



Hemato-lymphoid system

Practical Part

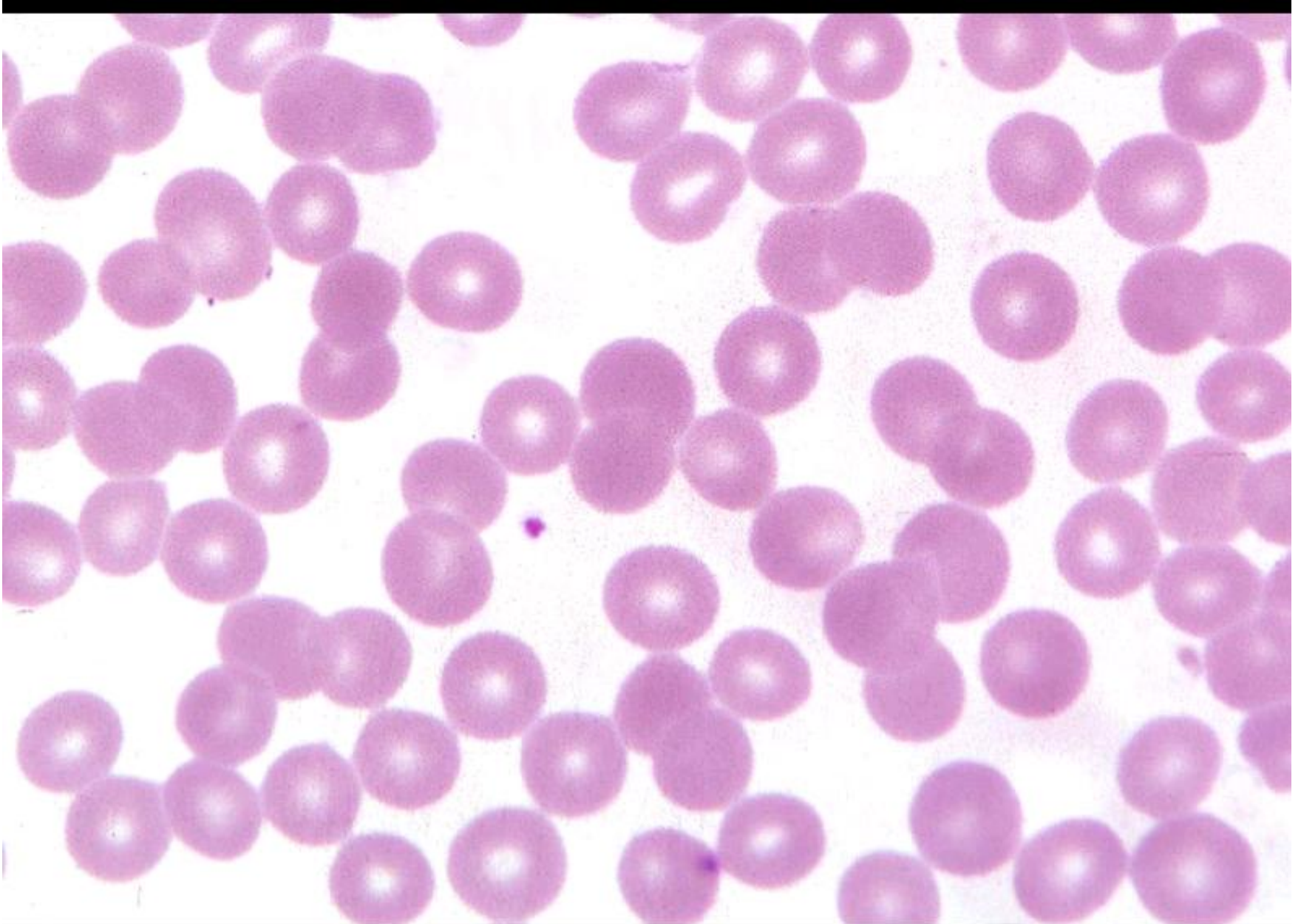
Dr. Heba Kalbouneh

DDS, MSc, DMD/PhD

Professor of Anatomy, Histology and Embryology

Blood

Erythrocytes





Hypochromia



Normochromia



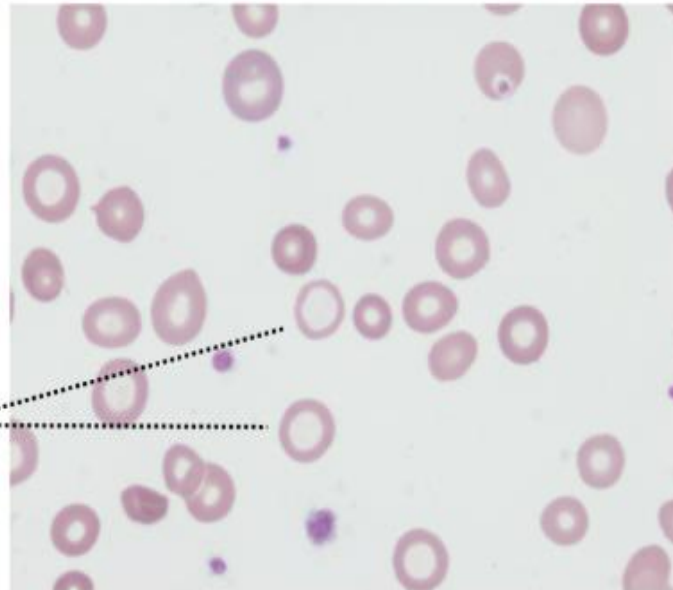
Hyperchromia

For example.....

