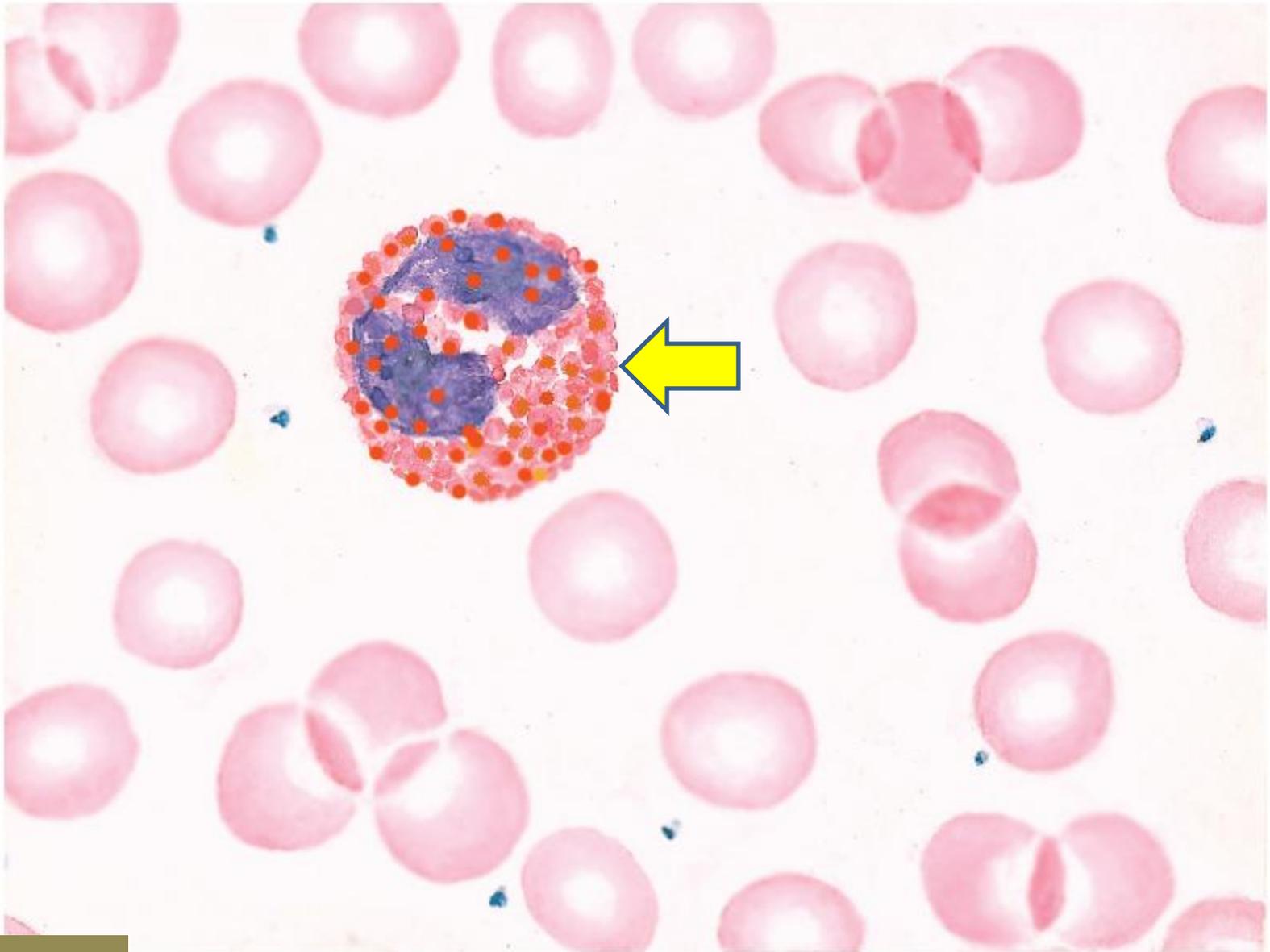
Neutrophil
Large lymphocyte



Neutrophil

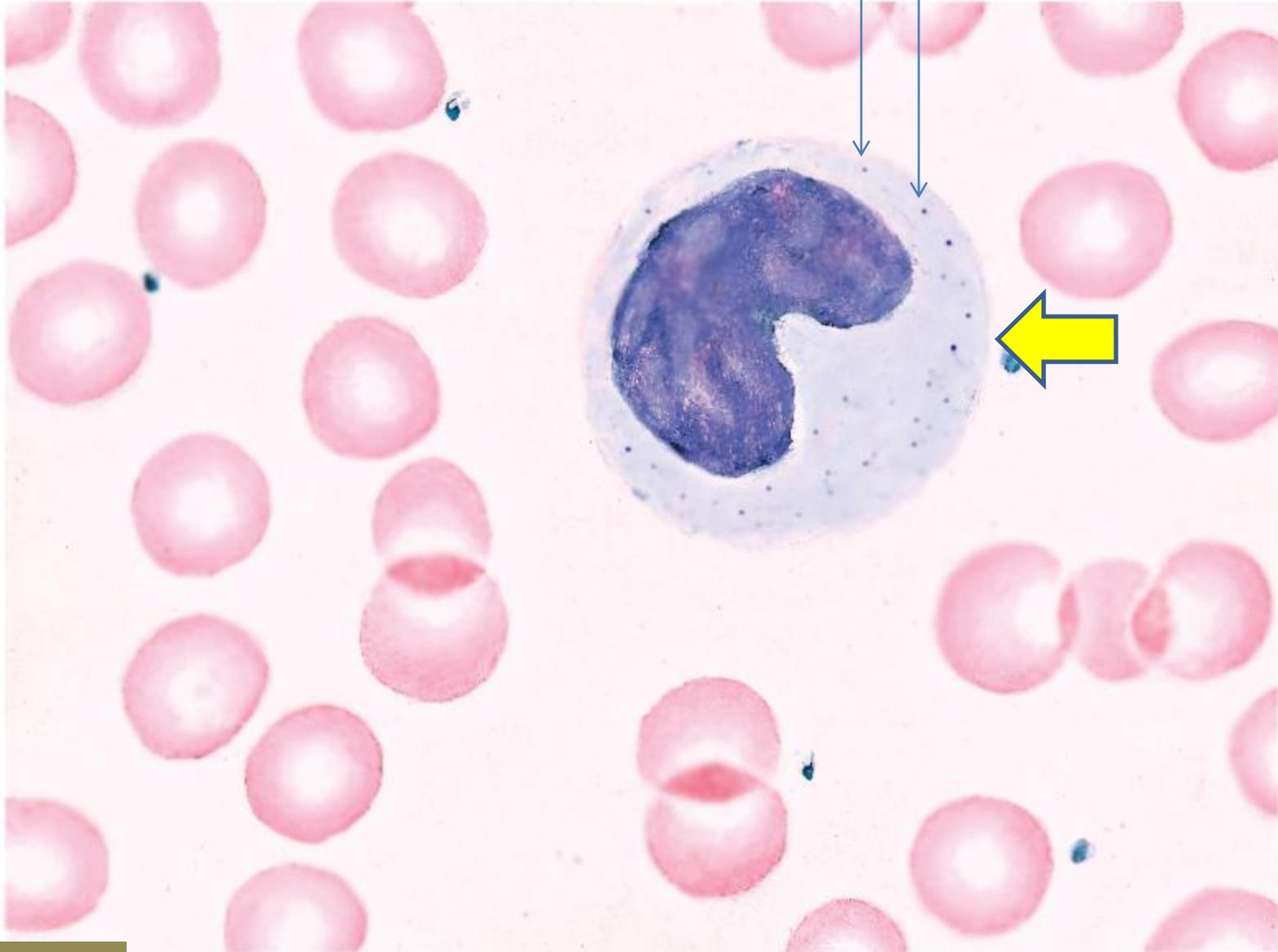


Small lymphocyte
Large lymphocyte

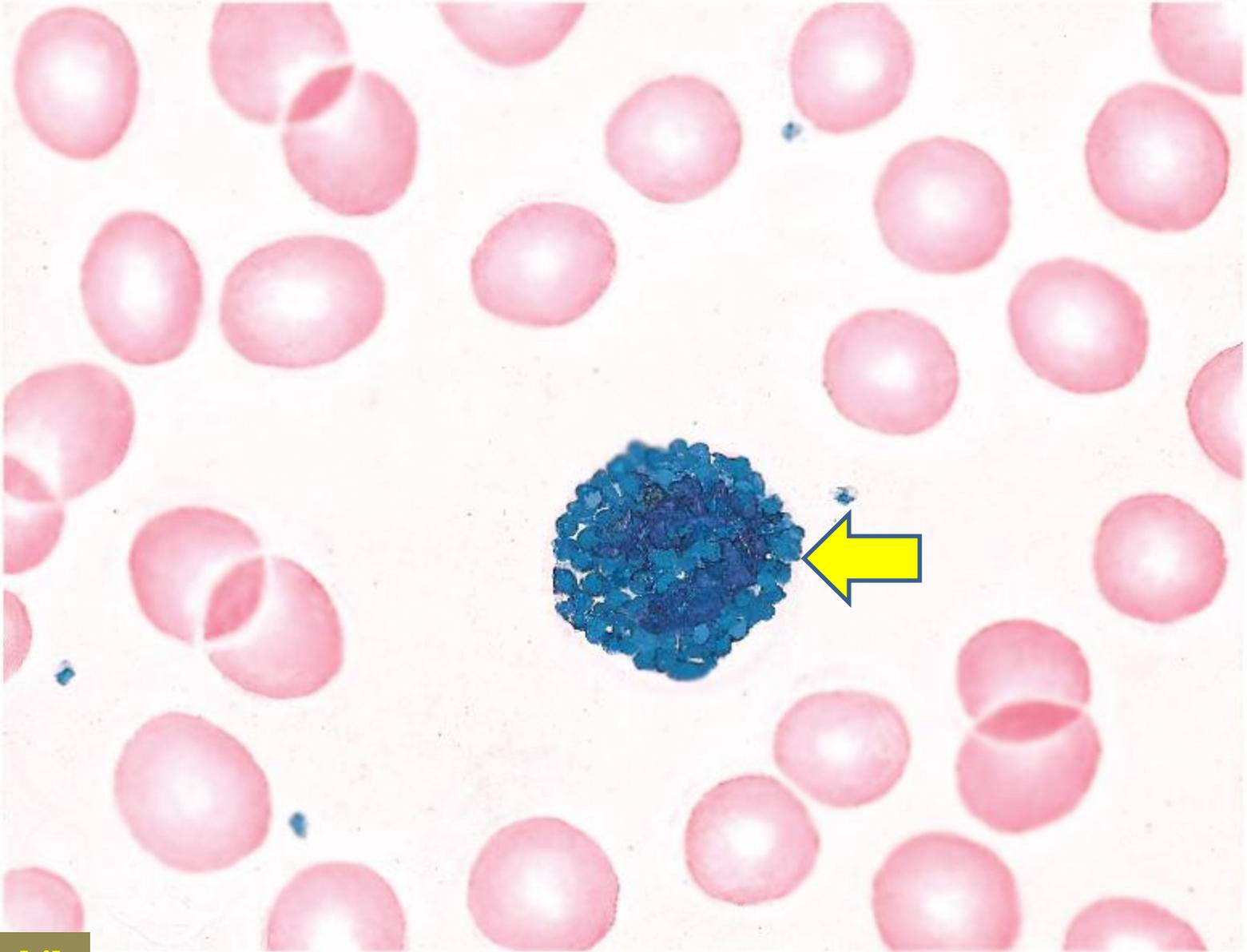


Eosinophil

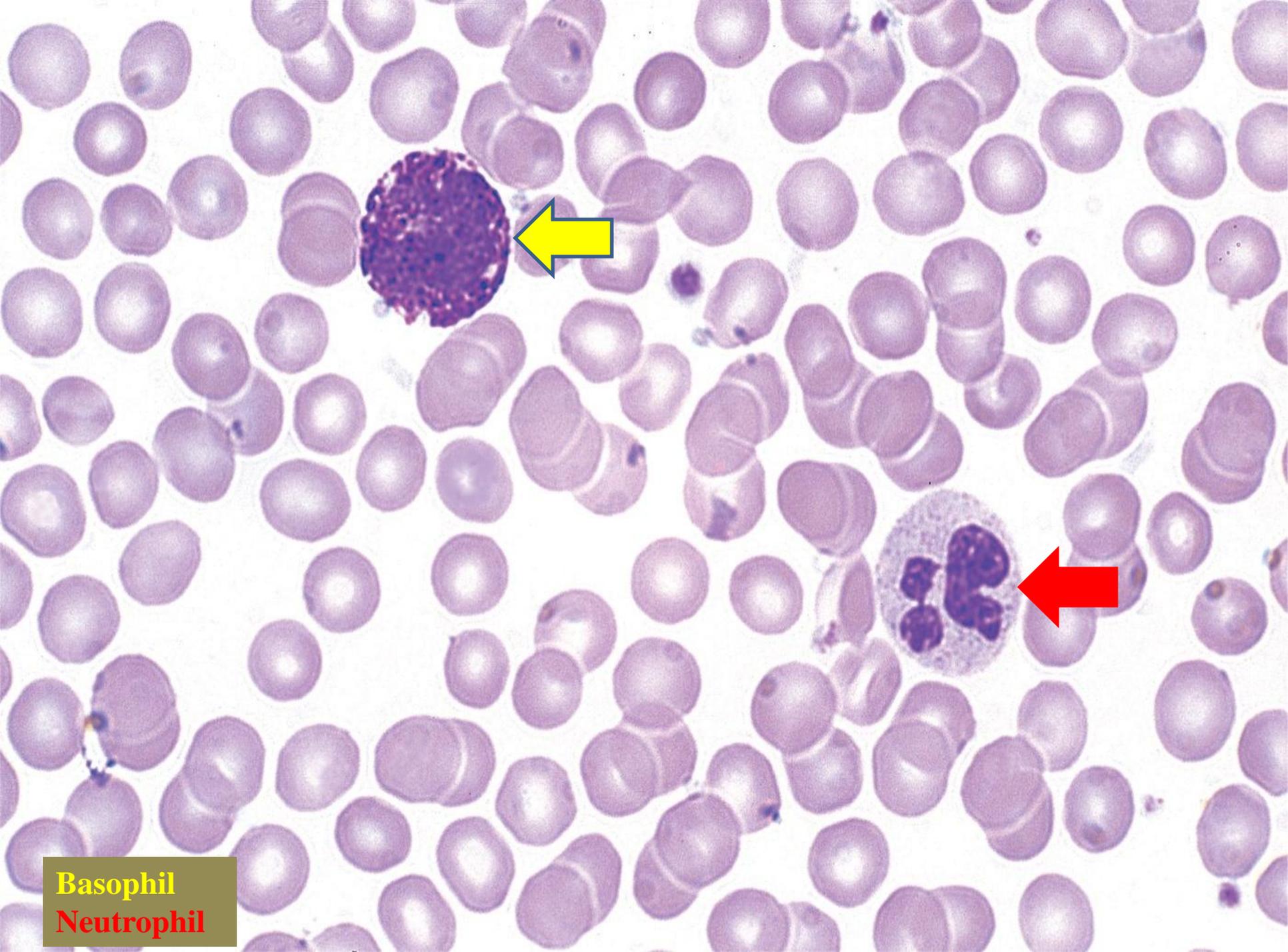
These are azurophilic non specific granules not specific granules