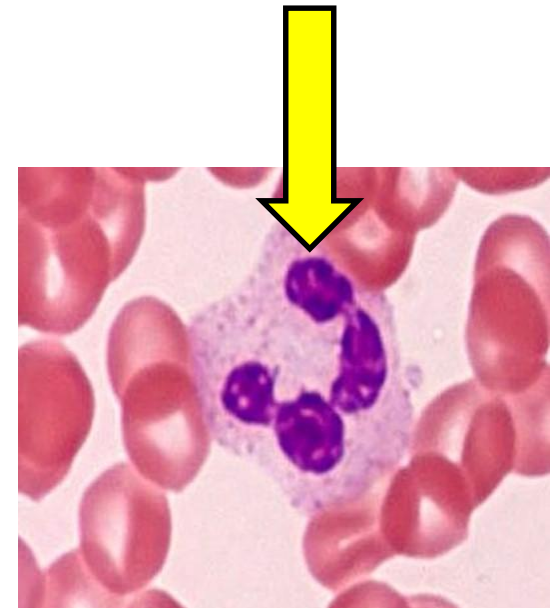
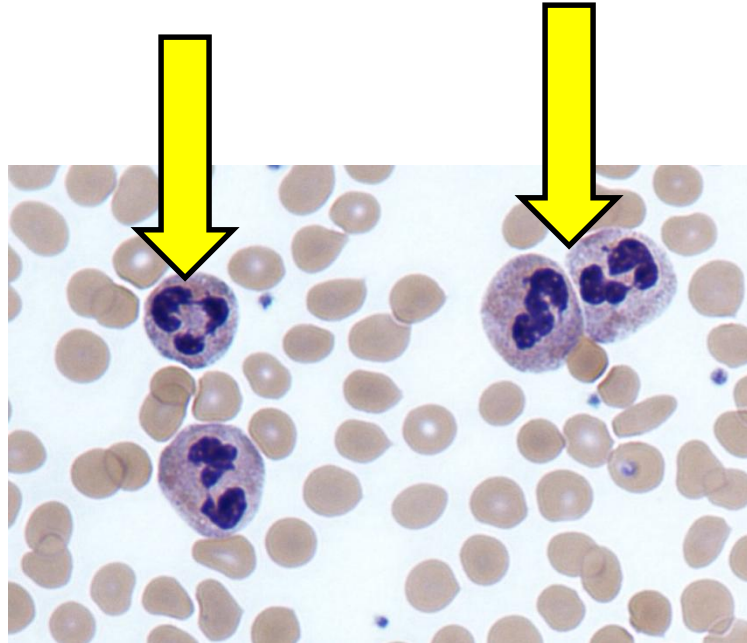
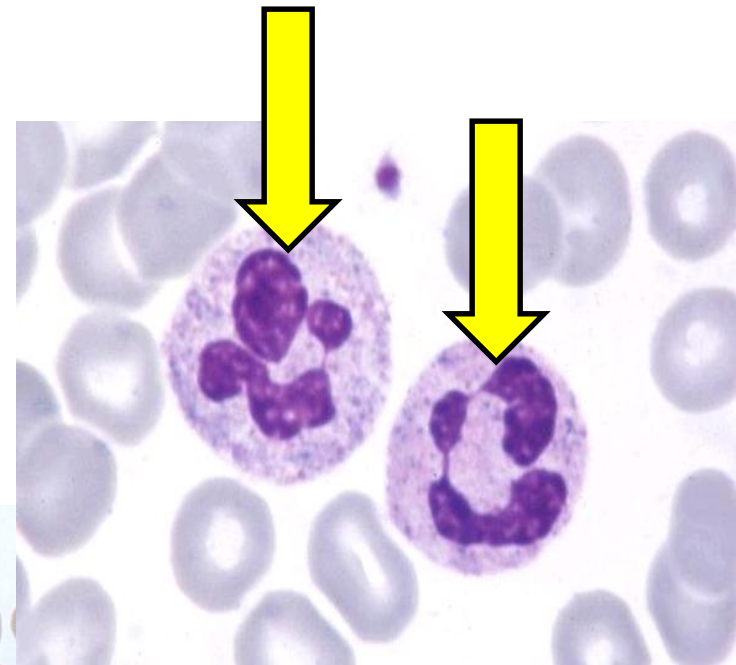
Hypochromic Red Blood Cells

Patient with iron deficiency anemia

Marked increase in central pallor in iron deficient RBCs

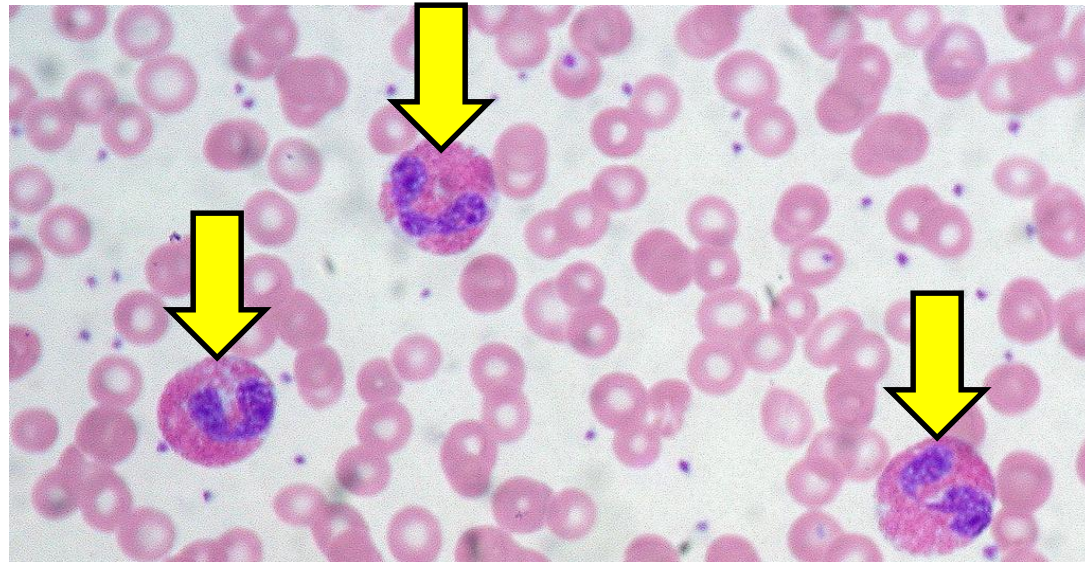
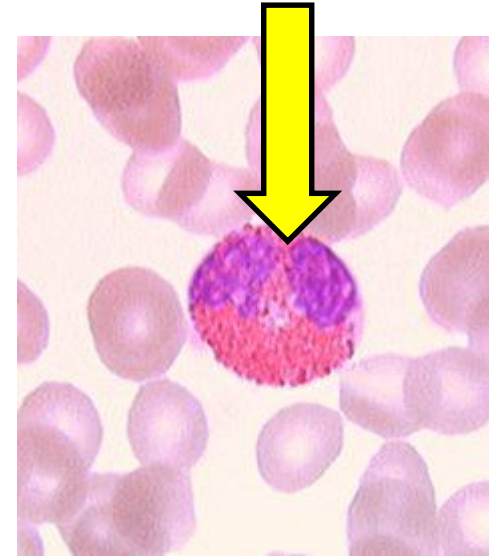
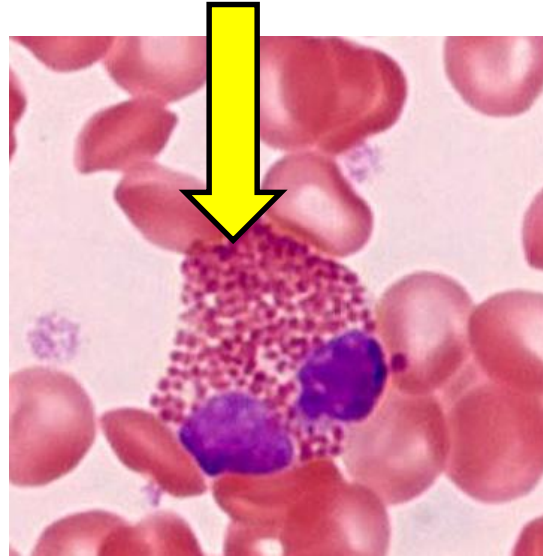
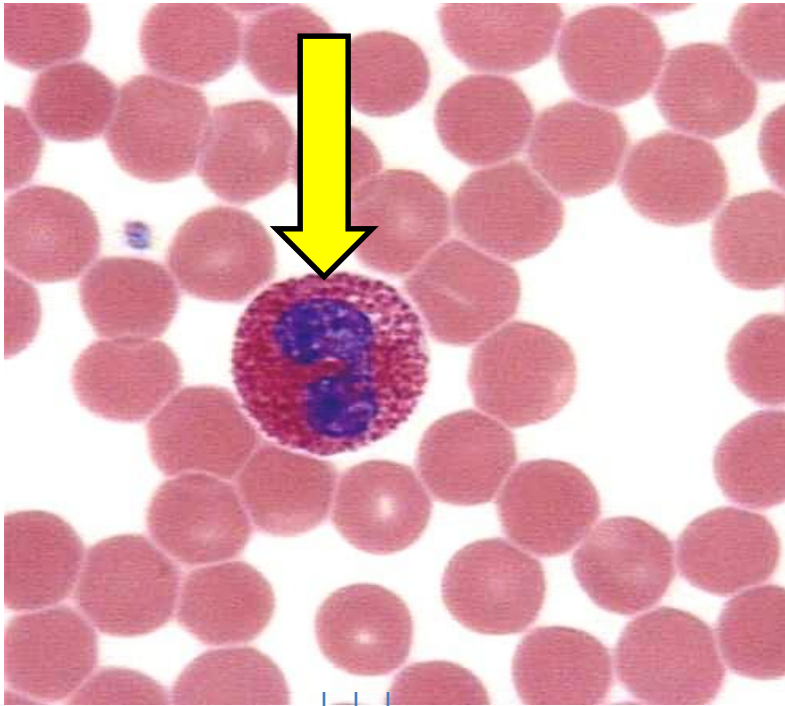


Neutrophils



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.

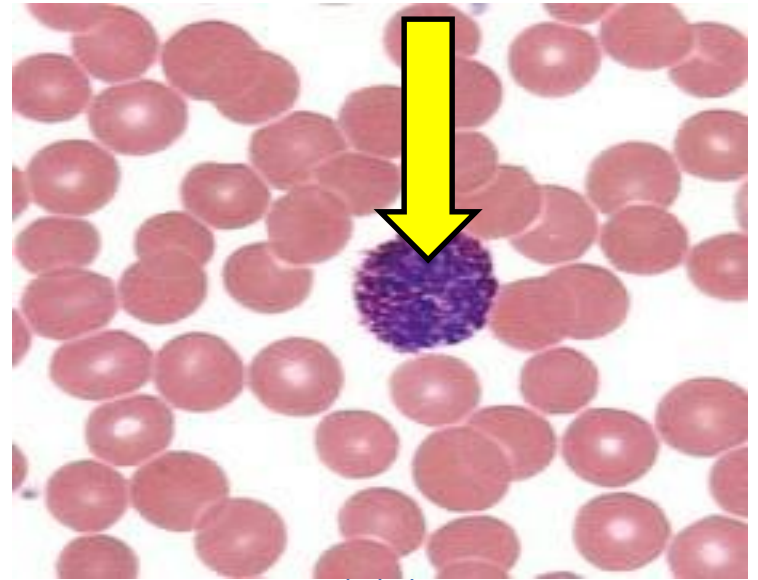
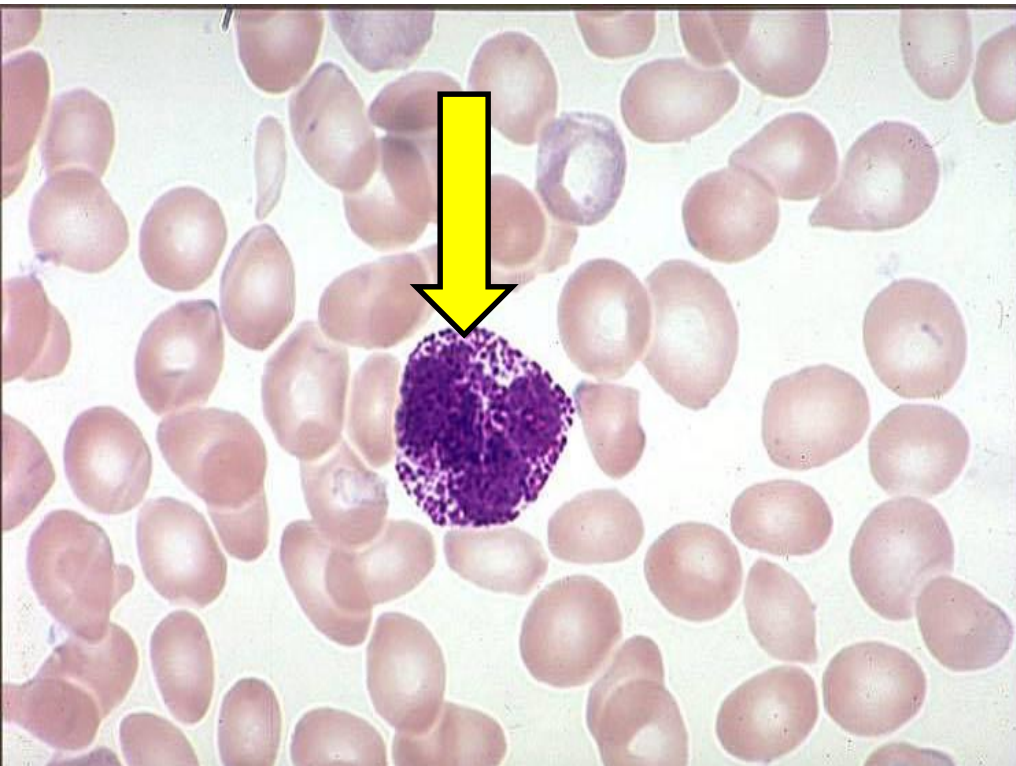
Eosinophils