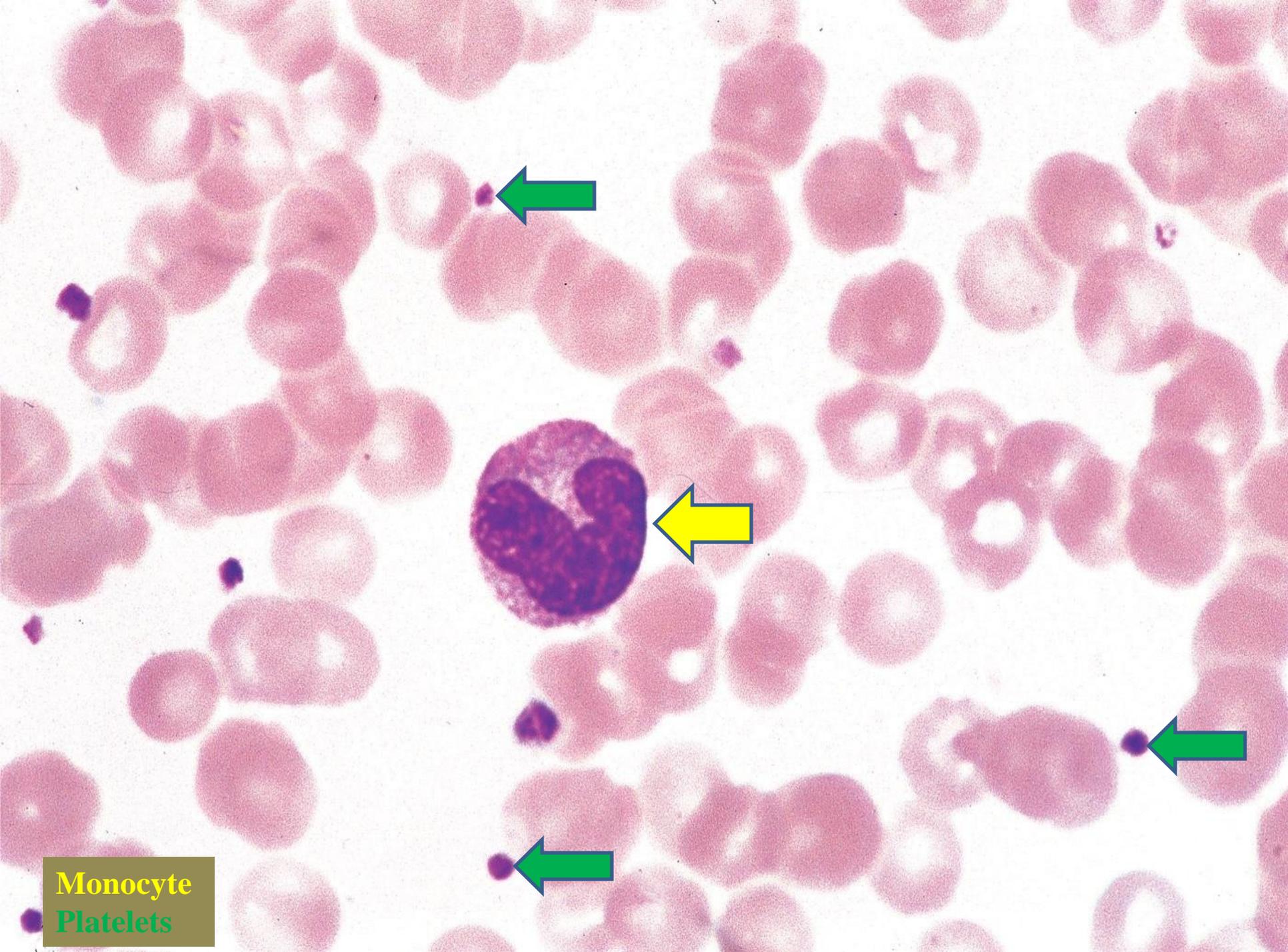
Monocyte



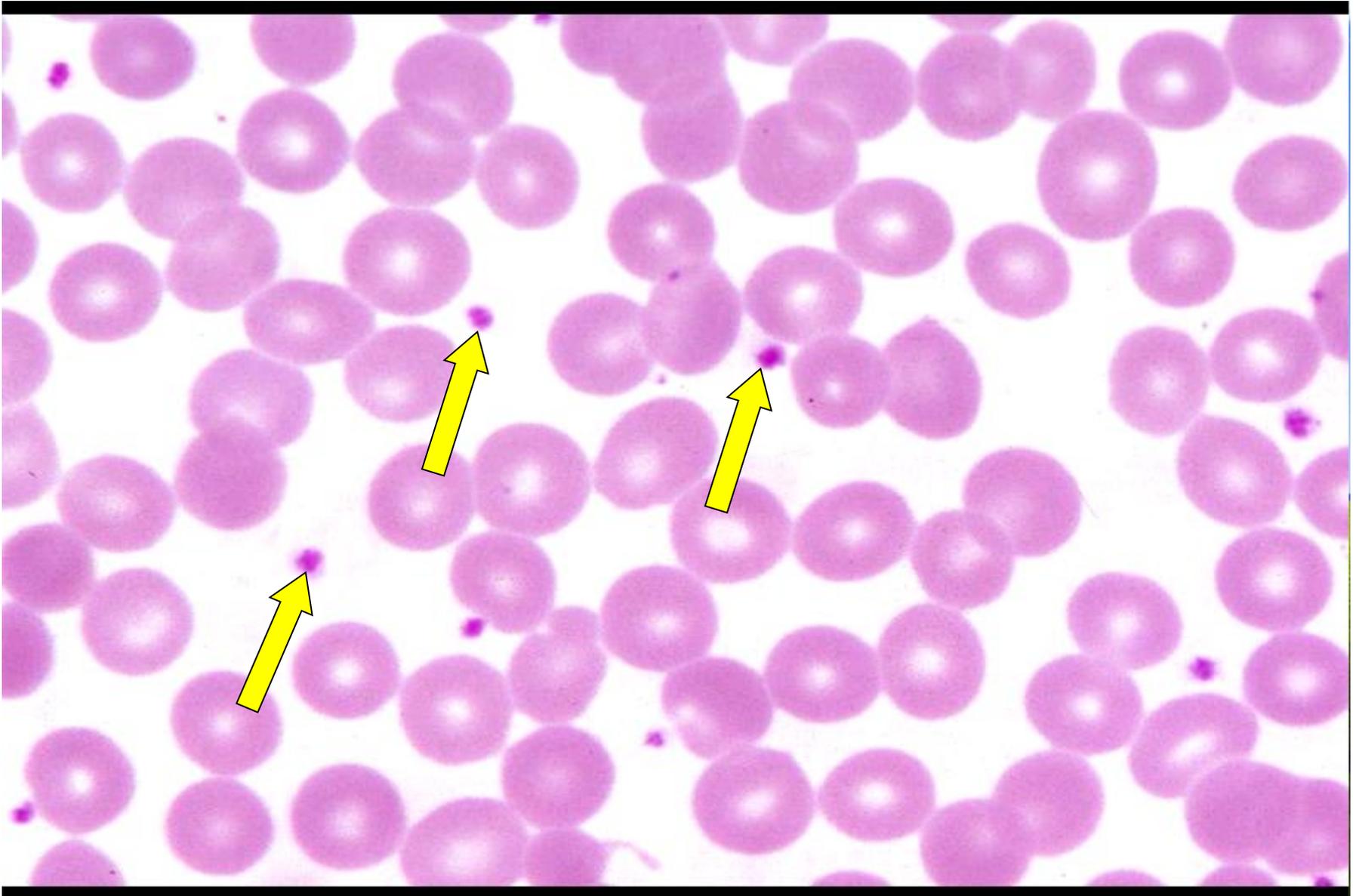
Basophil



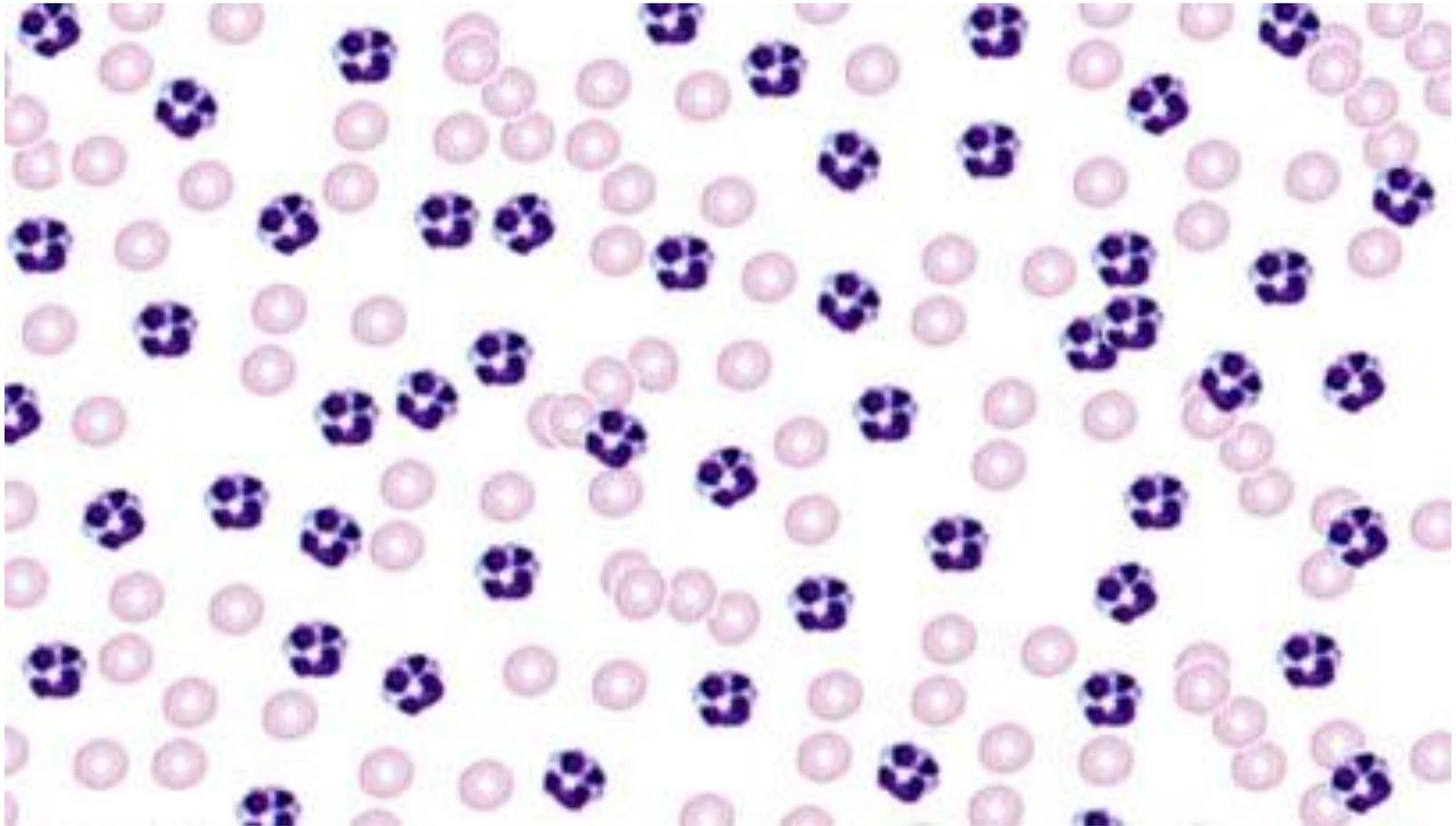
Basophil
Neutrophil



Monocyte
Platelets



Platelets

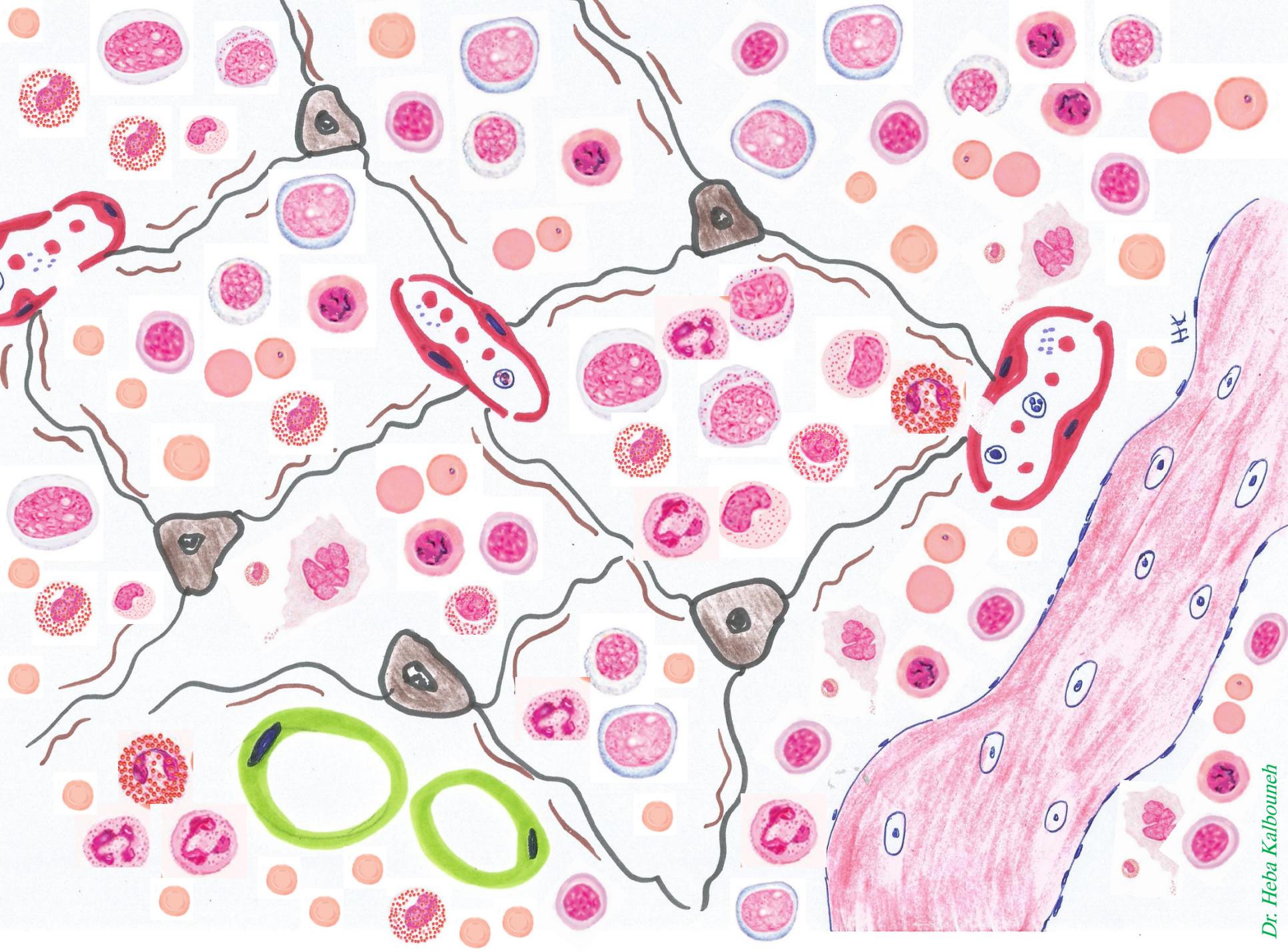


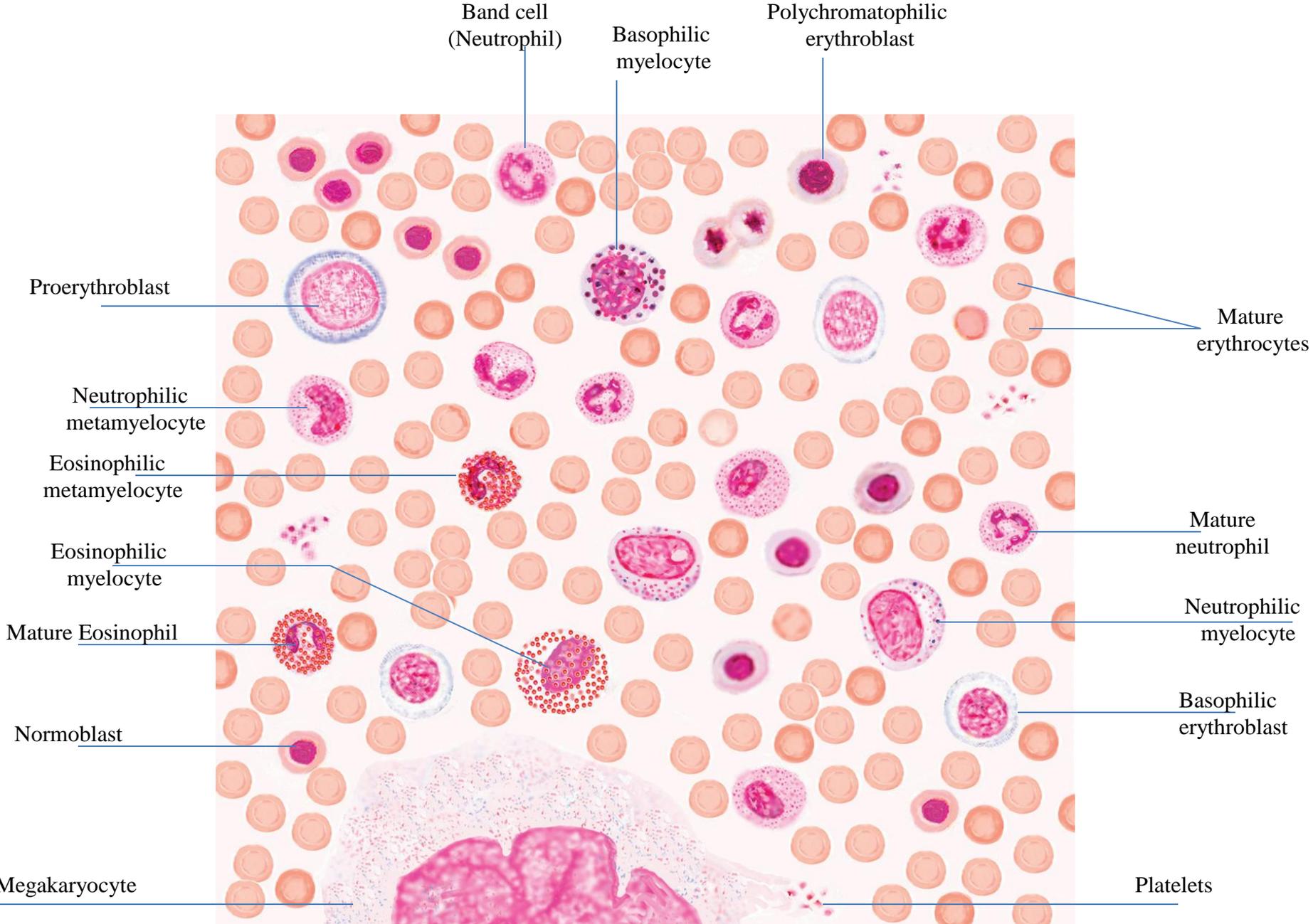
Don't Worry, Be Happy! ☺

Bone marrow

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

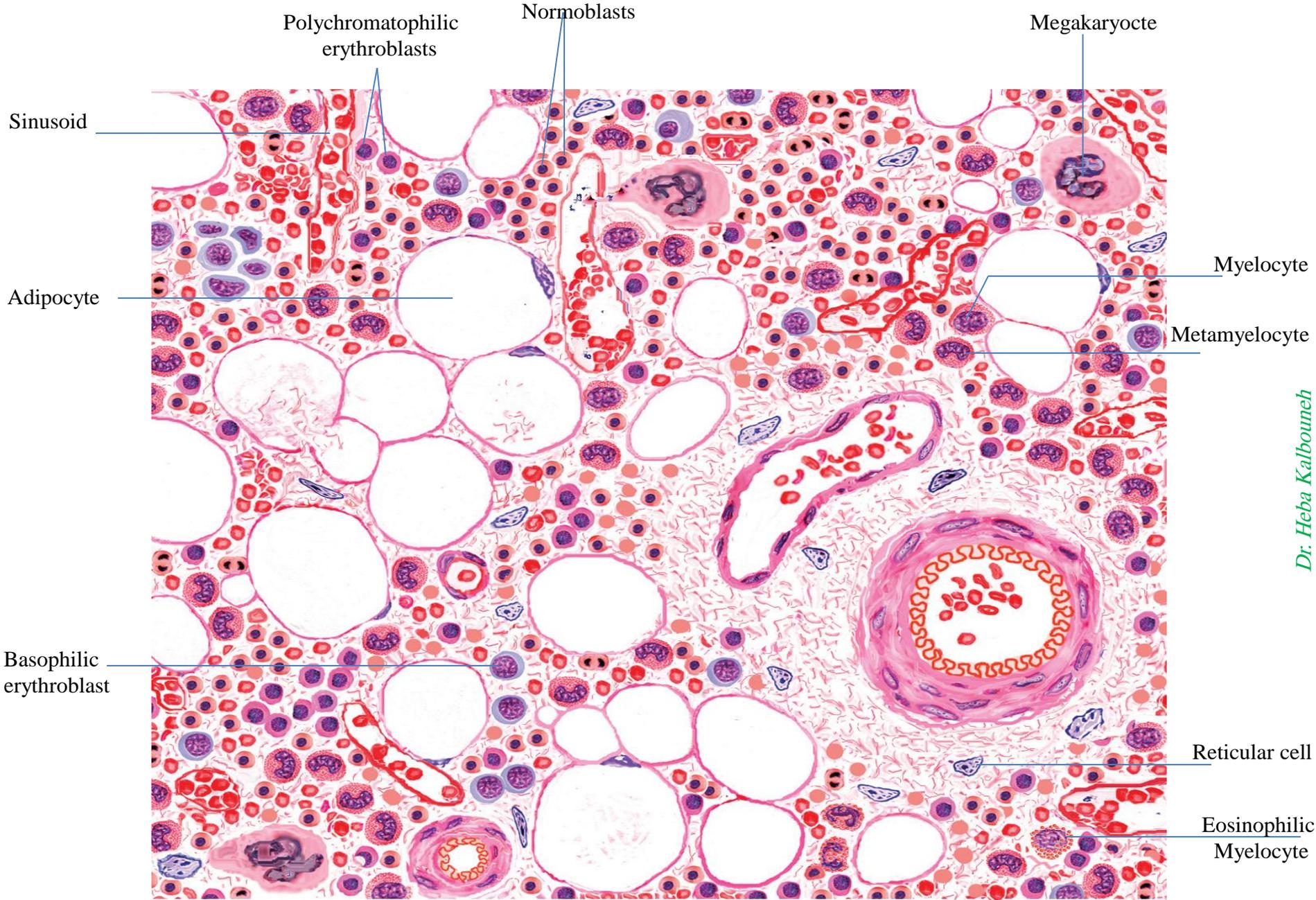
While yellow bone marrow consists mainly of adipocytes





Red Bone Marrow (Giemsa stain)

Dr. Heba Kalbouneh



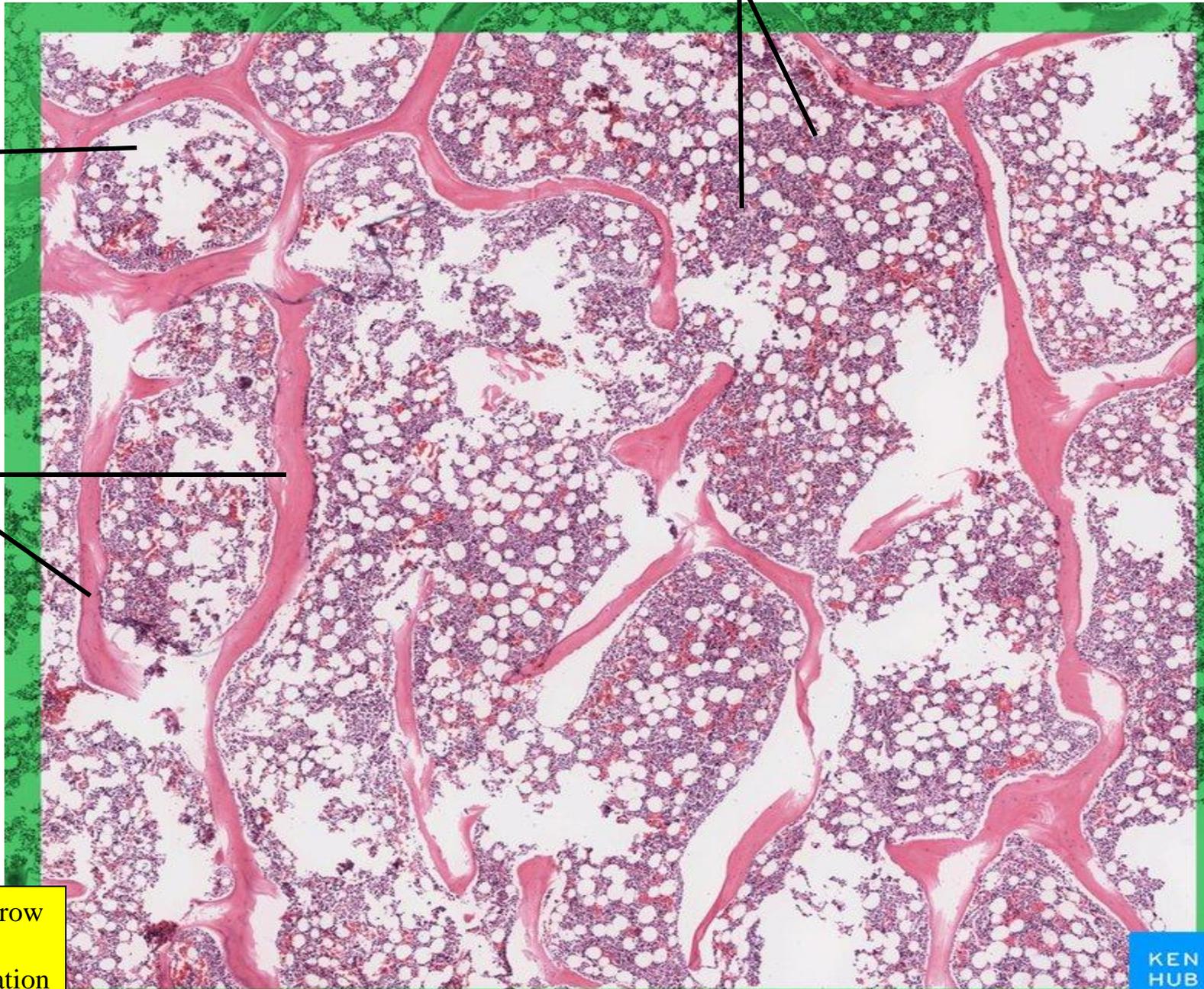
Dr. Heba Kalbouneh

Red Bone Marrow (H&E)