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

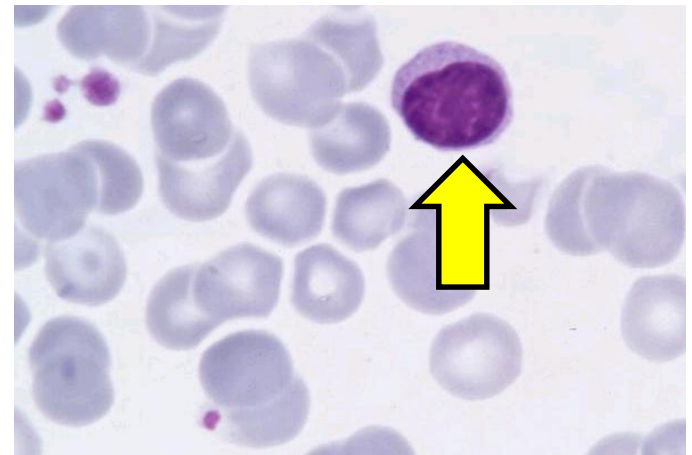
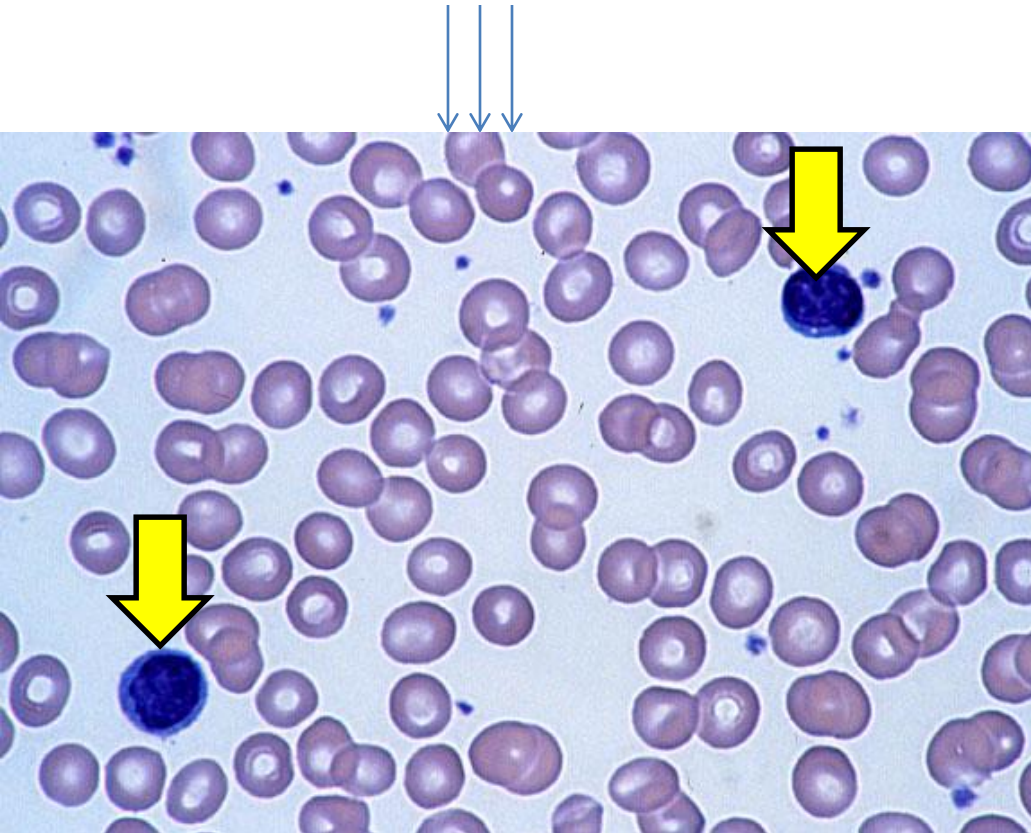
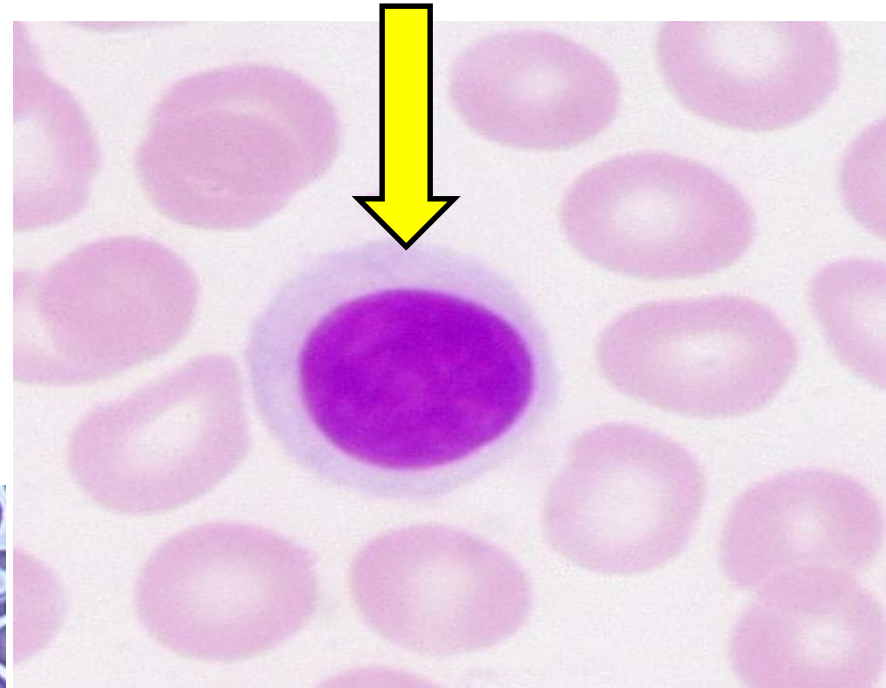


This shows a basophil in a blood smear. The basophil contains lots of deep blue staining granules (basic) and a bilobed irregular nucleus, that is often difficult to see.

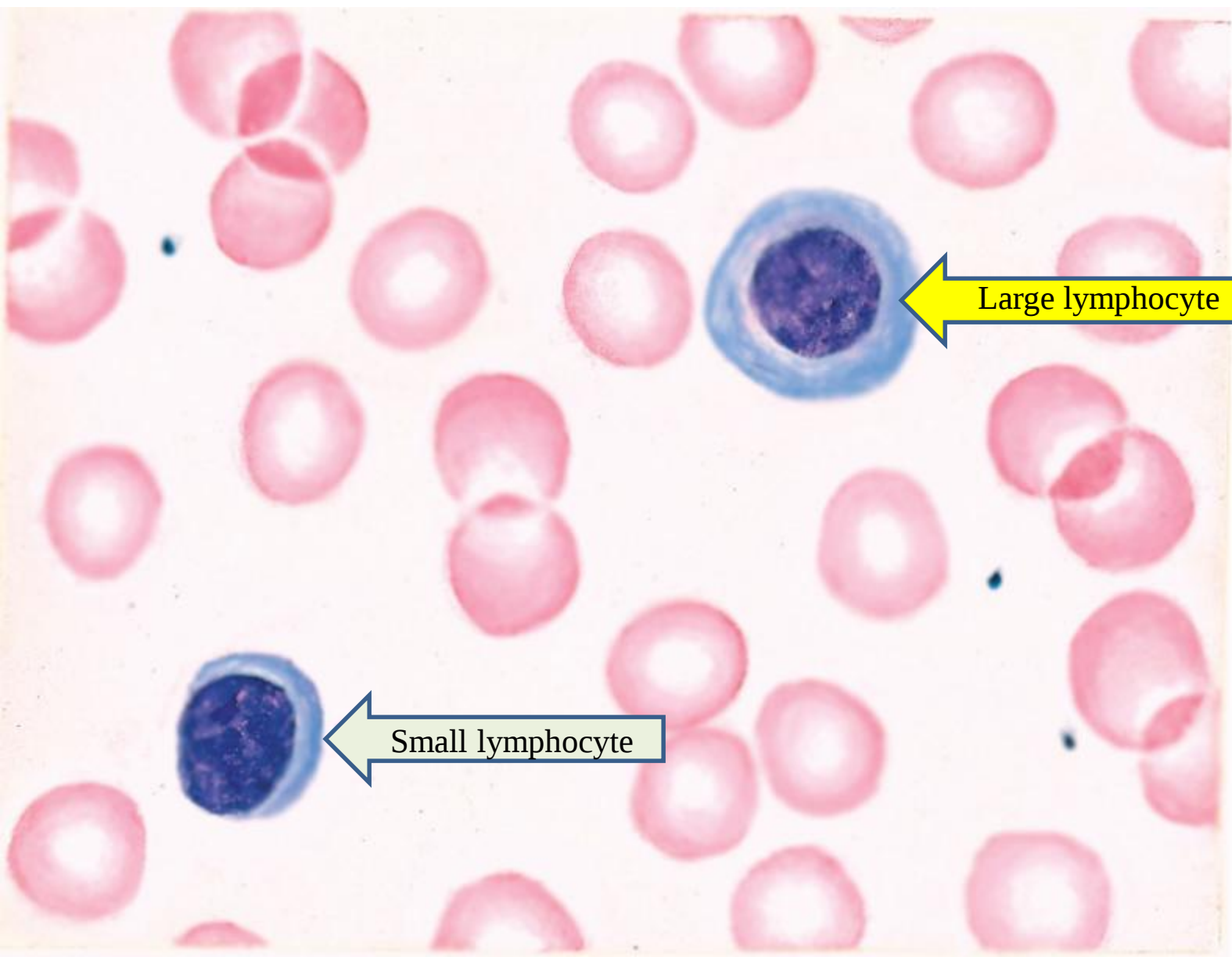
Lymphocytes

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).

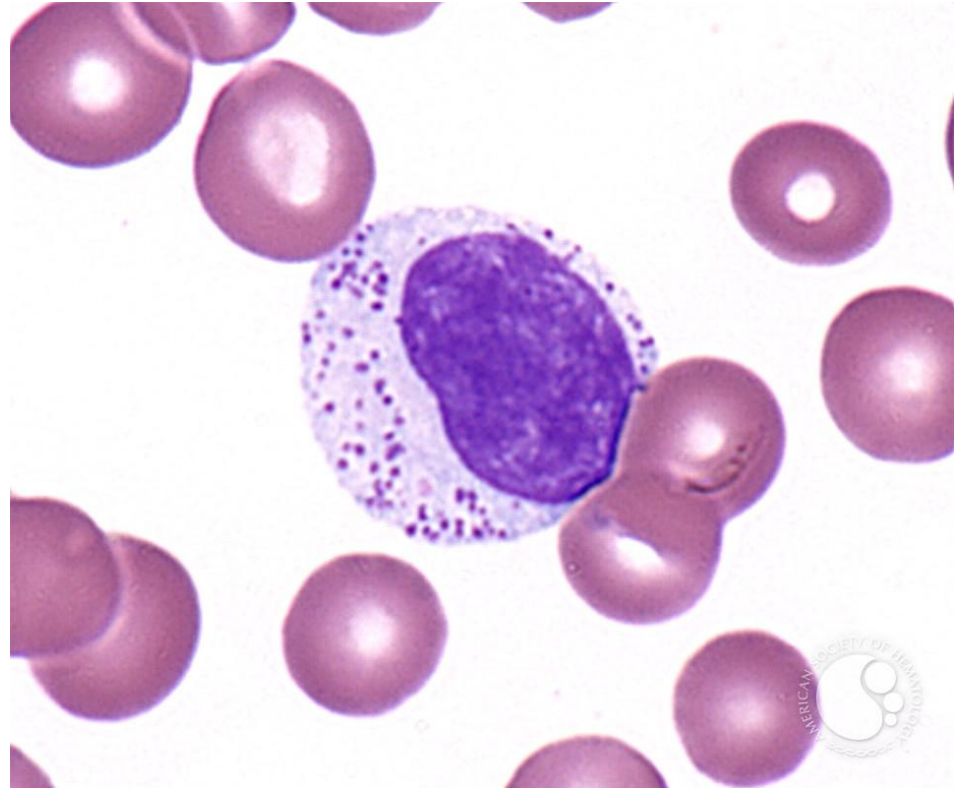


The rest of lymphocytes (around 10%) are larger. These larger cells have more cytoplasm and more euchromatic nucleus. Larger lymphocytes are commonly activated lymphocytes.



Large Granular Lymphocyte

*Note: all NK cells are large granular lymphocytes.
But not all large granular lymphocytes are NK cells-
some are activated cytotoxic cells*



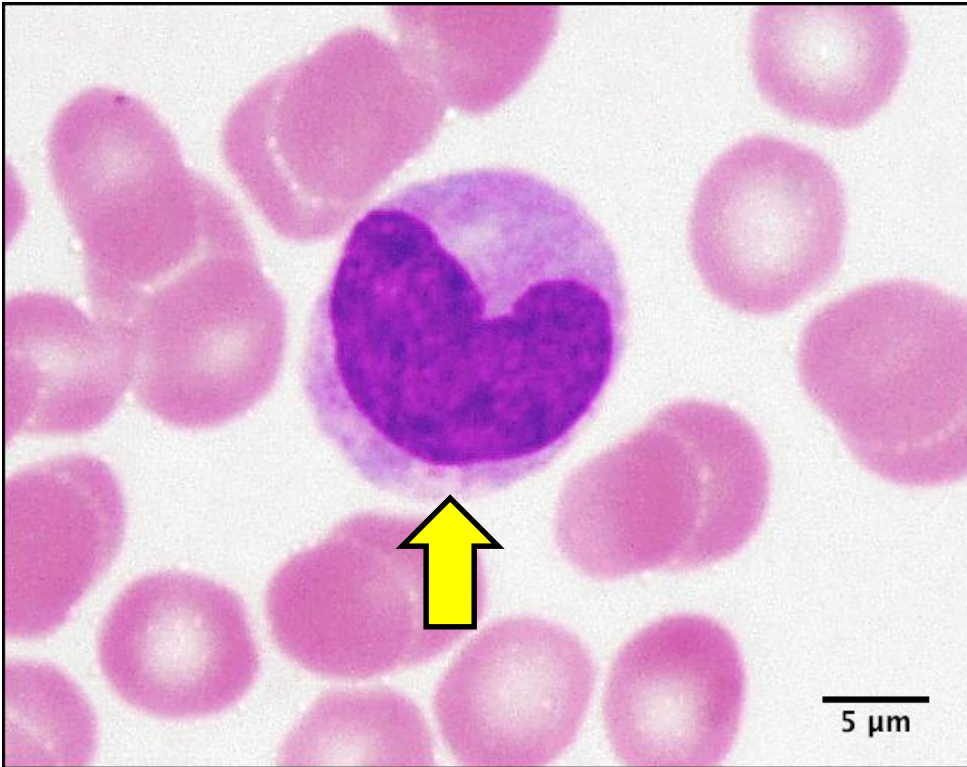
Observe the followings:

Size: Larger than small resting lymphocytes.

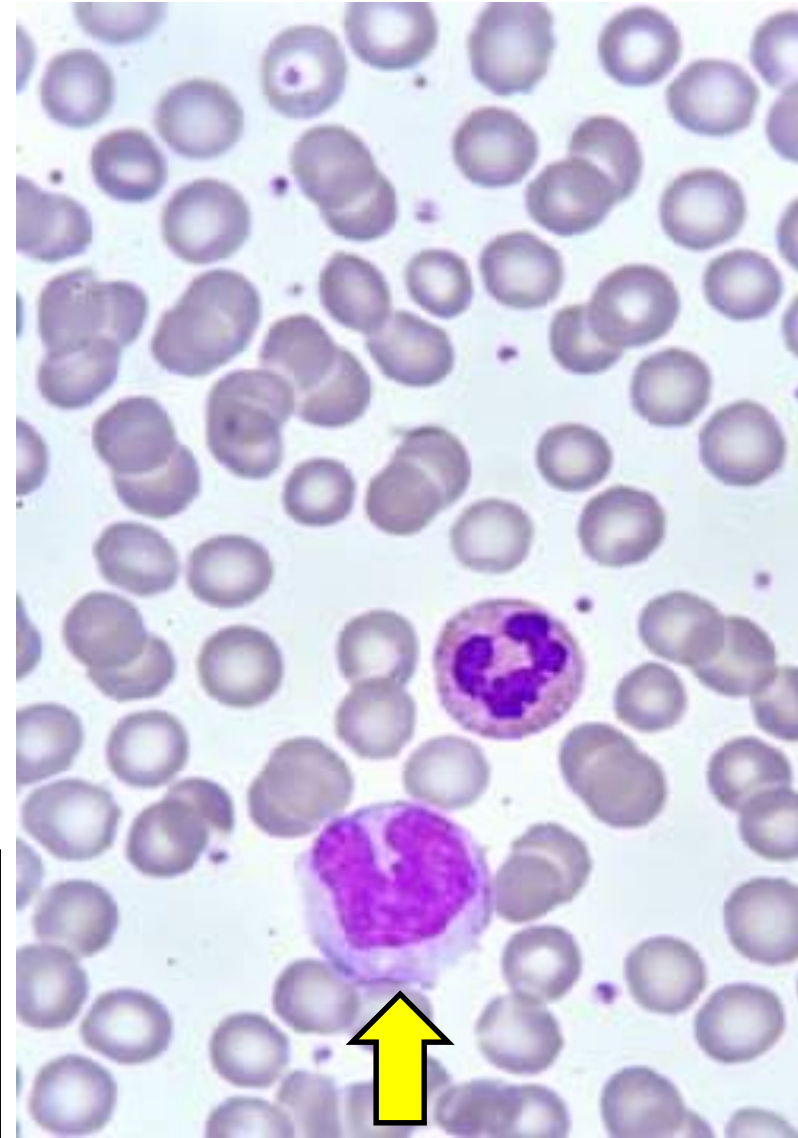
Cytoplasm: Abundant, pale blue.