Hematopoietic cords

Adipocytes

Trabeculae of
spongy bone



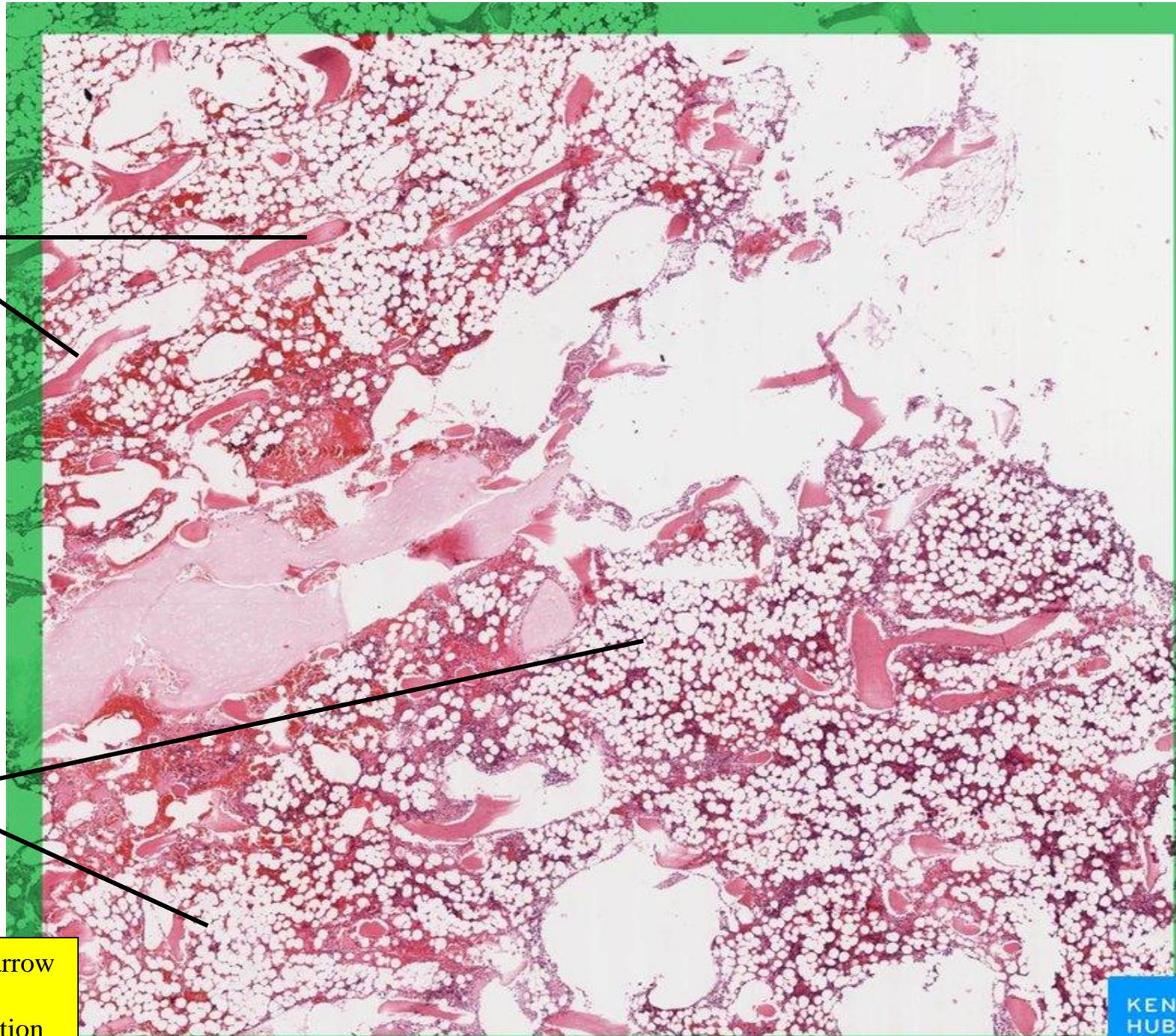
Red Bone Marrow
H&E
Low magnification

KEN
HUB

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

Trabecula

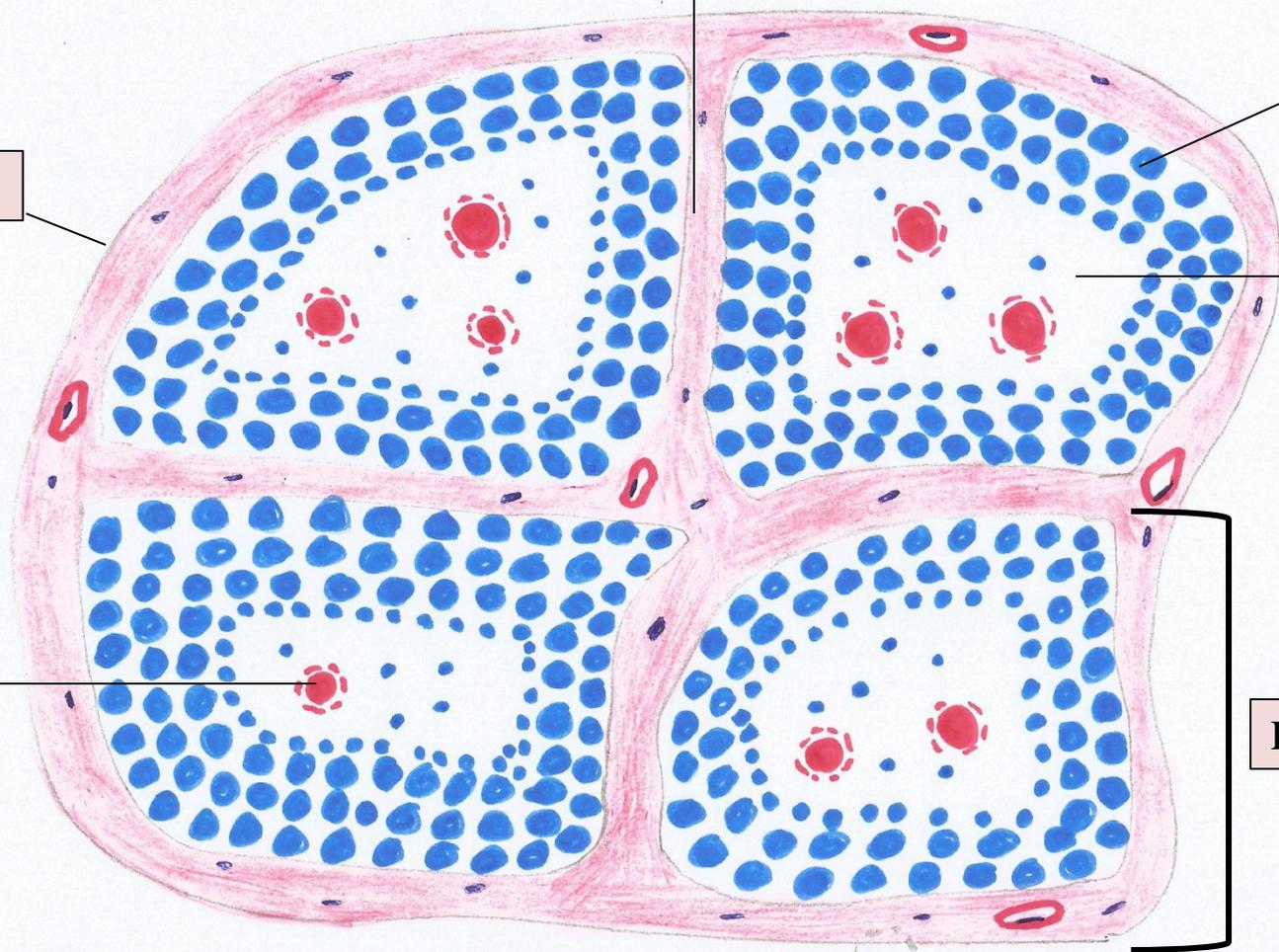
Cortex

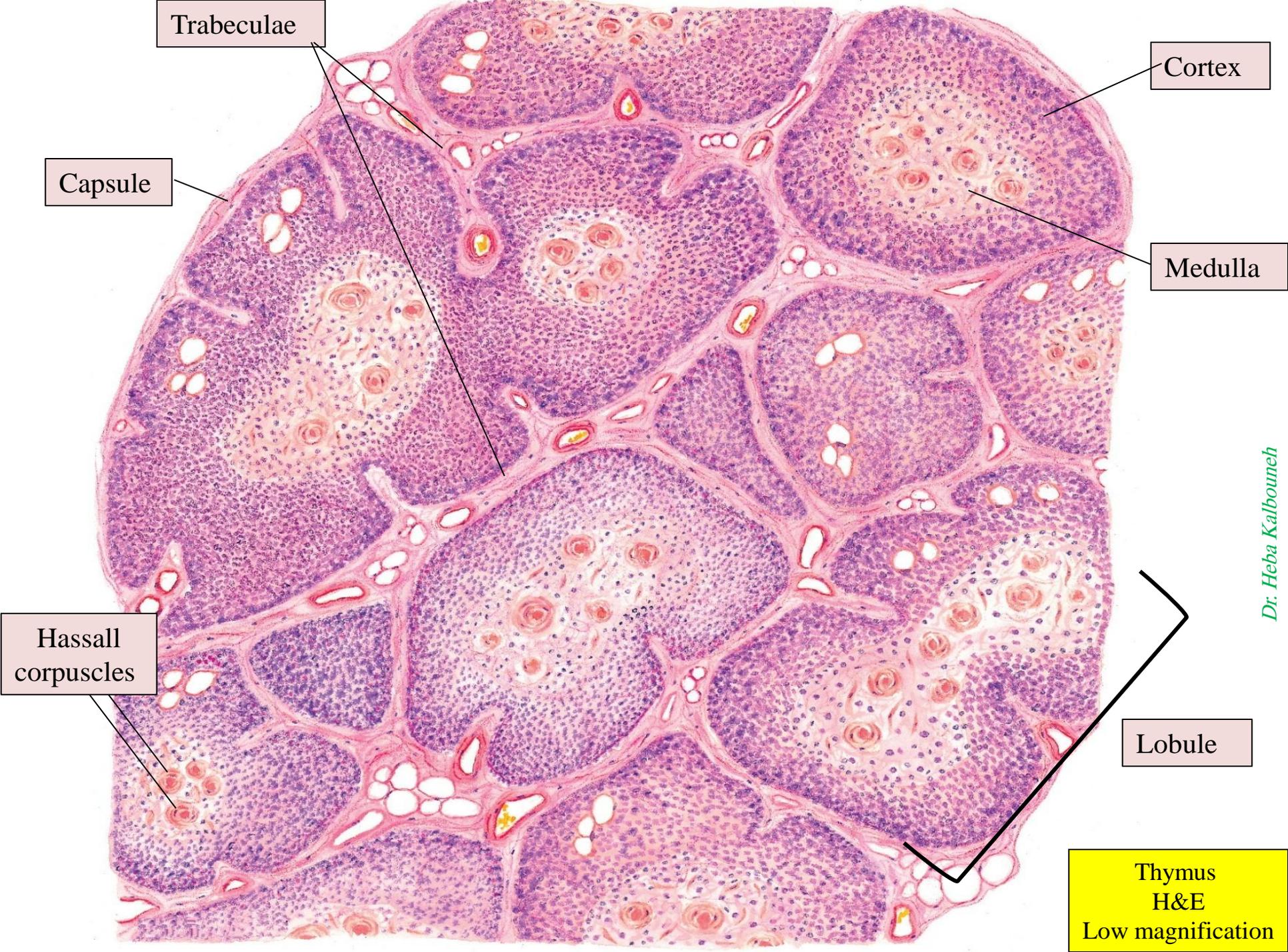
Capsule

Medulla

Hassall corpuscle

Lobule





Trabeculae

Cortex

Capsule

Medulla

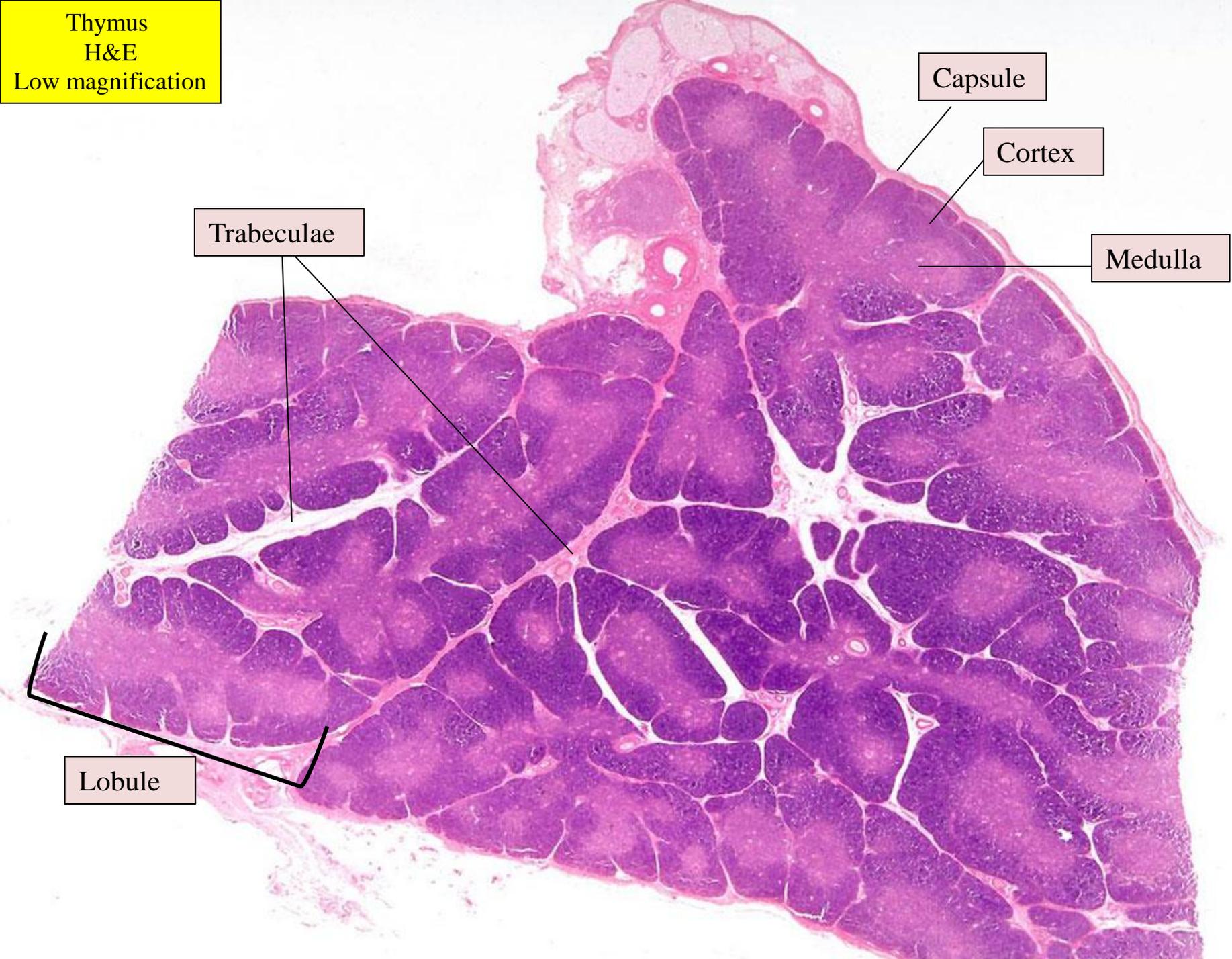
Hassall corpuscles

Lobule

Thymus
H&E
Low magnification

Dr. Heba Kalbouneh

Thymus
H&E
Low magnification



Capsule

Cortex

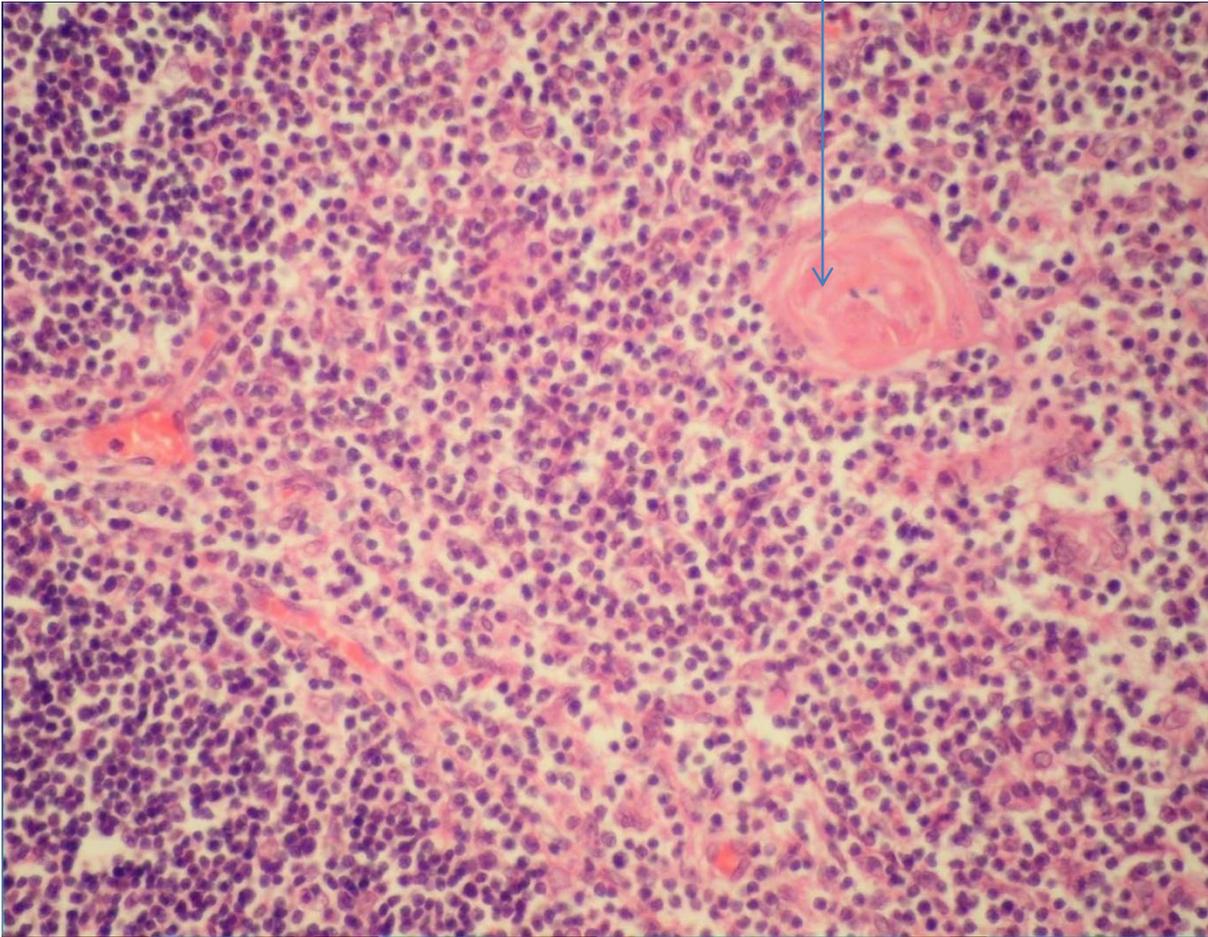
Medulla

Trabeculae

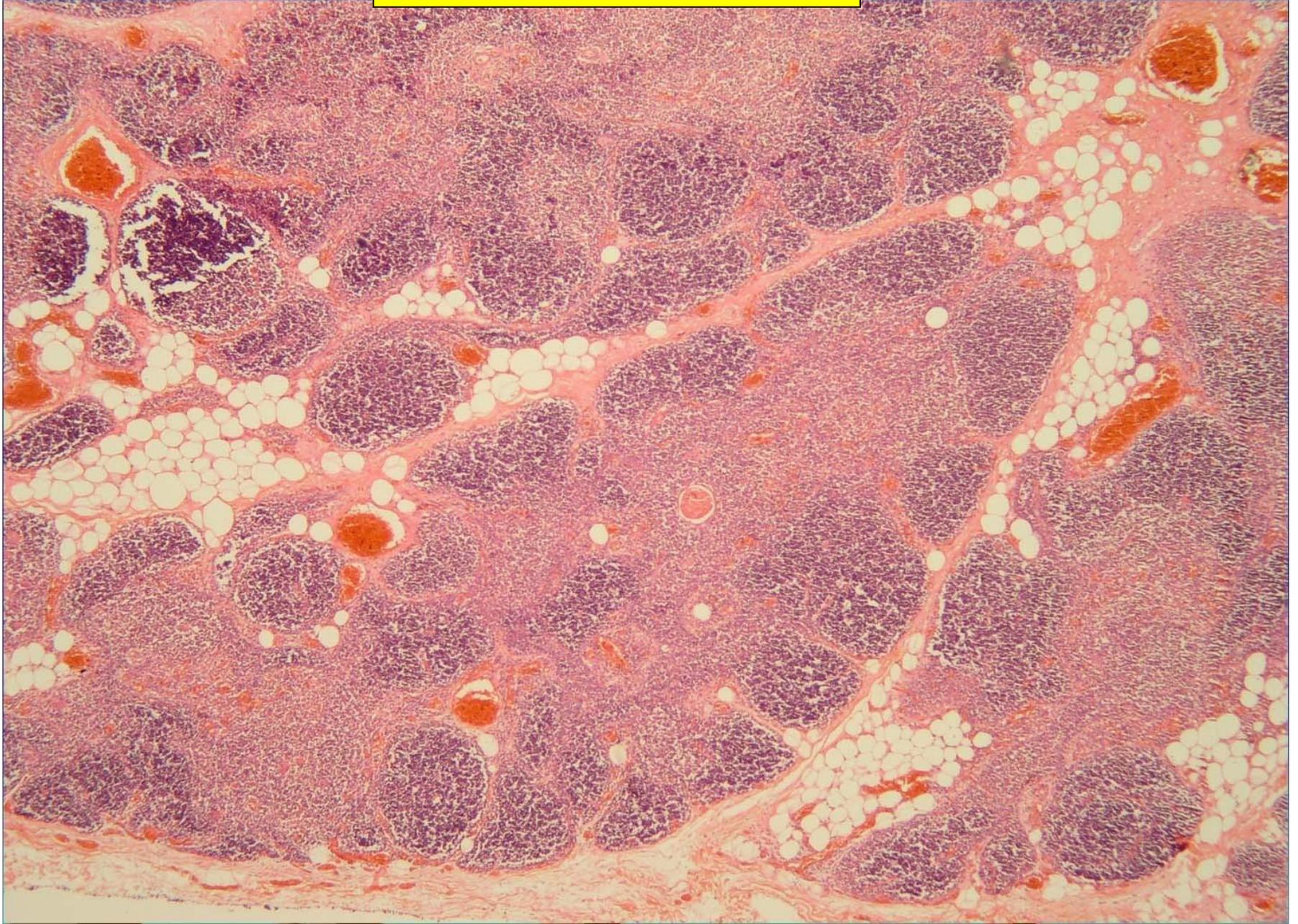
Lobule

Thymic medulla
H&E
High magnification

Hassall
Corpuscle in medulla

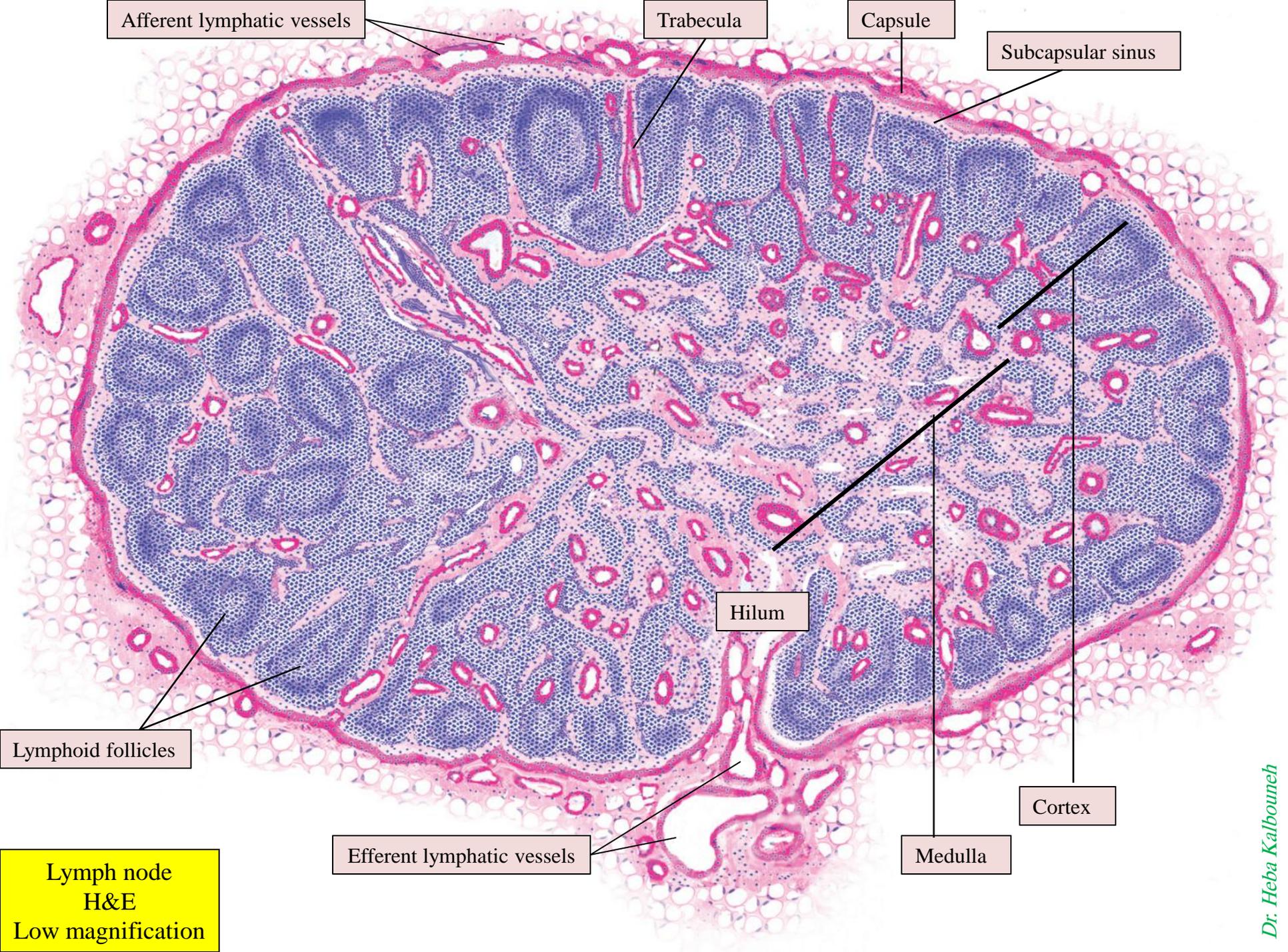


Involved Thymus
H&E
Low magnification



Lymph nodes

The lymph node is encased by a capsule. The lymph enters the node via afferent lymphatic vessels. The capsule and trabeculae, which extend into the node from the capsule, provide the main structural support. Note the B-cell containing lymphoid follicles located in the outer cortex. The medulla contains medullary cords (aggregates of lymphoid tissue) and medullary sinuses (lymphatic channels). Between the outer cortex and medulla lies an ill-defined region called the paracortex (inner cortex). The hilum of the lymph node is the location where blood vessels enter and exit the node. It is also where the medullary sinuses merge into efferent lymphatic vessels, which carry the lymph away from the node.



Lymph node
H&E
Low magnification

Lymph node
H&E
Higher magnification

Cortex

Medulla



Lymphoid follicles

Capsule

Subcapsular sinus

Germinal center

Trabecula

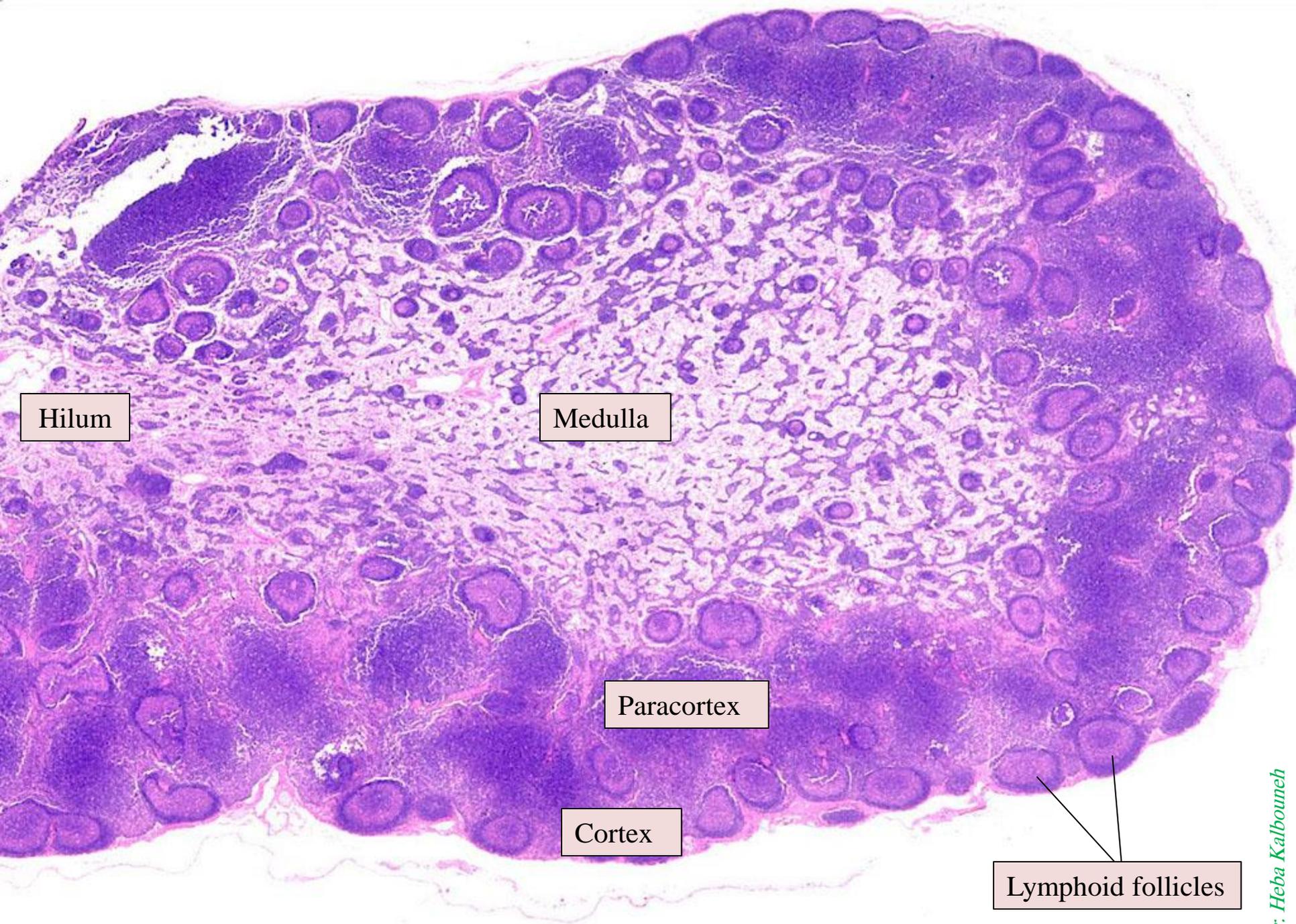
Subtrabecular sinus

Paracortex

What type of cells would you expect to find in the paracortex?