Granules: Azurophilic (reddish-purple) cytoplasmic granules, which contain perforin and granzymes.

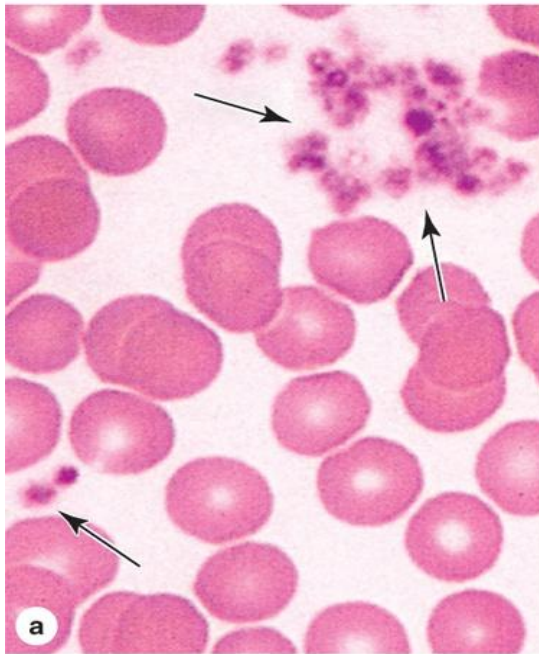
Monocytes



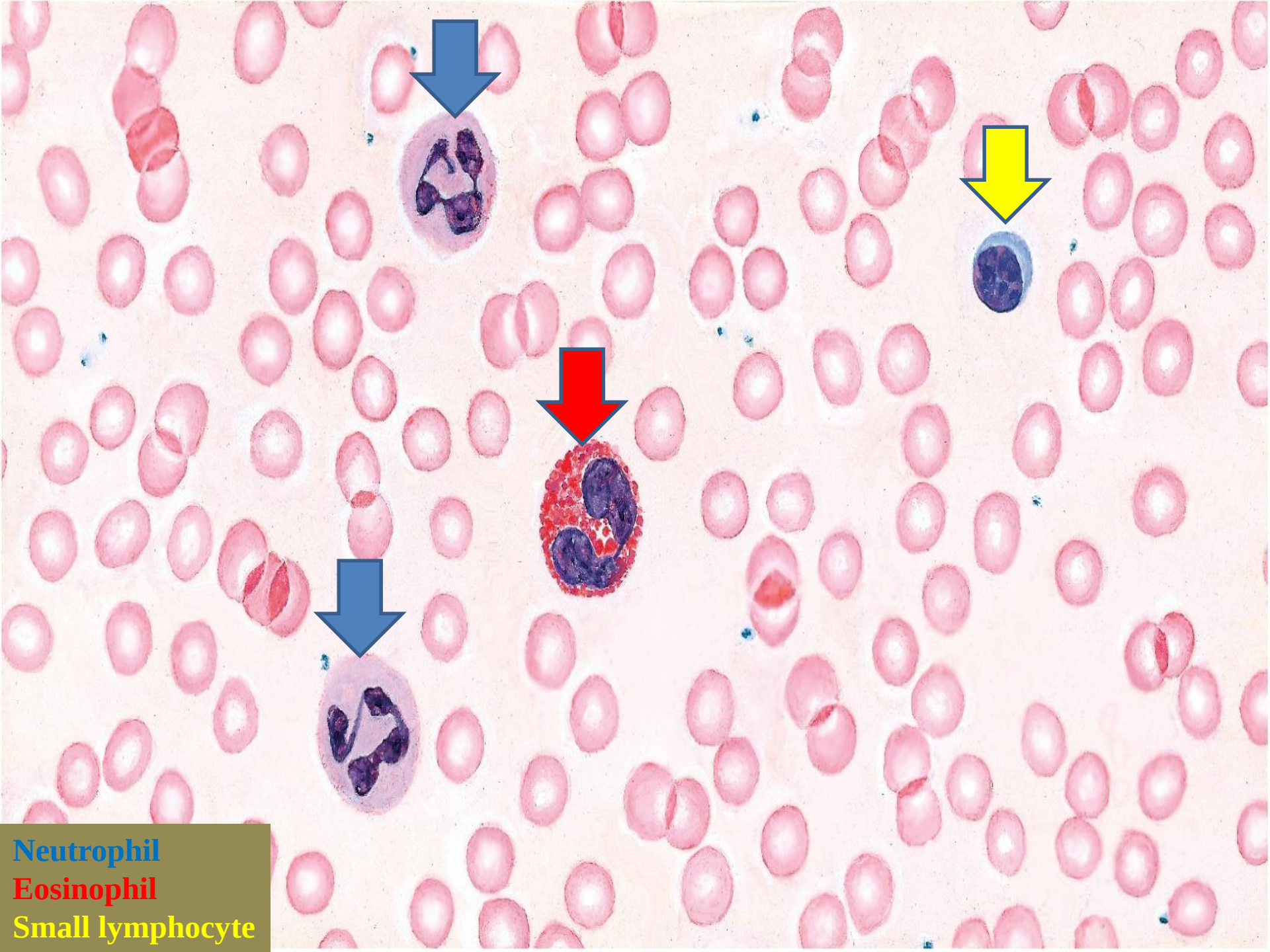
This shows a monocyte in a blood smear. Monocytes are the largest type of white blood cells, and can be up to 20μm in diameter. They have a large eccentrically placed nucleus, which is C or kidney bean shaped. They have abundant cytoplasm, and some fine purple granules in cytoplasm (frosted glass appearance).