Medullary sinuses

Medullary cords



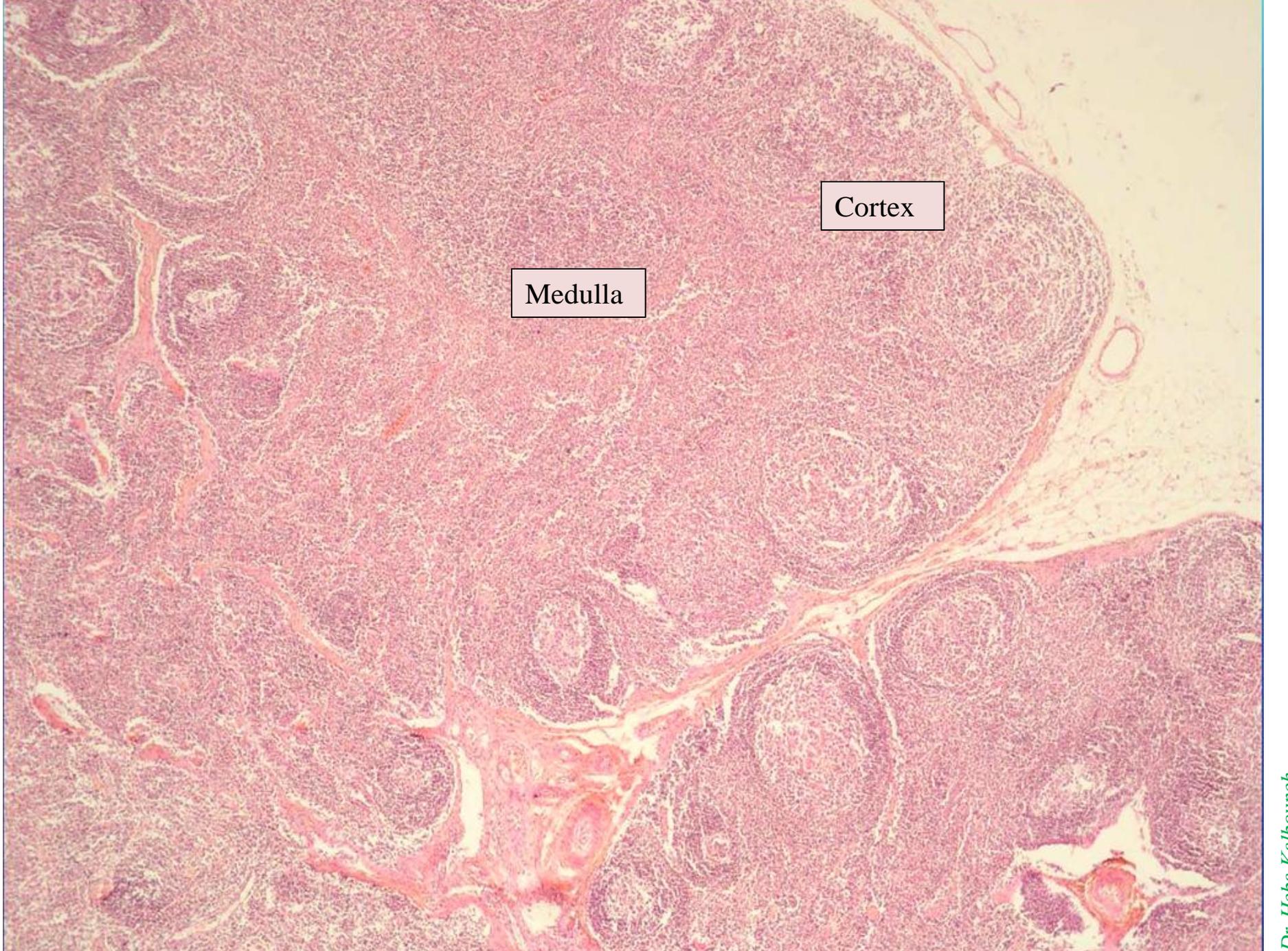
Hilum

Medulla

Paracortex

Cortex

Lymphoid follicles

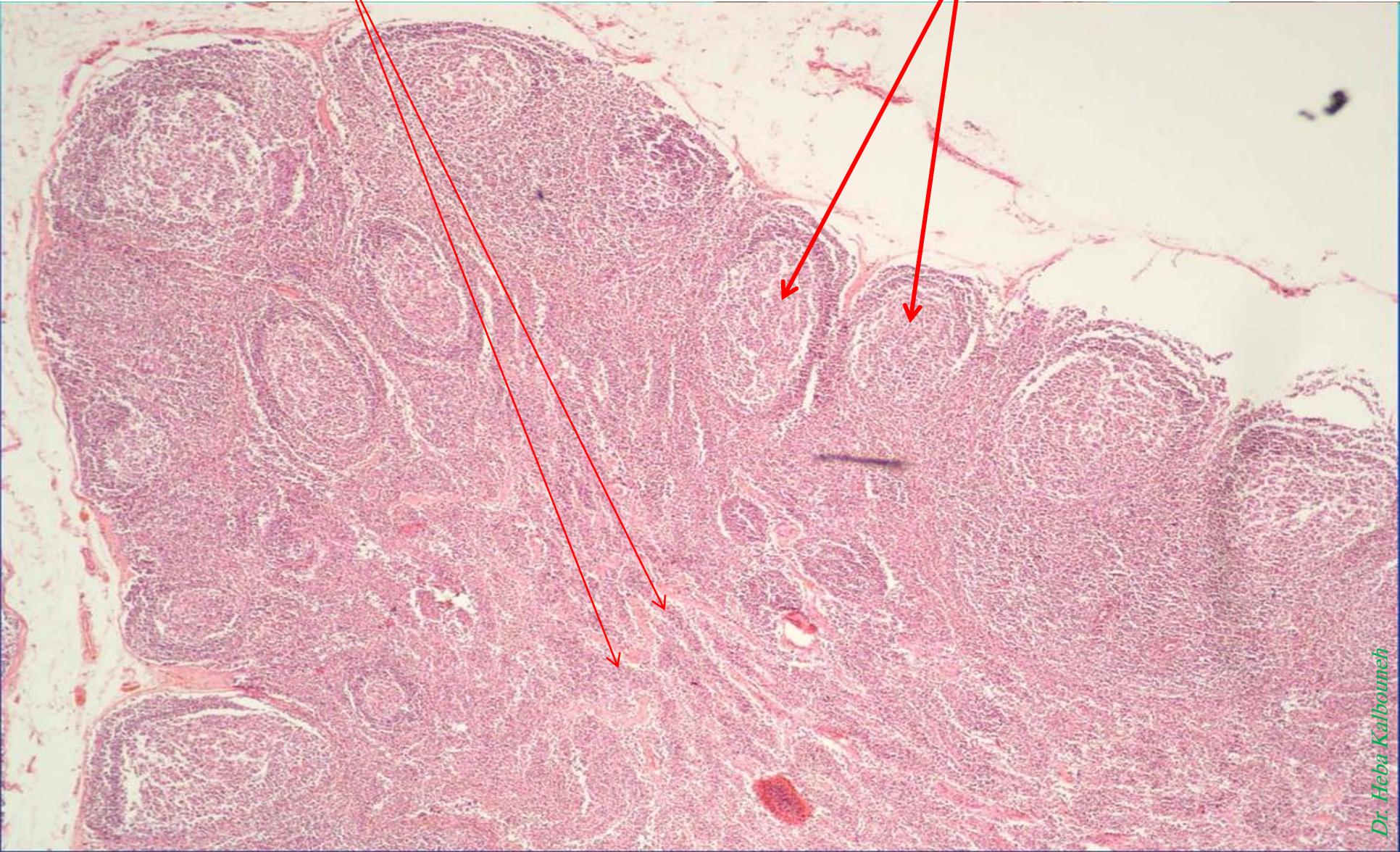


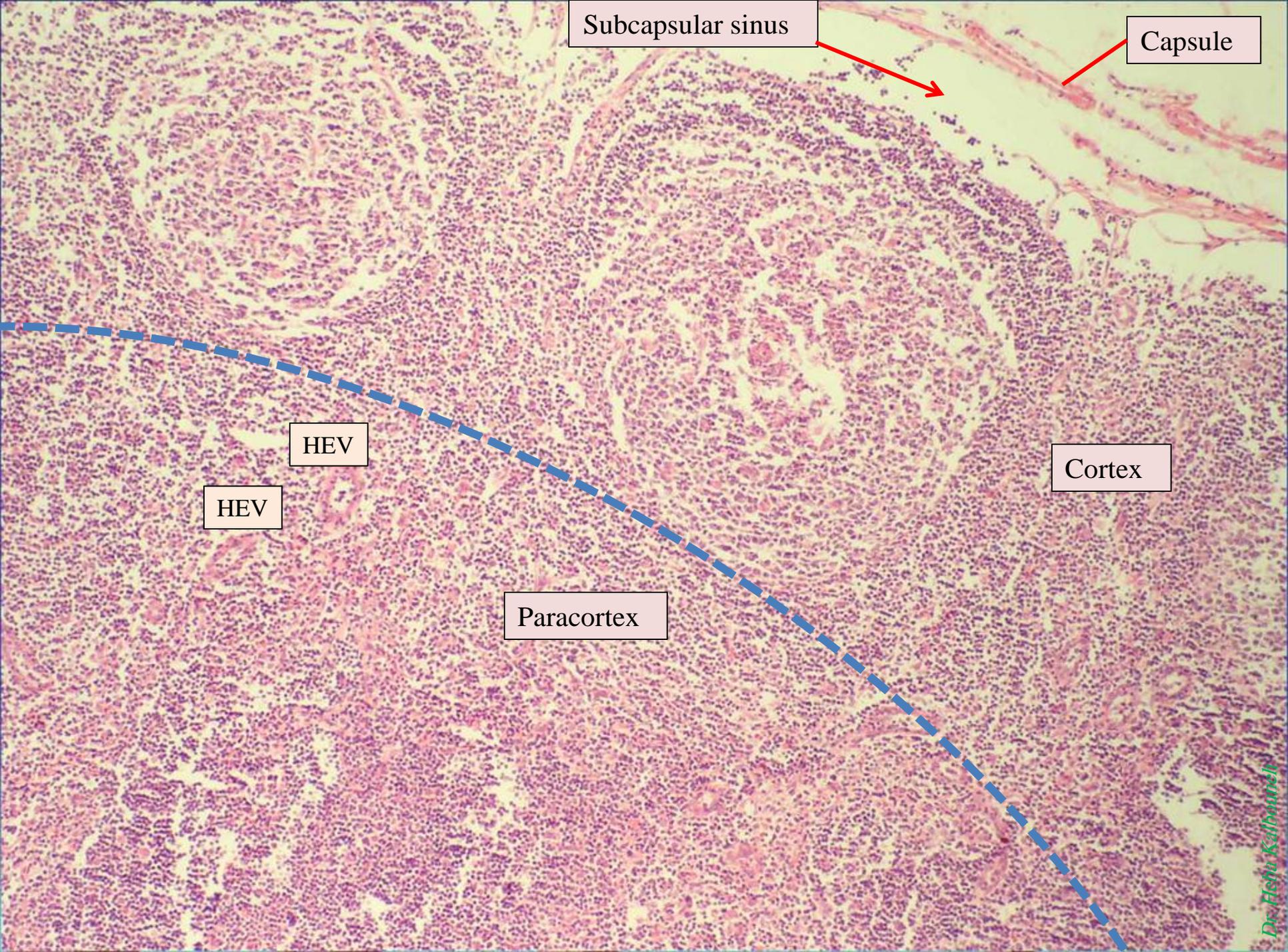
Cortex

Medulla

Medullary cords

Lymphoid follicles





Subcapsular sinus

Capsule

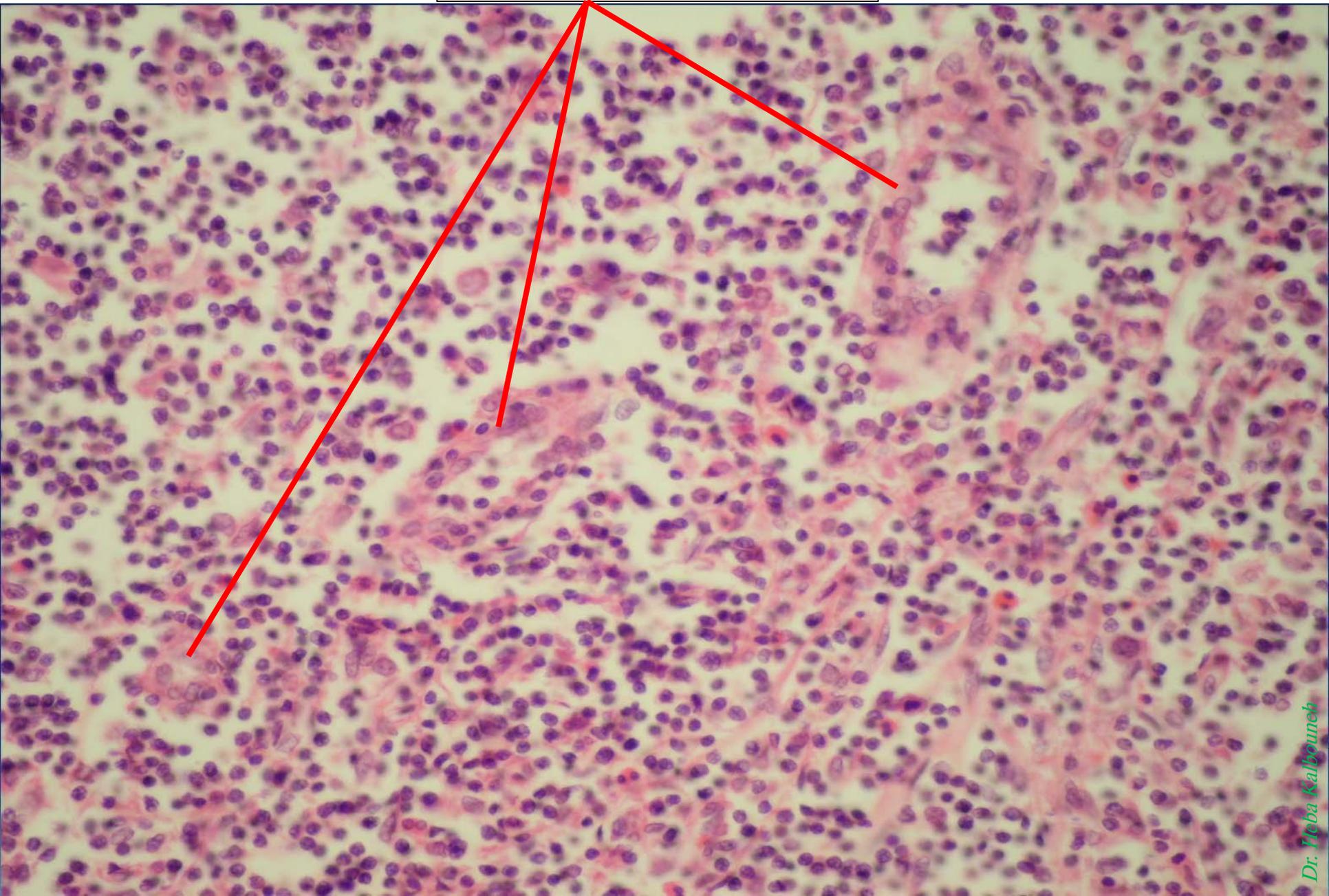
HEV

HEV

Cortex

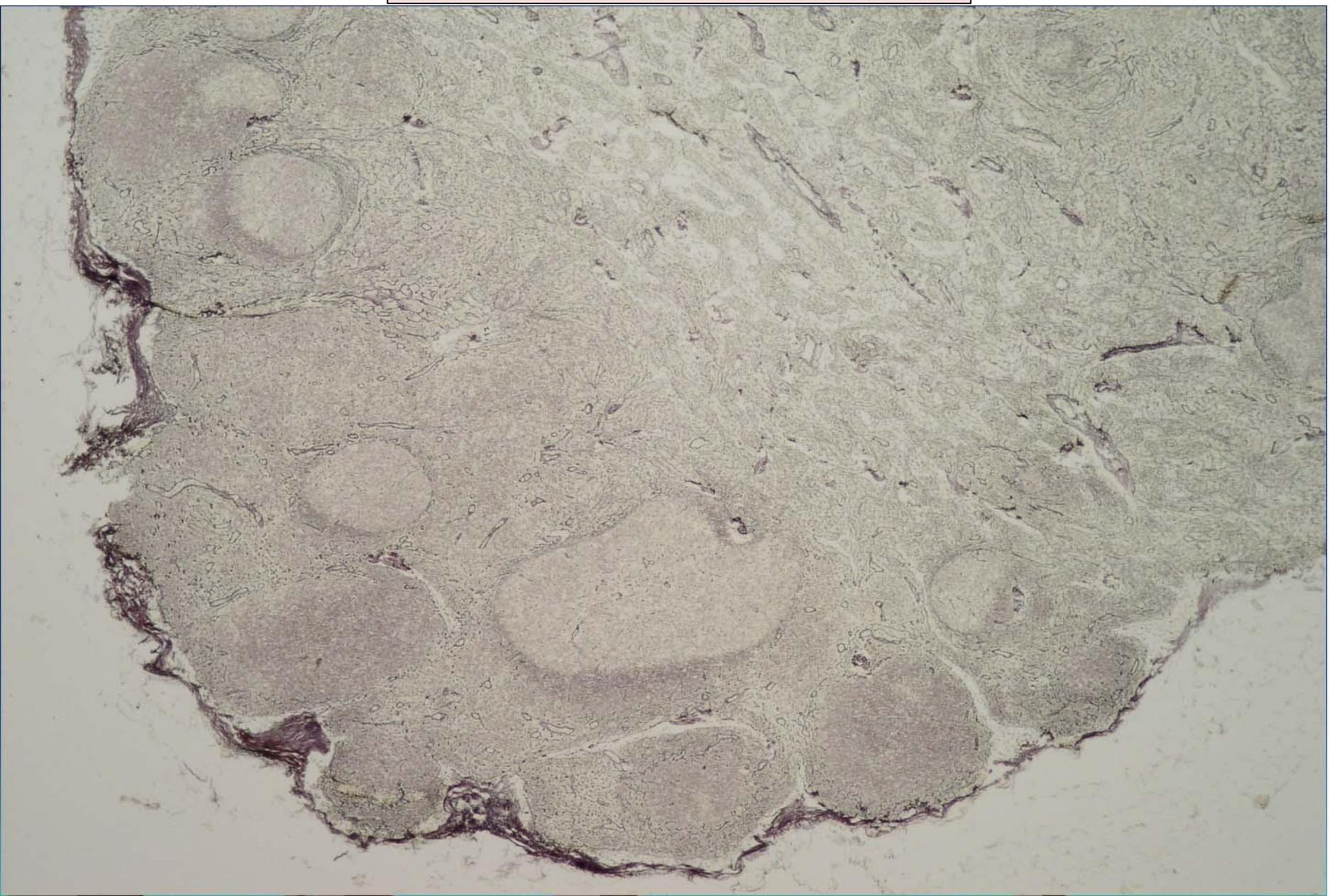
Paracortex

HEVs in paracortex



Lymph node- Silver Stain

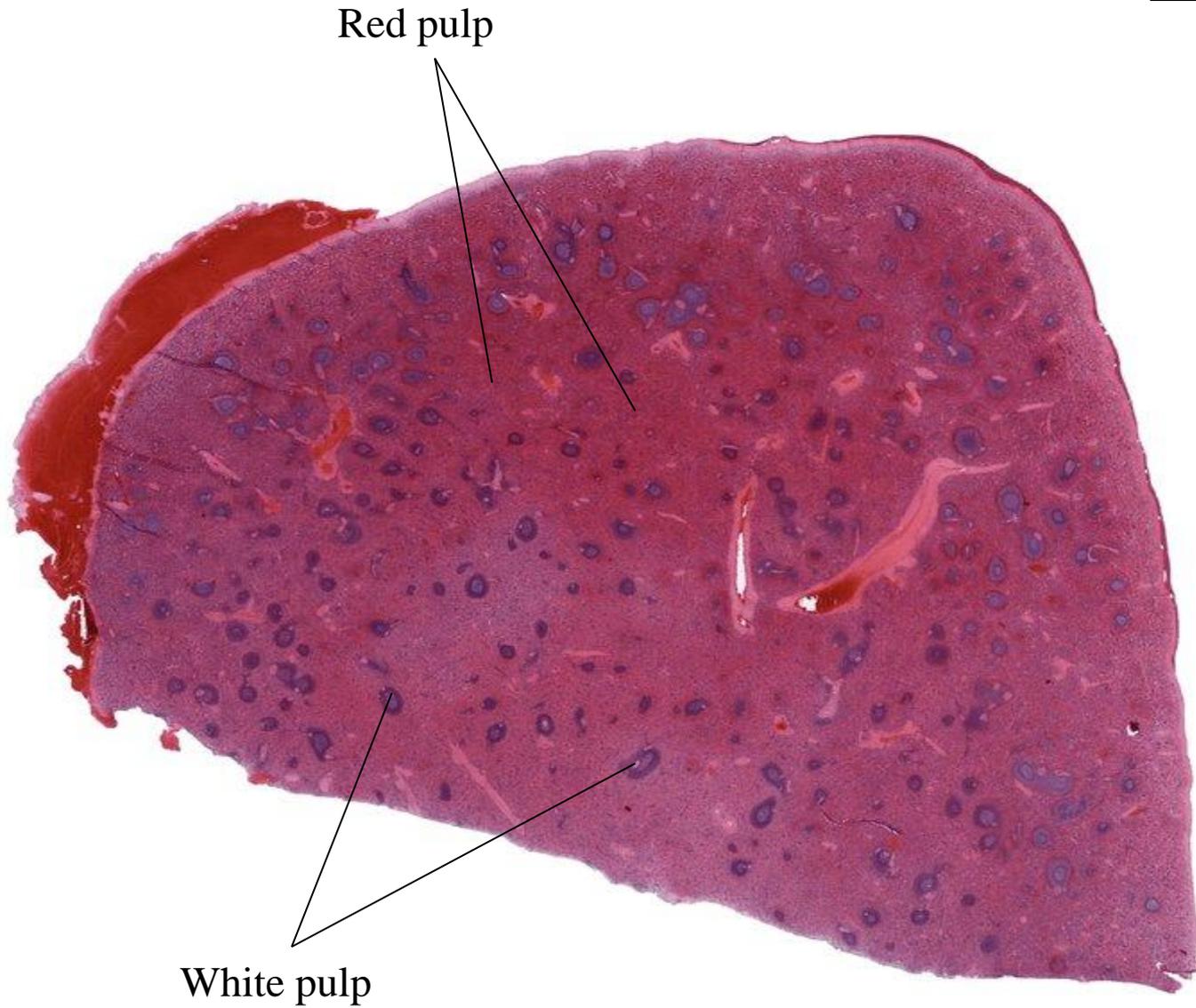
Remember: reticular fibers are argyrophilic



Spleen

On the outer edge of spleen, note the presence of a capsule from which short trabeculae (containing a trabecular artery and trabecular vein) extend into the parenchyma. In contrast to lymph nodes and thymus, the spleen is not arranged into cortex and medulla. Instead, the majority of the spleen consists of well-vascularized red pulp (pale-stained due to lower cell density) with white pulp (lymphoid aggregations) scattered throughout.

Note the presence of sinuses within the red pulp.



Spleen
H&E
Low magnification

Capsule

Central arteriole

Germinal center

Trabecula

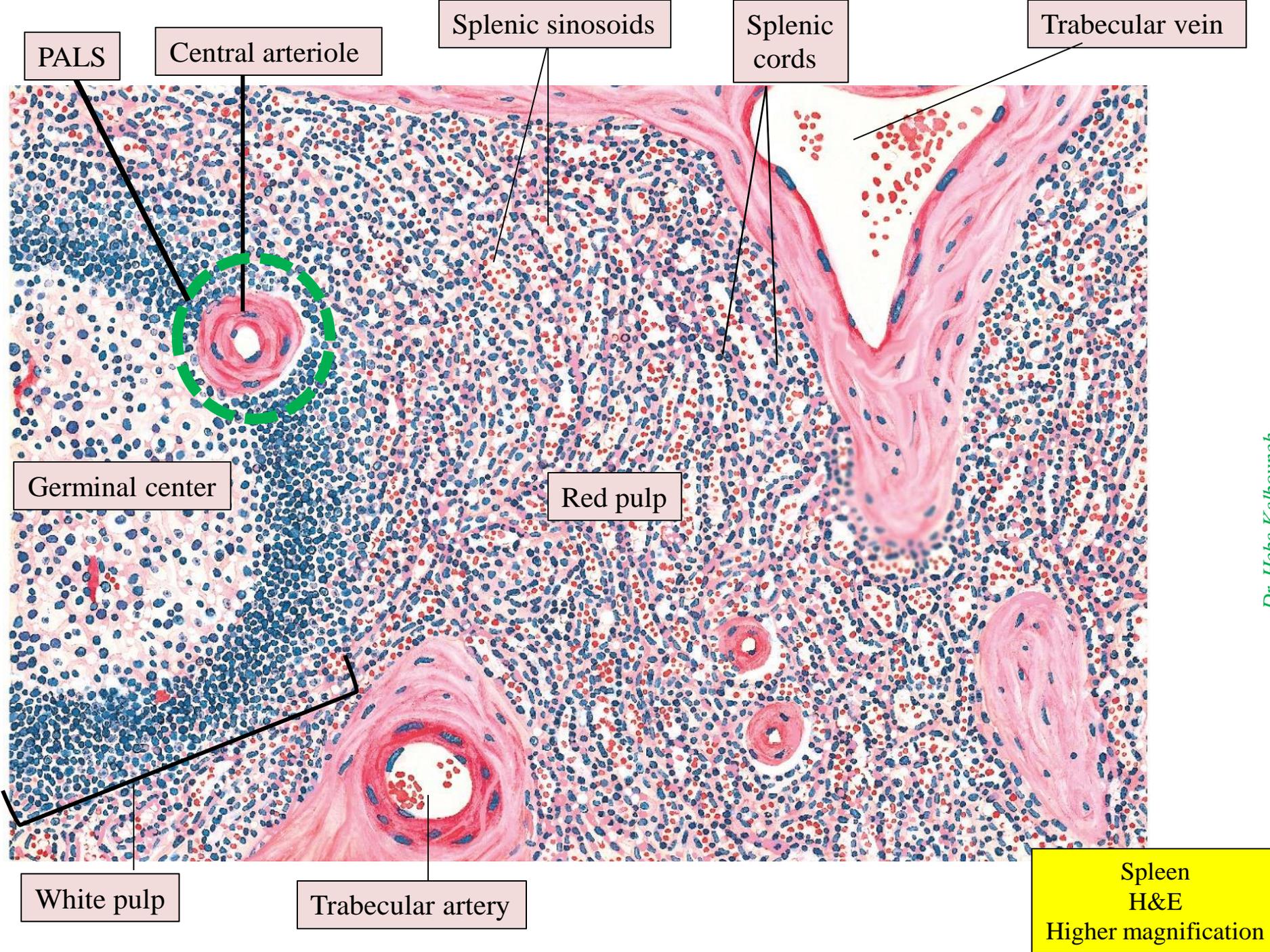
PALS

Trabeculae containing
trabecular
artery and
vein

Lymphoid follicle
(white pulp)

Red pulp





PALS

Central arteriole

Splenic sinusoids

Splenic cords

Trabecular vein

Germinal center

Red pulp

White pulp

Trabecular artery

Spleen
H&E
Higher magnification

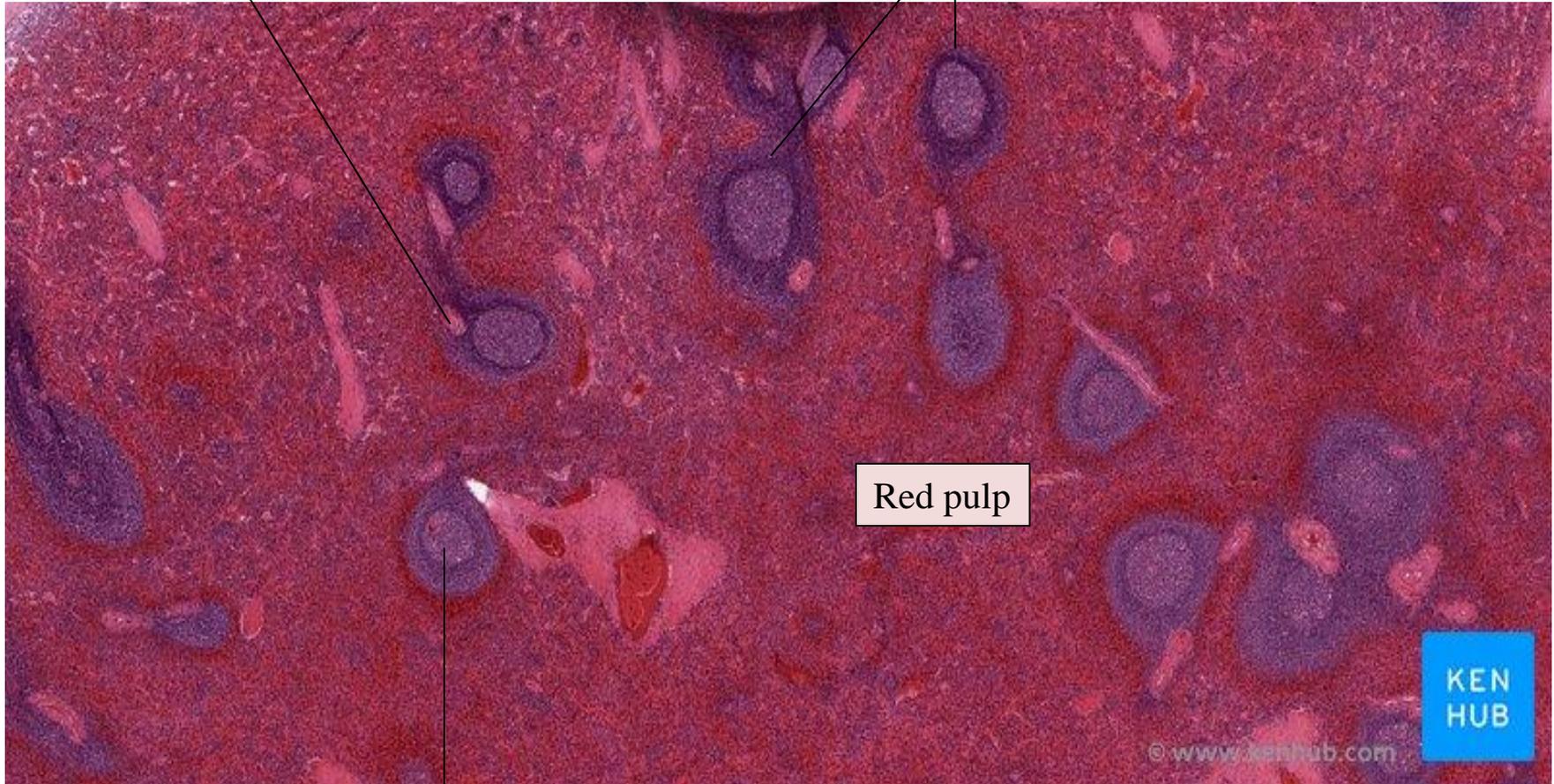
Dr. Heba Kalbouneh

Central arteriole

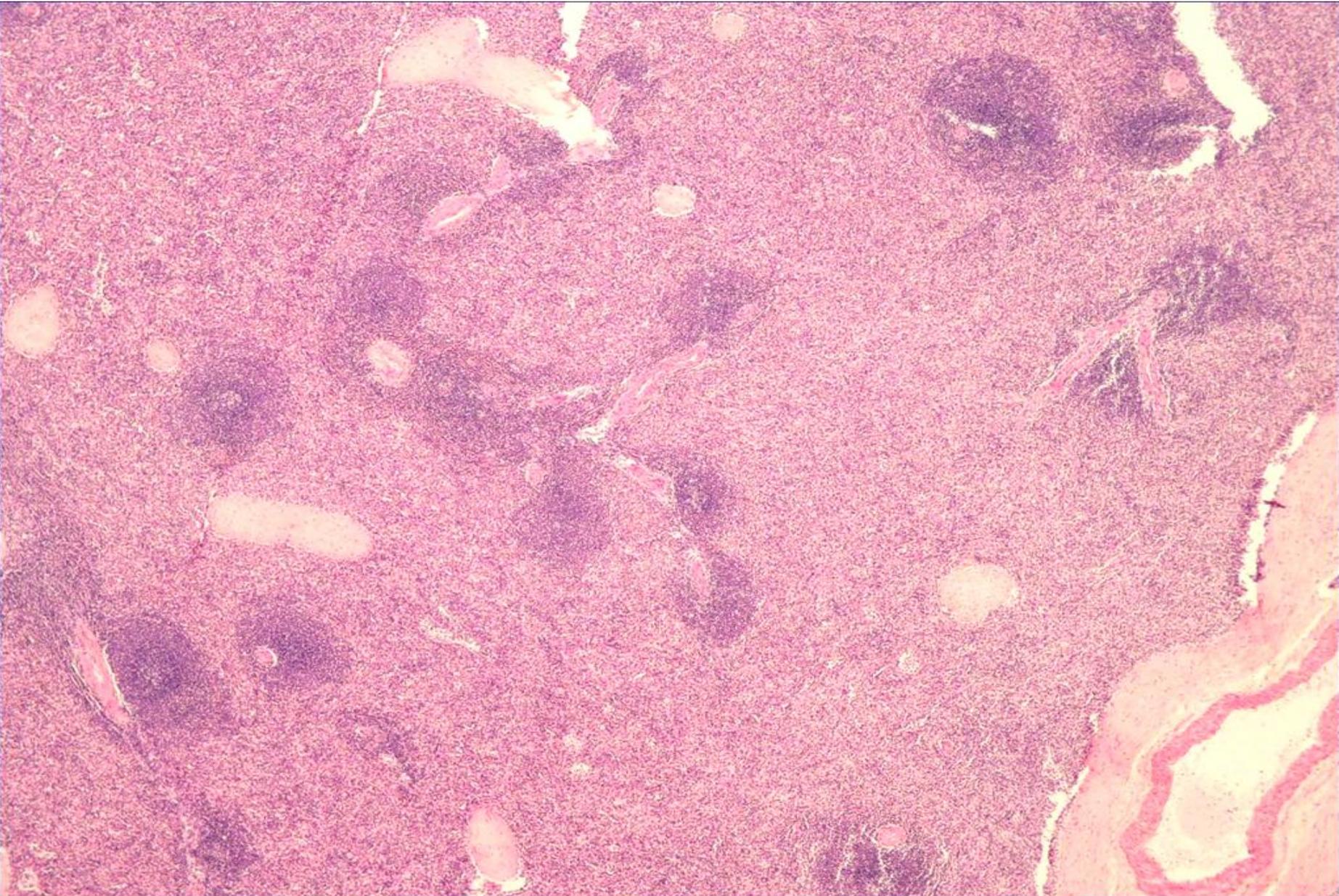
Lymphoid follicle
(white pulp)