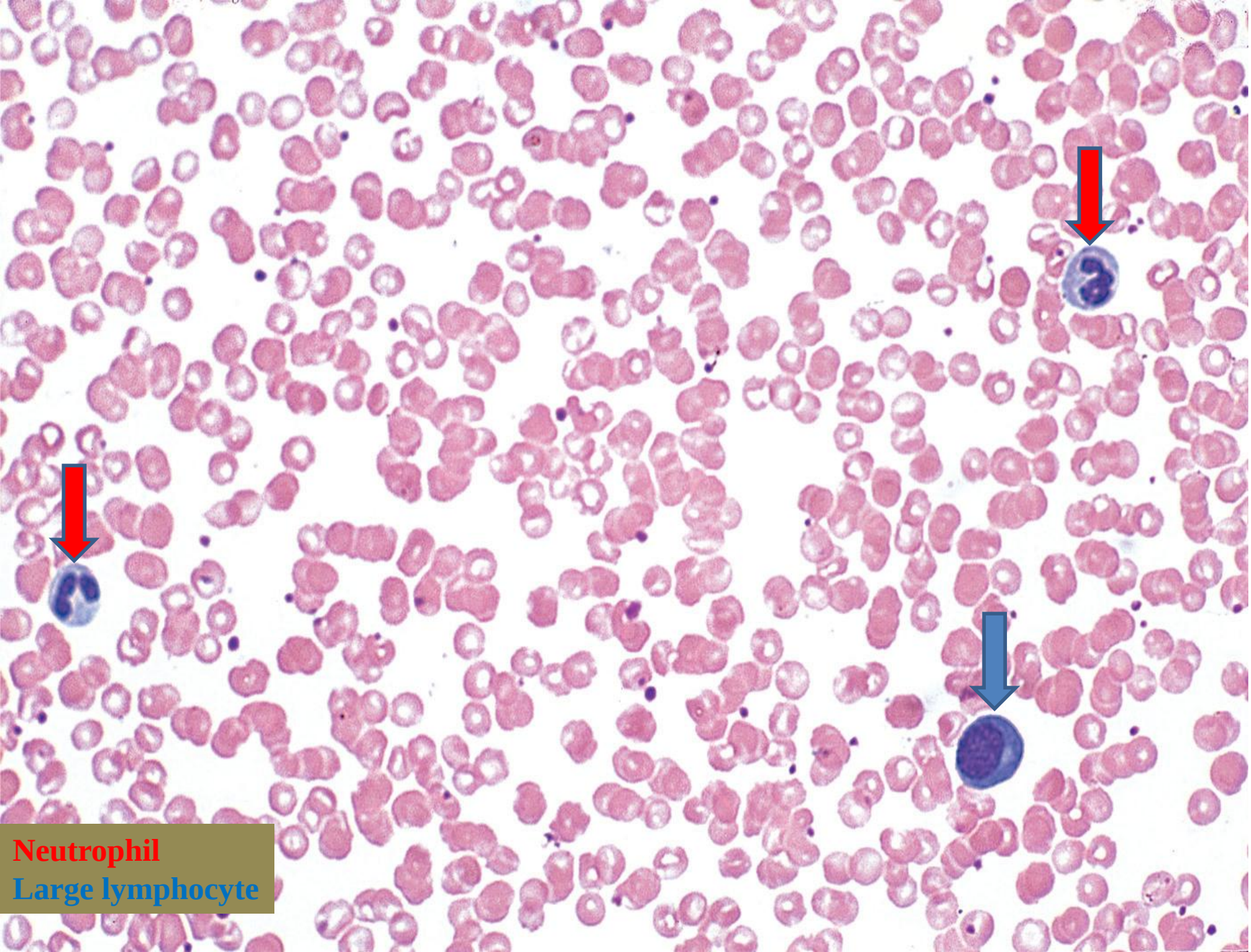
Platelets



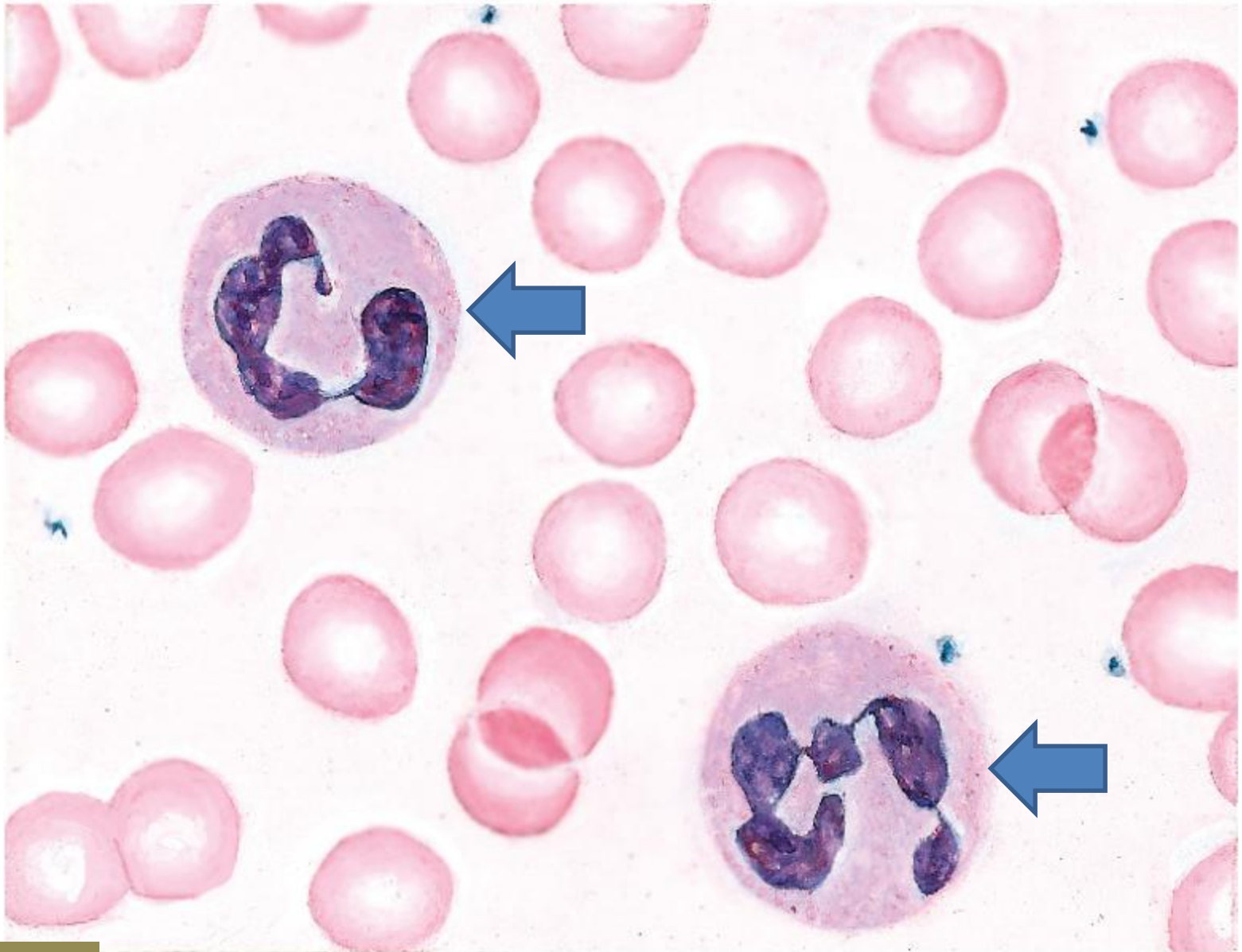
Identify



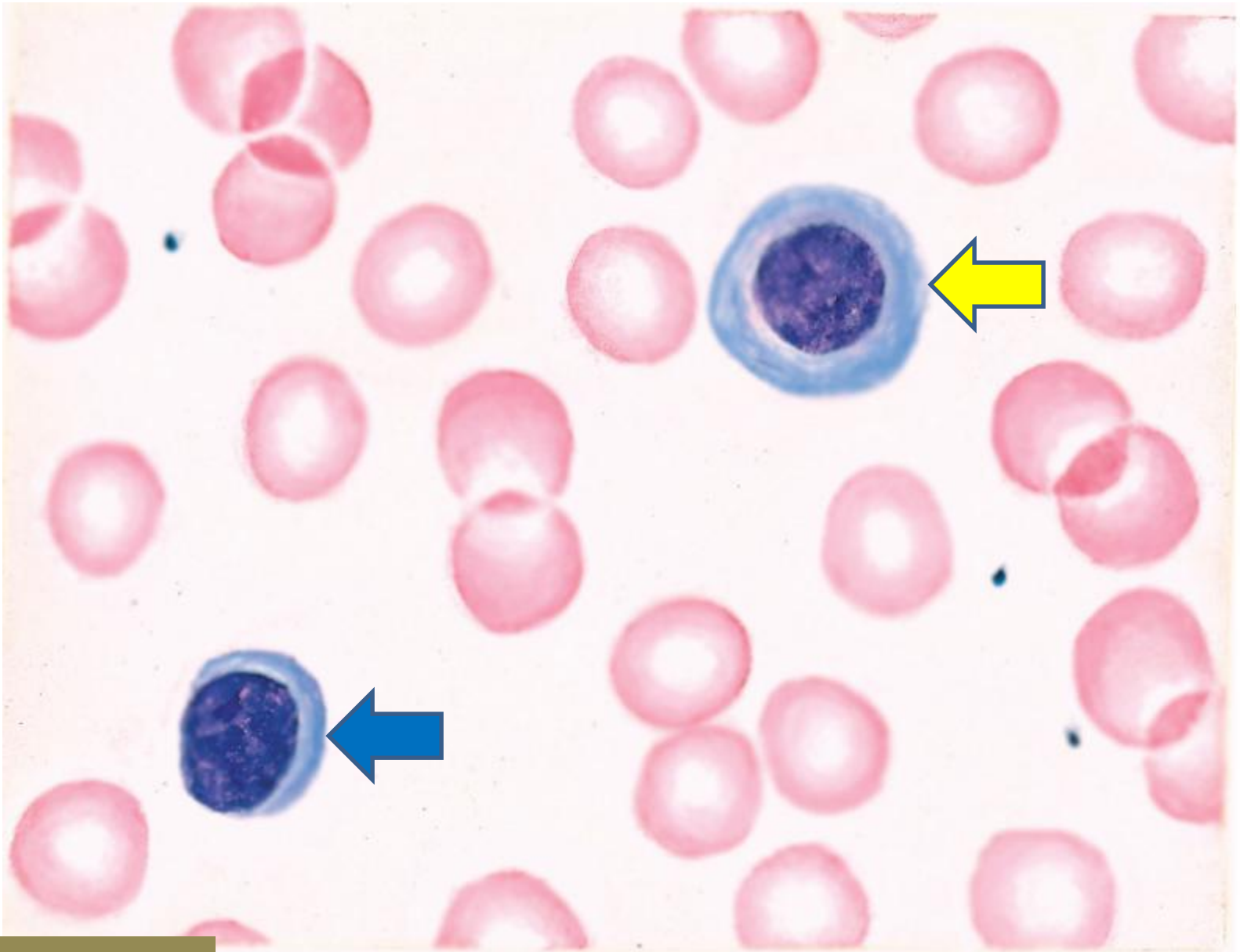