Red pulp

Germinal center



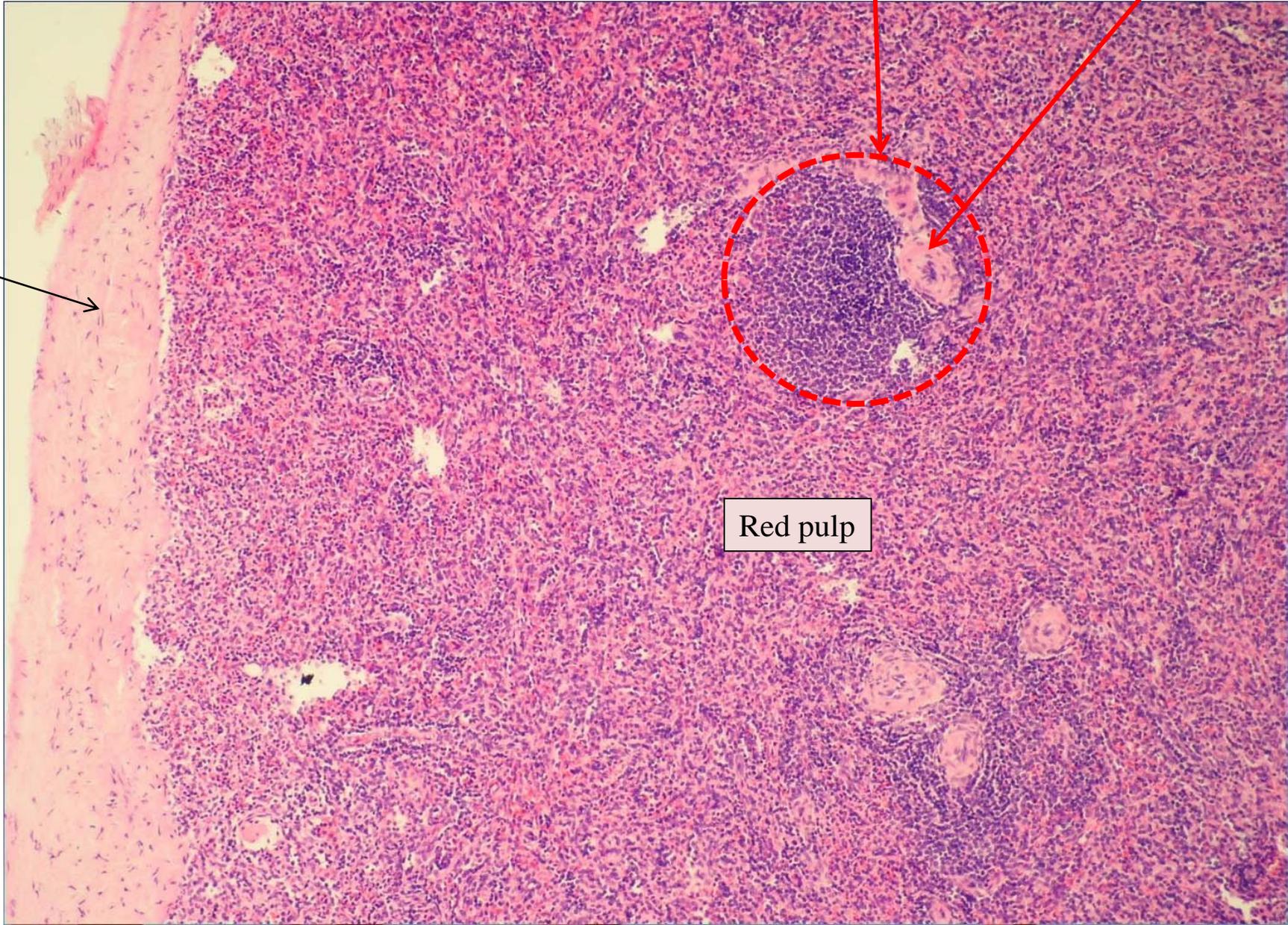
© www.kenhub.com



Capsule

Lymphoid follicle
(white pulp)

Central arteriole

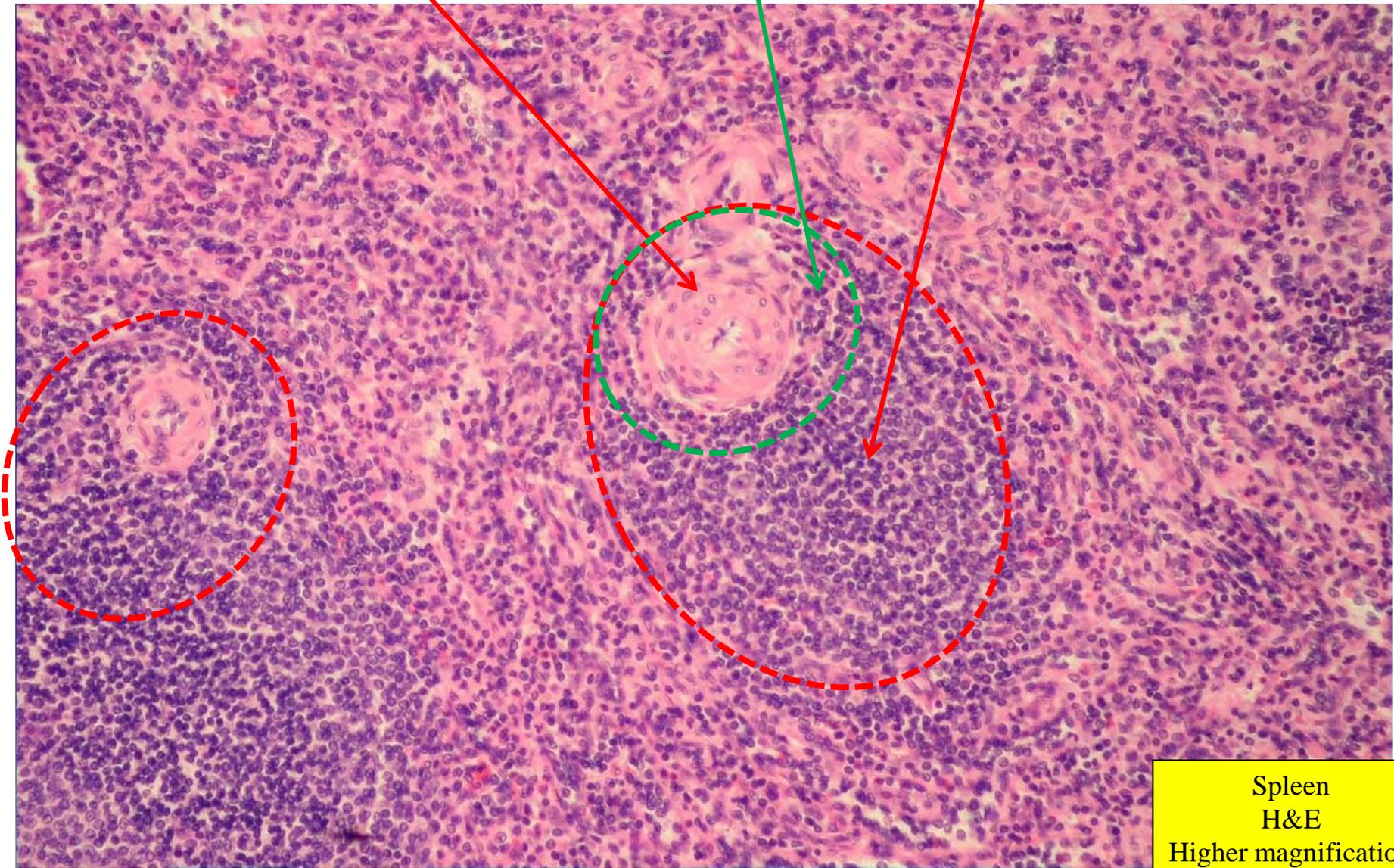


Red pulp

Central arteriole

PALS

Lymphoid follicle
(white pulp)



Spleen
H&E
Higher magnification

Palatine tonsils

Palatine tonsils

Stratified non-keratinized squamous epithelium

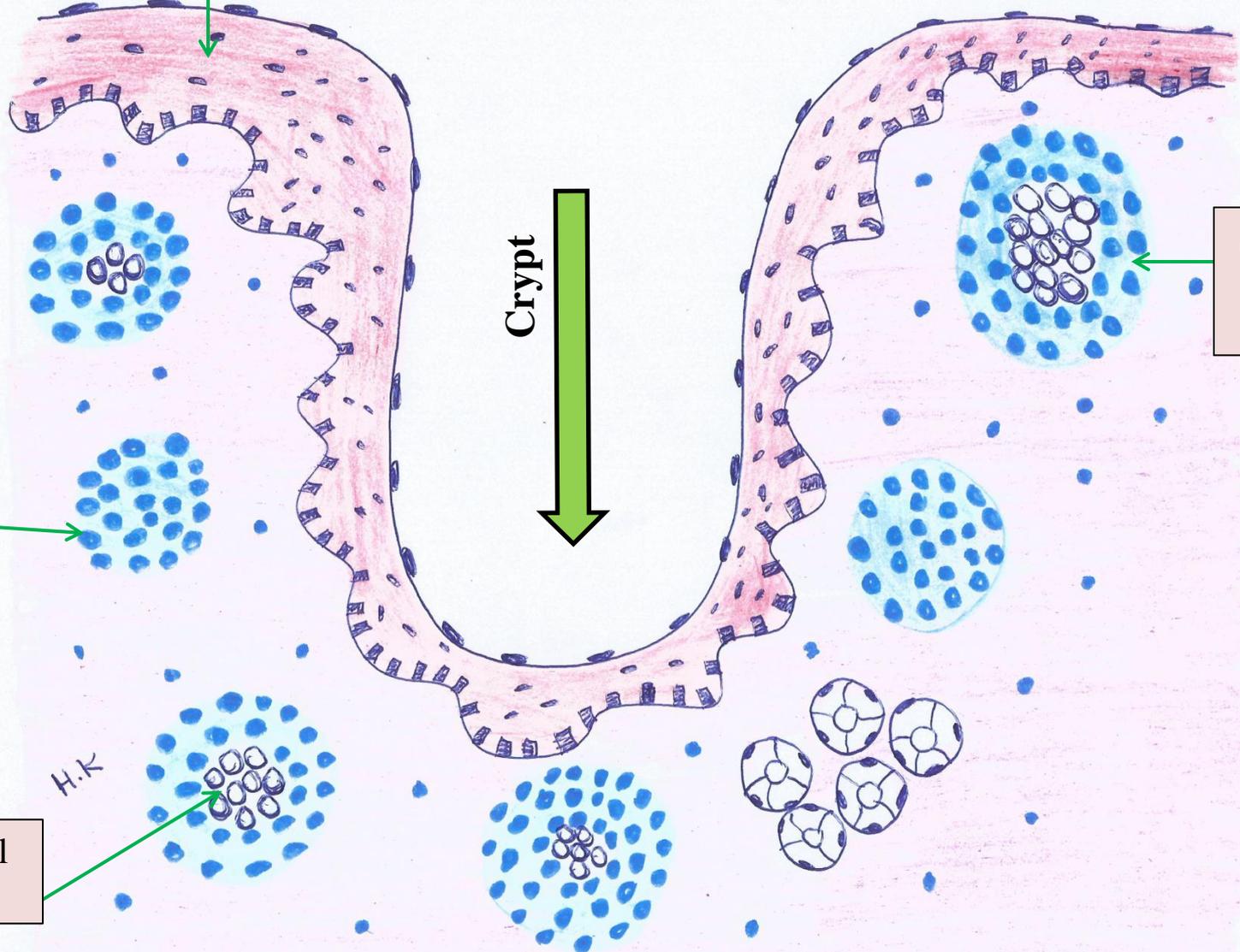
Crypt

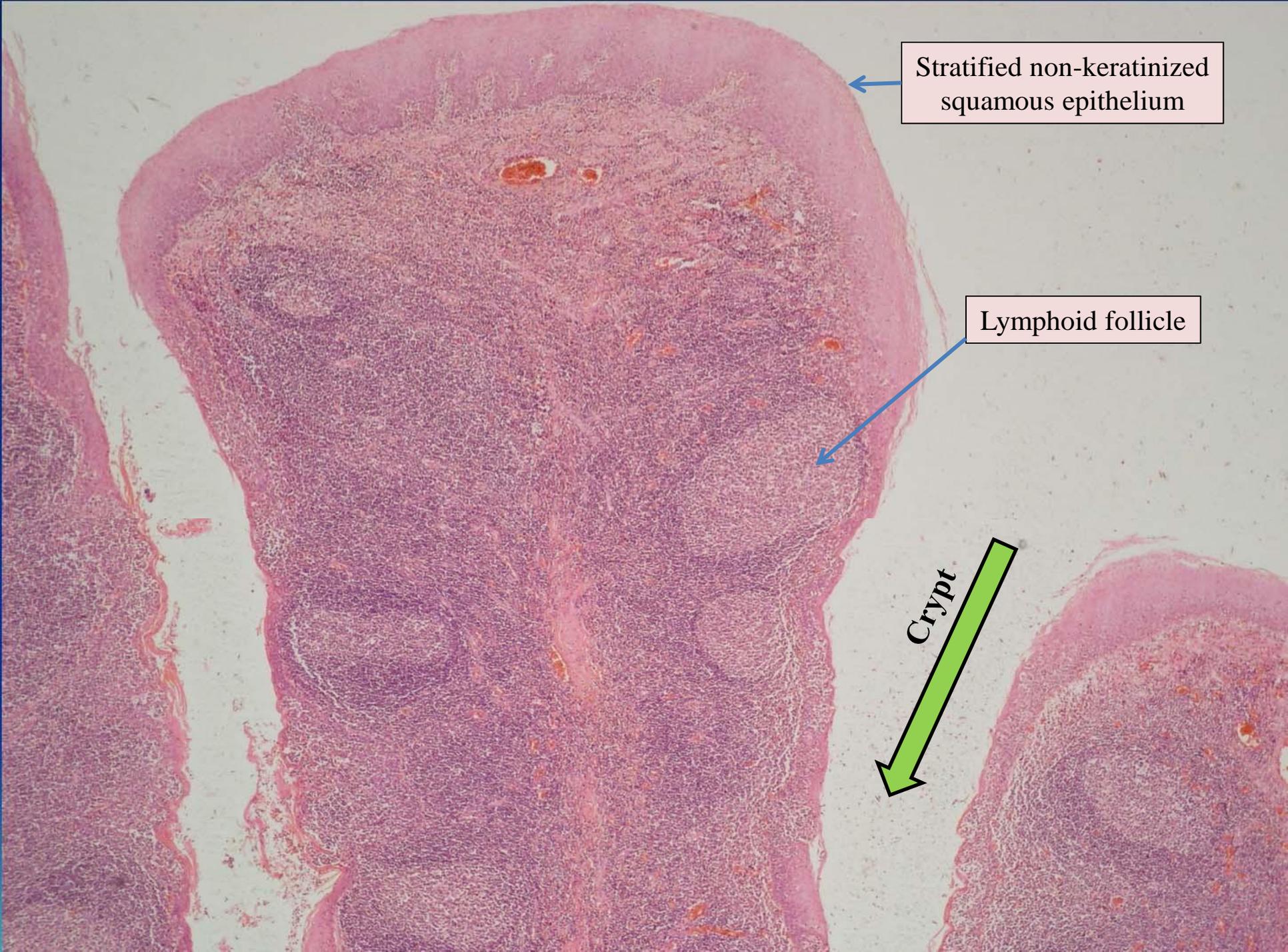
Secondary Lymphoid follicle

Primary Lymphoid follicle

Germinal center

H.K

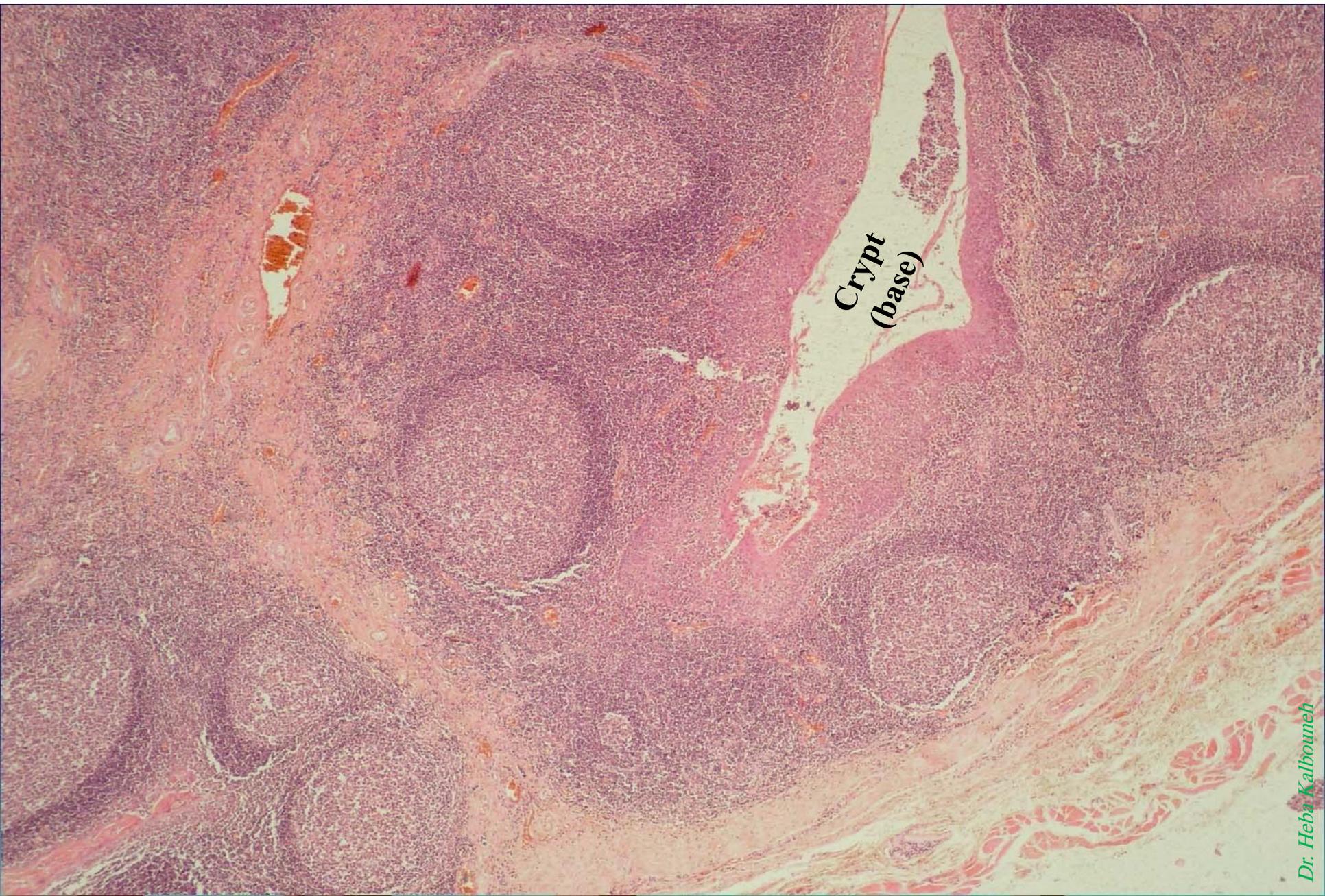




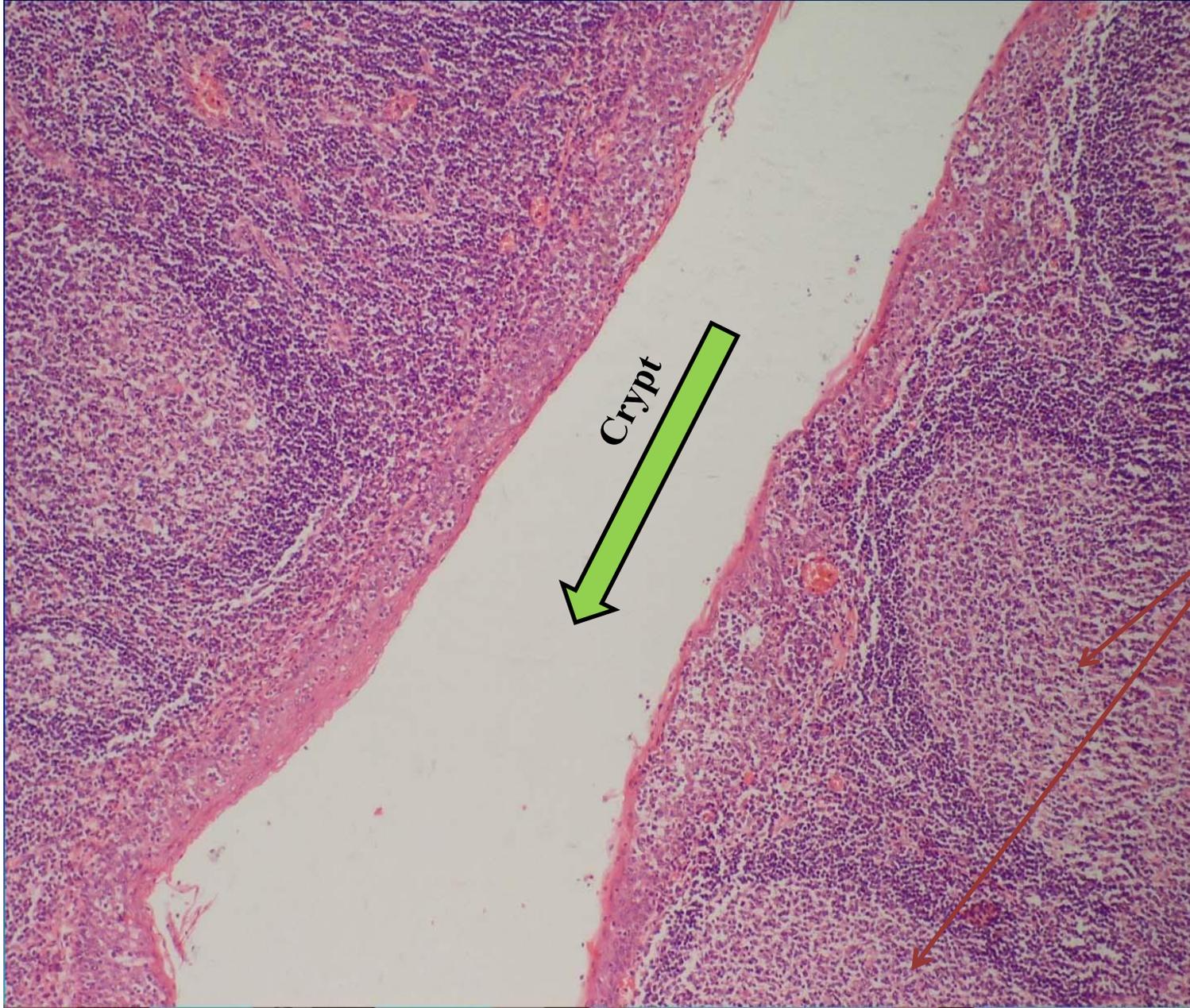
Stratified non-keratinized squamous epithelium

Lymphoid follicle

Crypt



**Crypt
(base)**

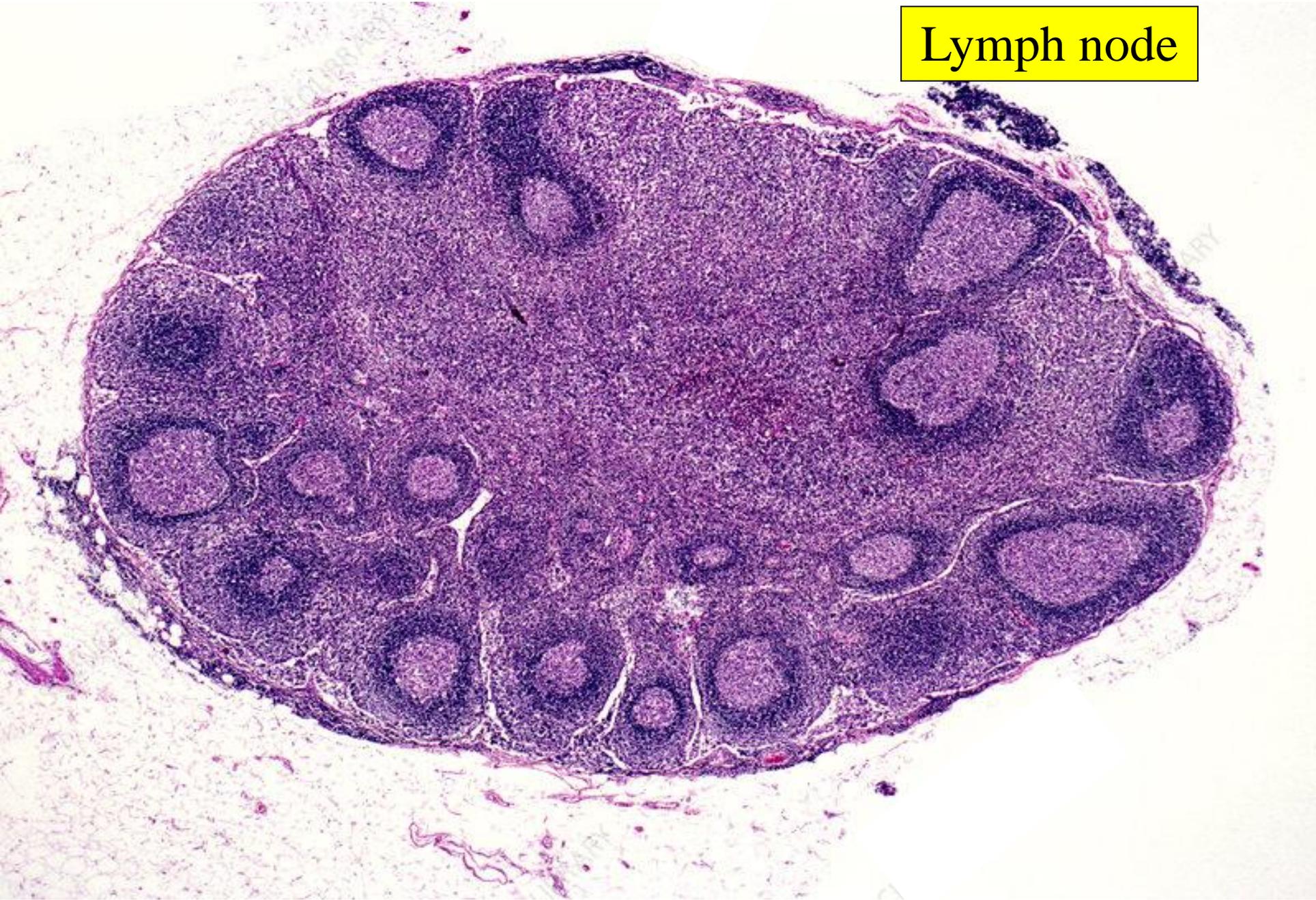


Crypt

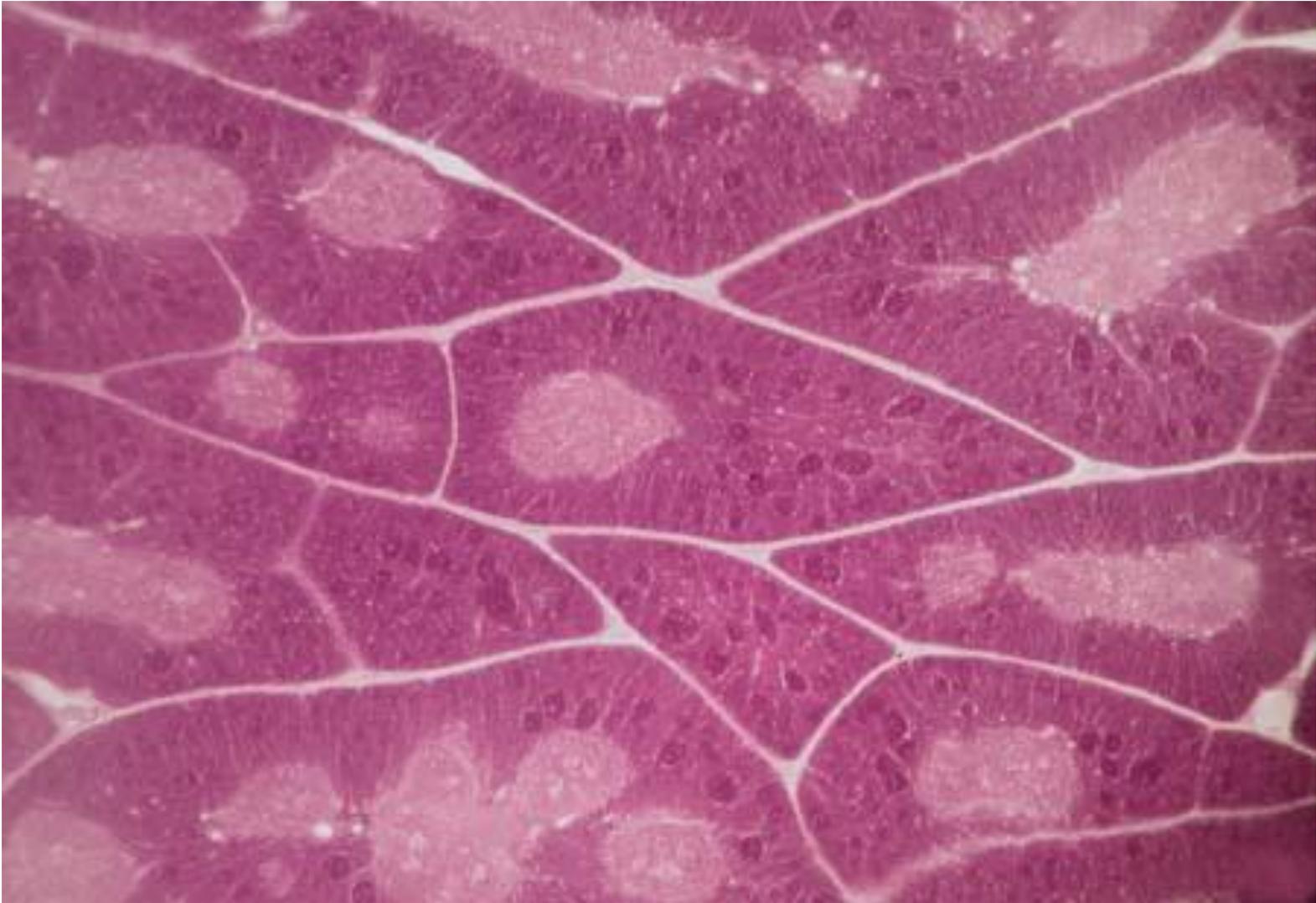
Lymphoid follicles

Identify

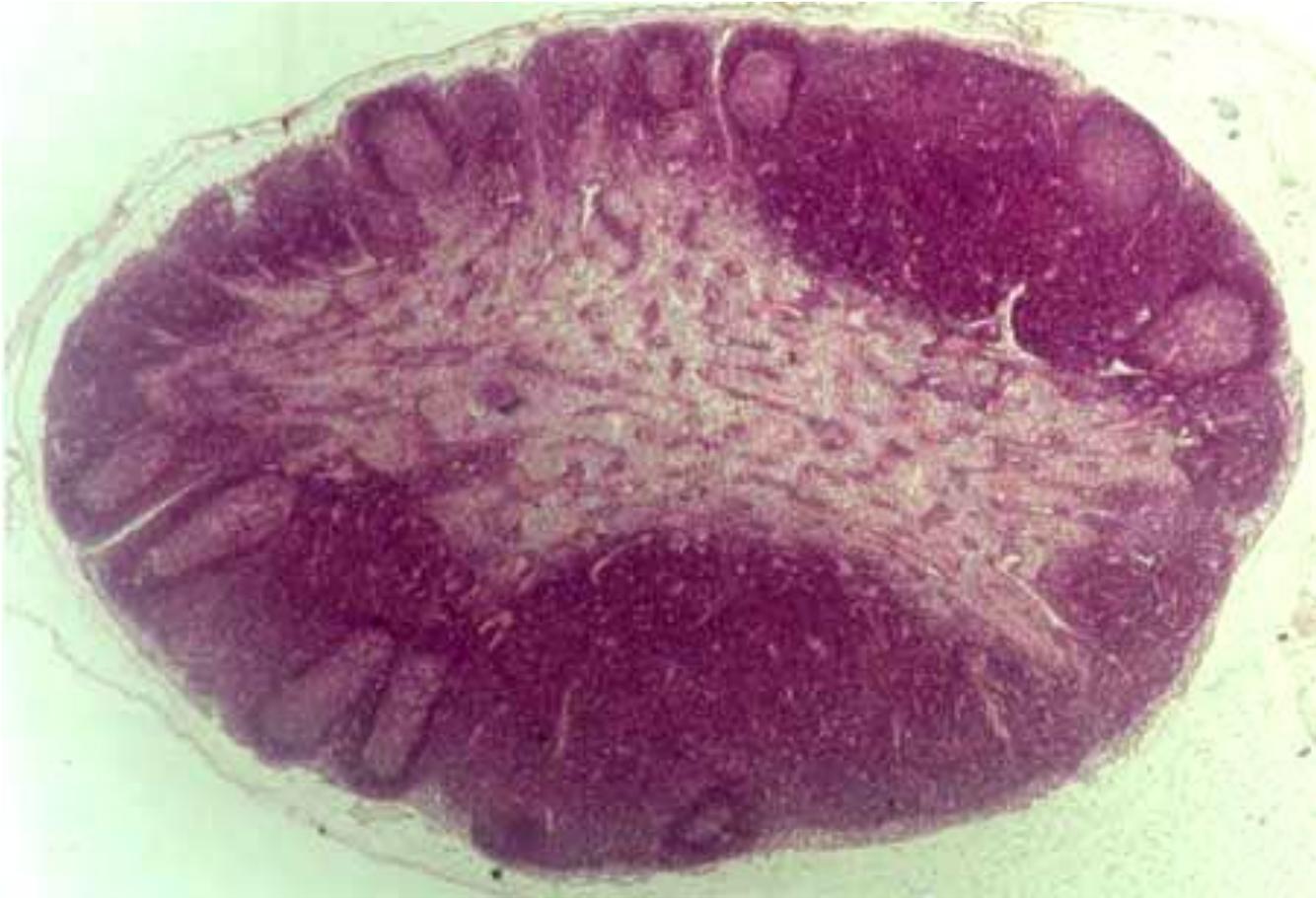
Lymph node



Thymus



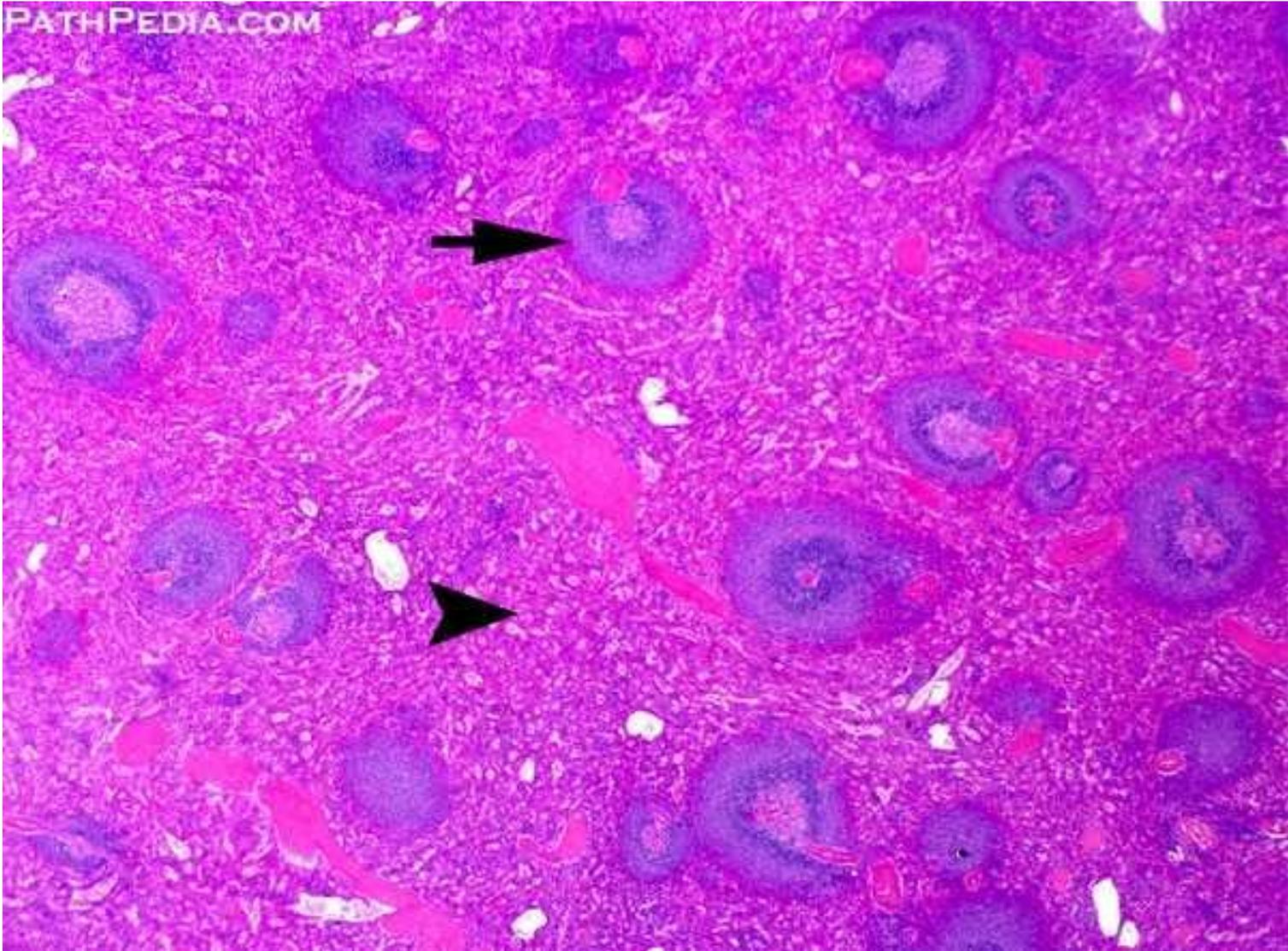
Lymph node



Palatine tonsils



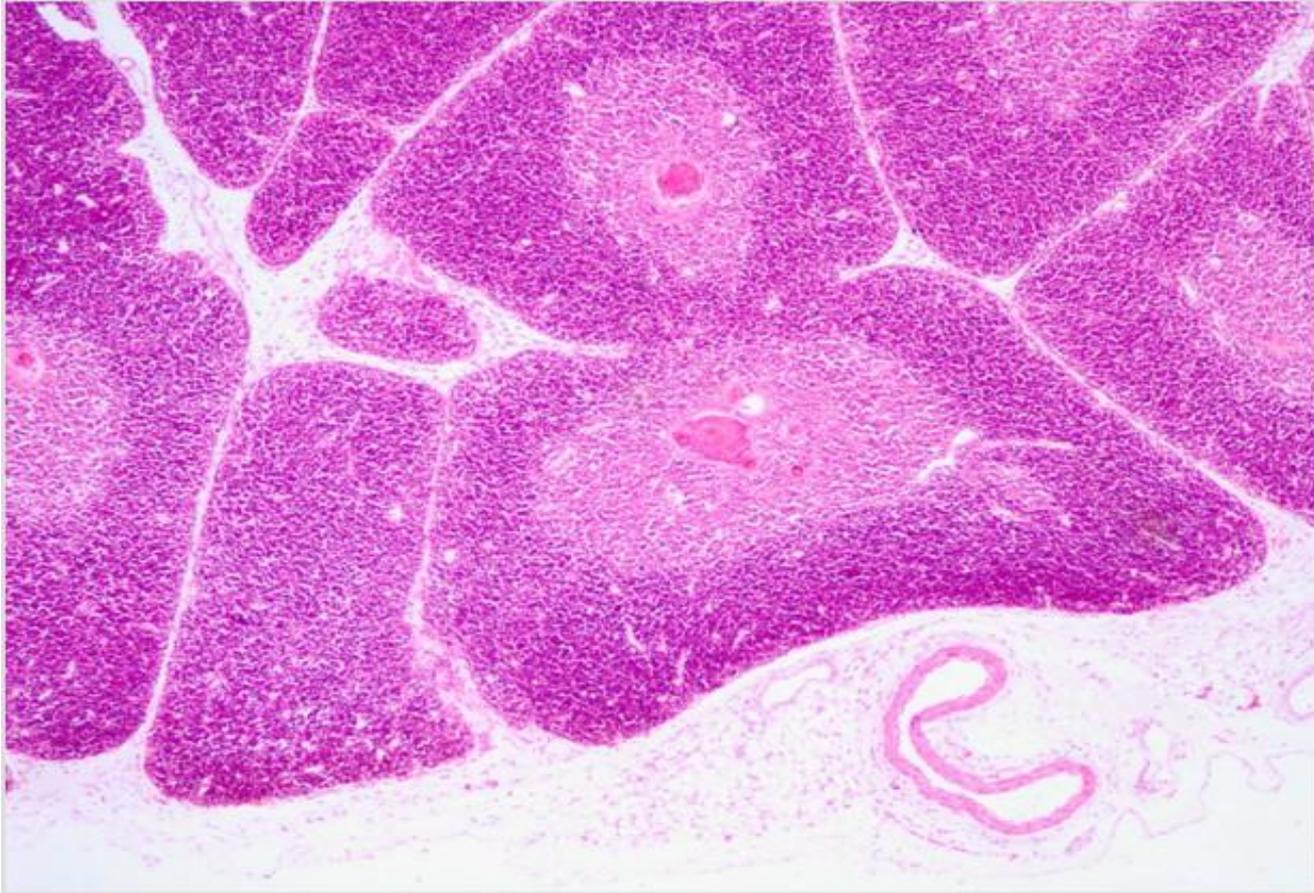
Spleen



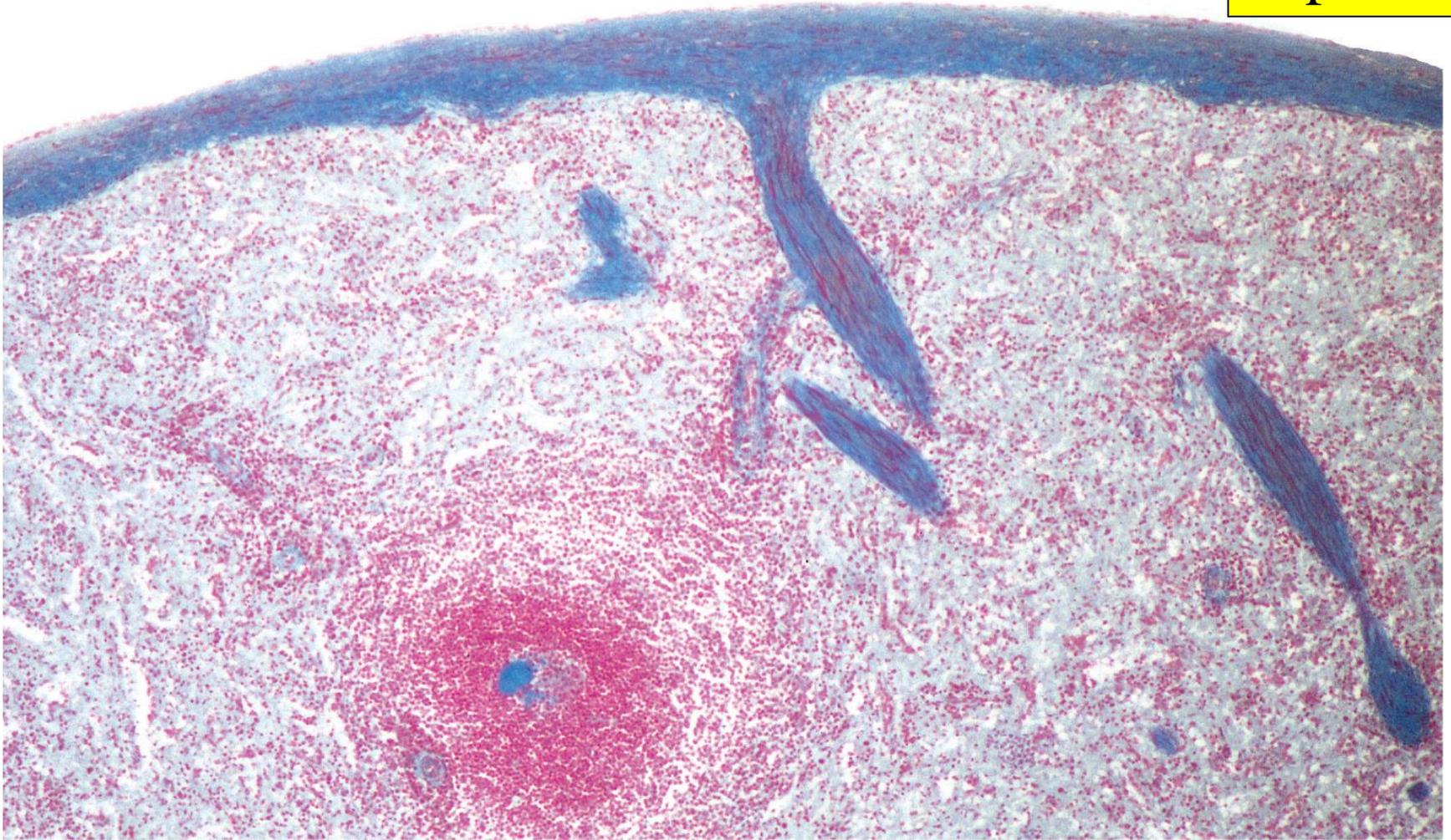
Palatine tonsils



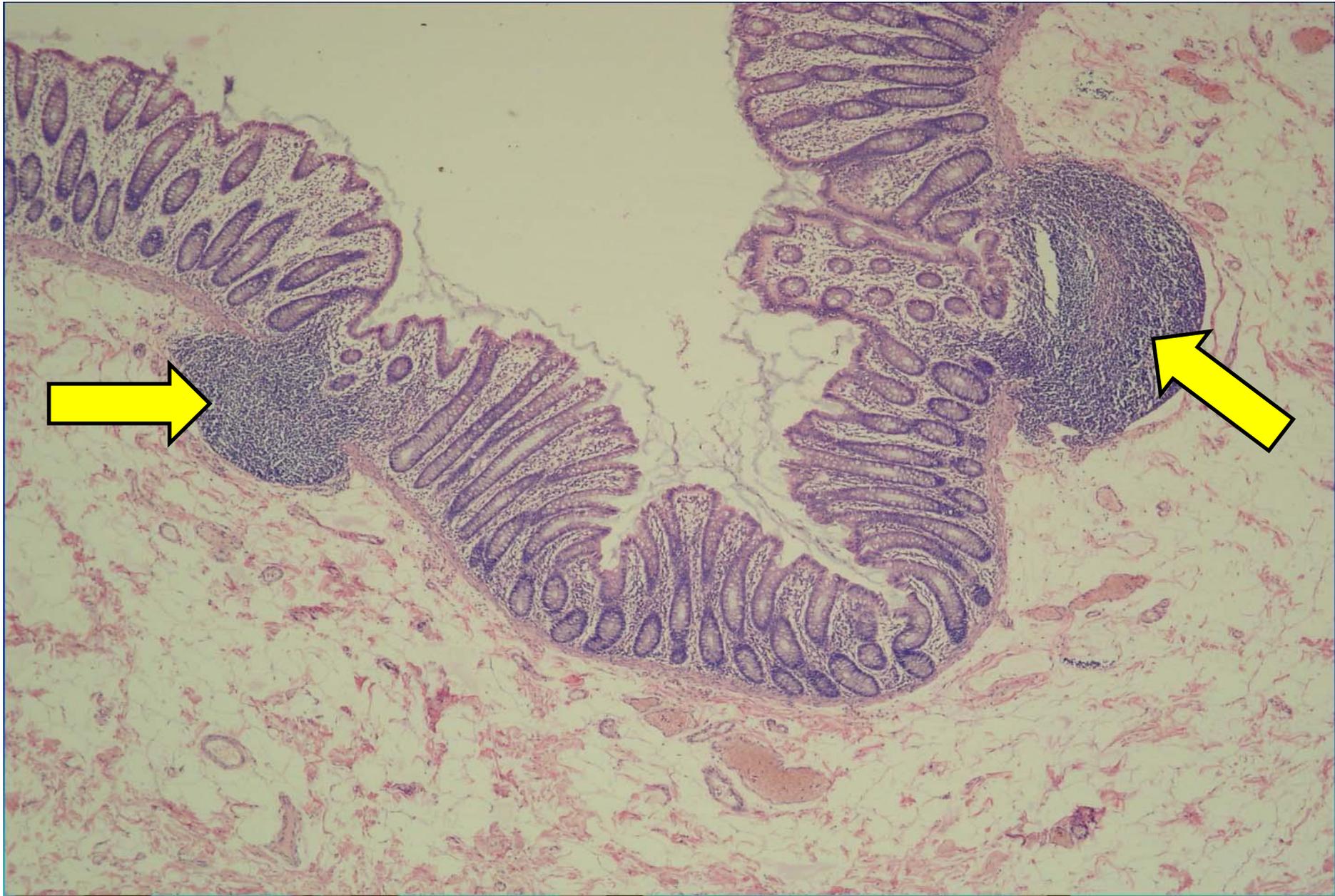
Thymus



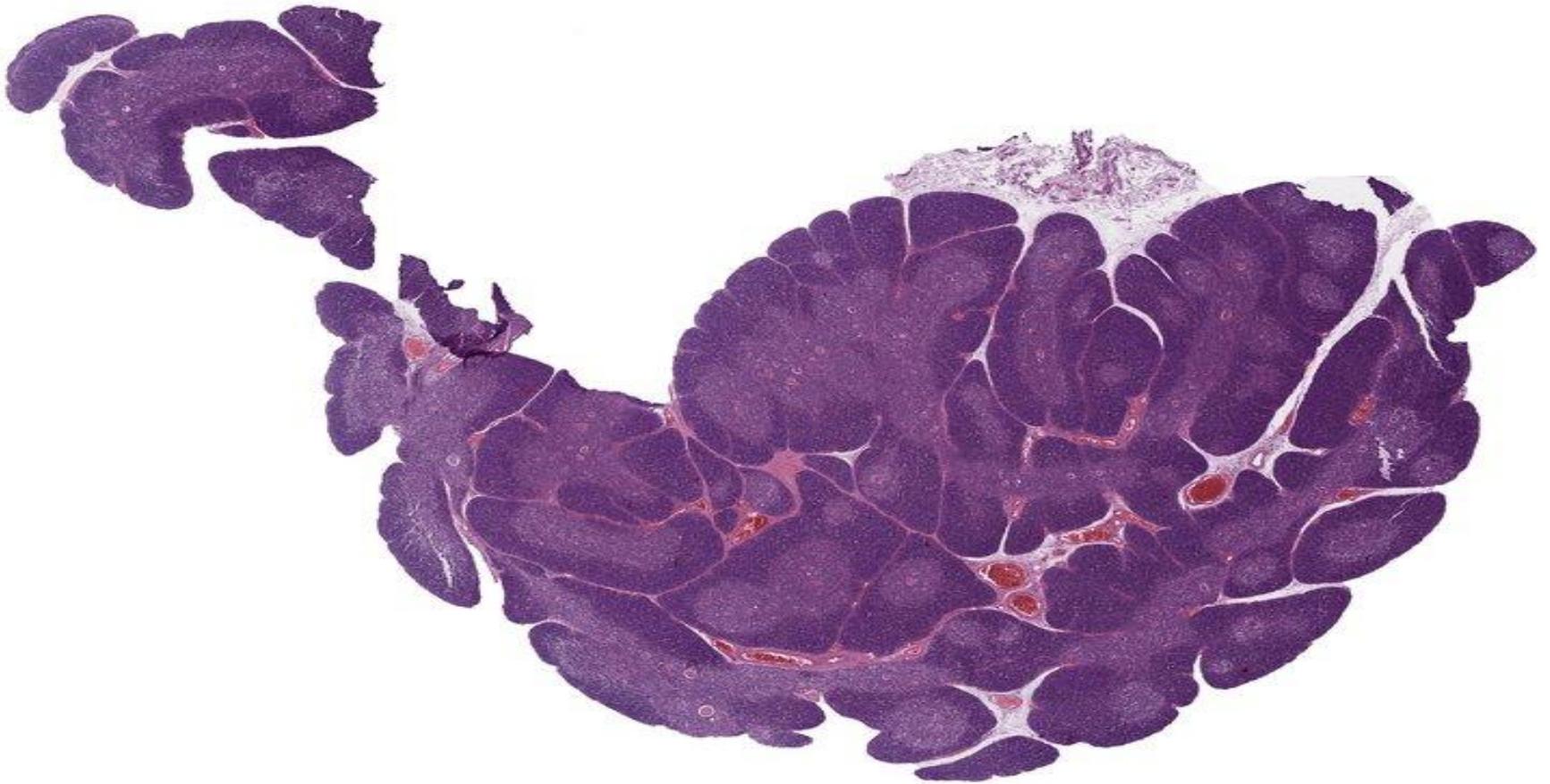
Spleen



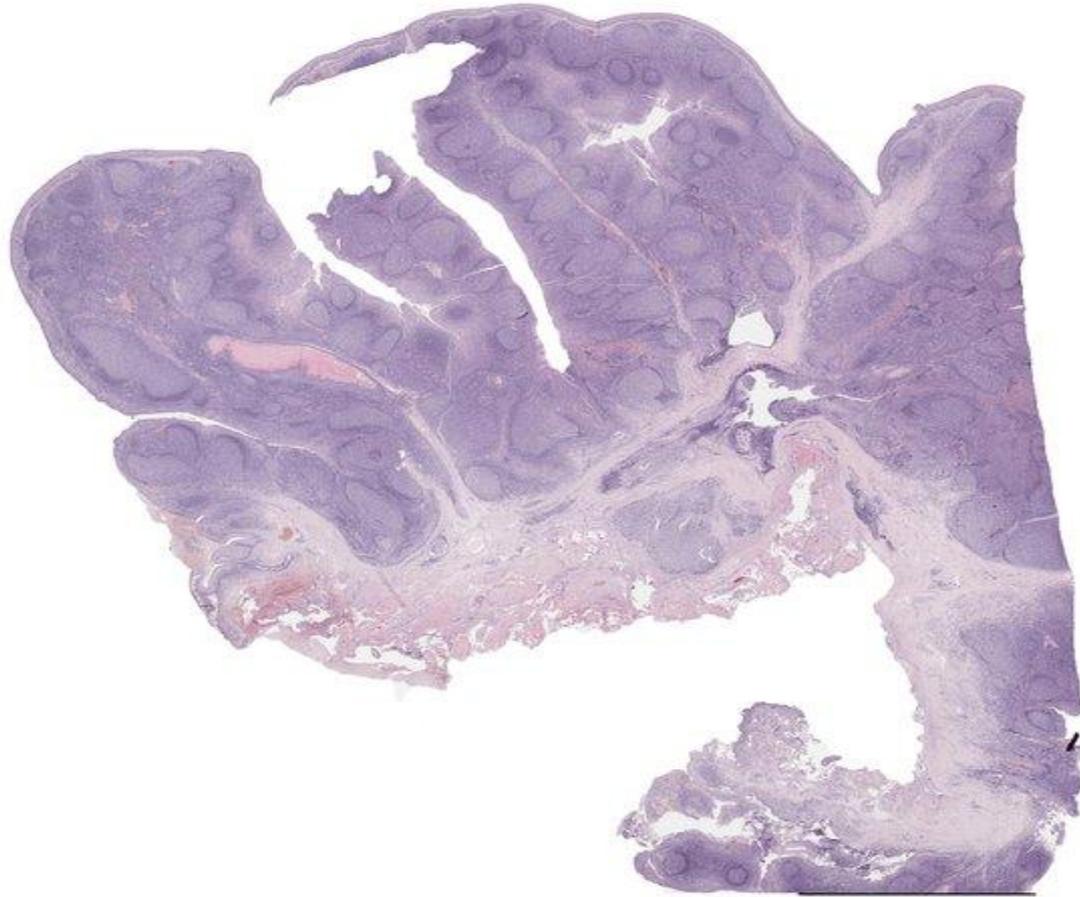
Solitary Lymphatic nodules (diffuse lymphatic tissue)



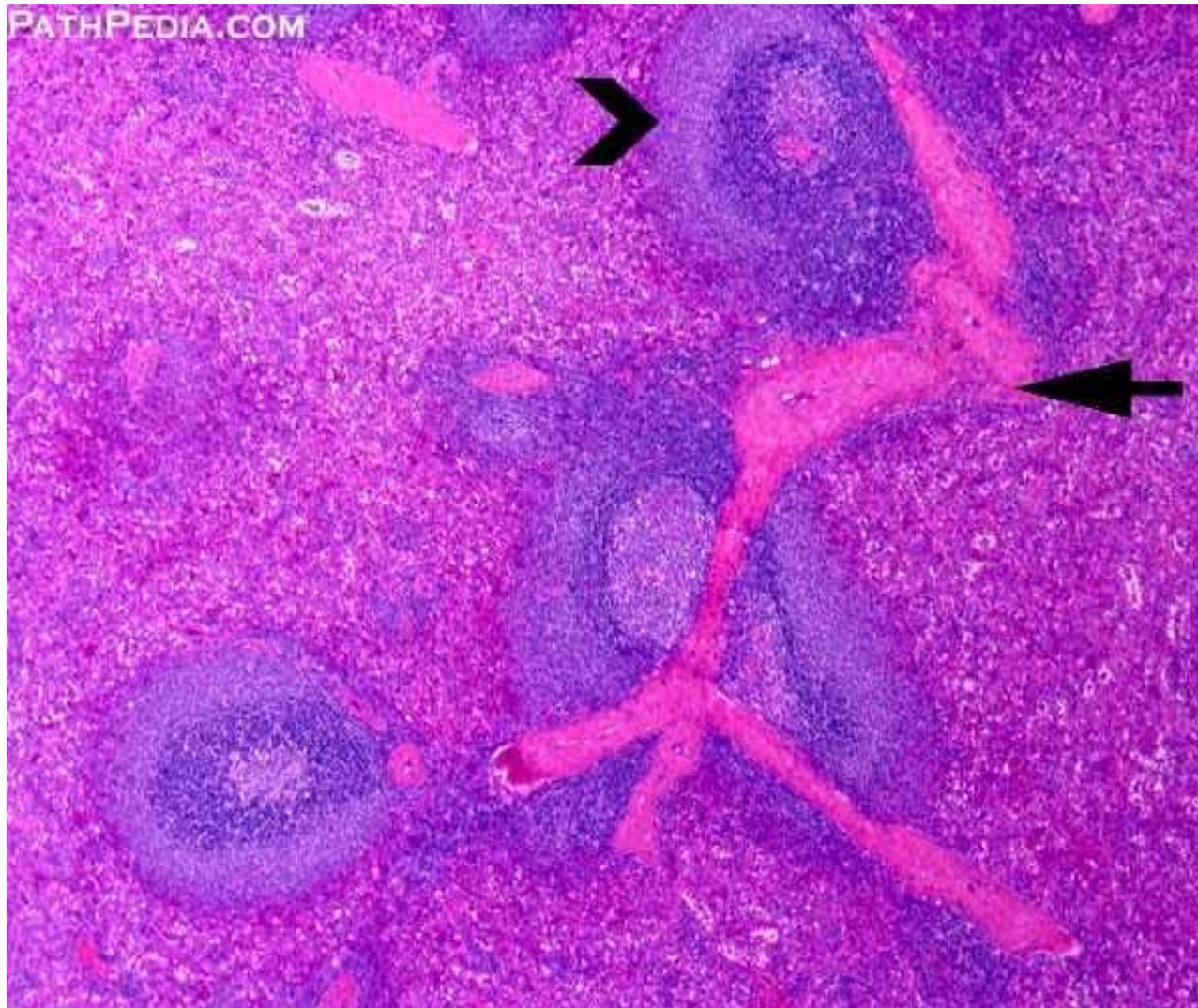
Thymus

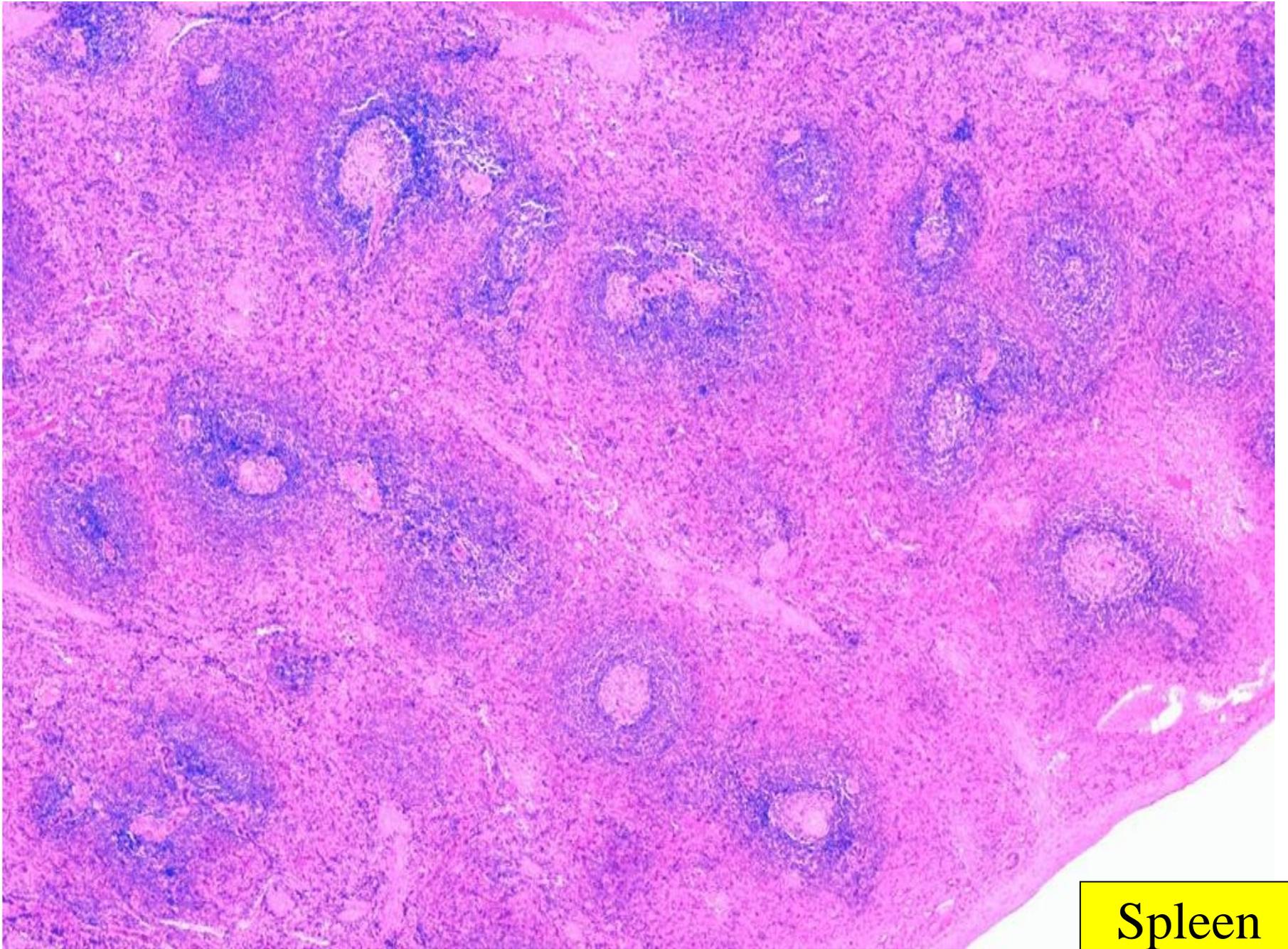


Palatine tonsils



Spleen





Spleen

	Lymph node	Spleen	Thymus
Cortex/ medulla	Present	Absent	Present
Lymphatic follicles (nodules)	Present (in cortex only)	Present (in white pulp only)	Absent
Lymphatic vessels	Afferents at capsule, emptying into subcapsular sinus; efferent at hilum	No afferents; efferents in trabeculae	No afferents; few efferents in septa
Unique features	Thin paracortical region between cortex and medulla, with high endothelial venules (HEV); medullary cords and sinuses	Minor white pulp component, with central arterioles; major red pulp component, with many sinusoids	Hassall (thymic) corpuscles in medulla; epithelial- reticular cells in cortex and medulla

Useful links (optional)

http://highered.mheducation.com/sites/dl/free/0072507470/291136/t_cell_dependent_antigens.swf

http://highered.mheducation.com/sites/dl/free/0072507470/291136/Cytotoxic_T_cell_activity_against_target_cells.swf

<http://highered.mheducation.com/sites/dl/free/0072507470/291136/immResponse.swf>