Neutrophil
Eosinophil
Small lymphocyte



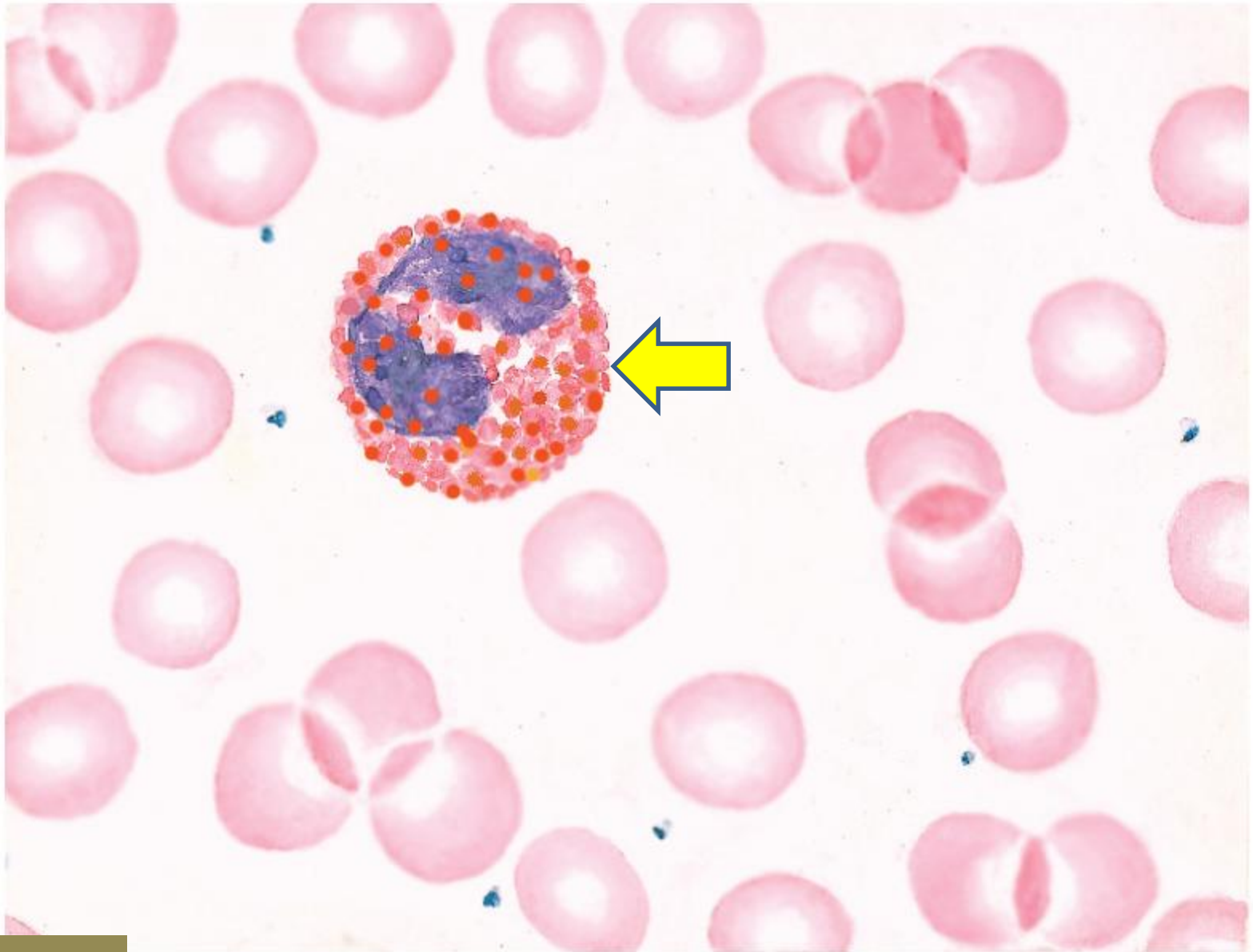
Neutrophil
Large lymphocyte



Neutrophil

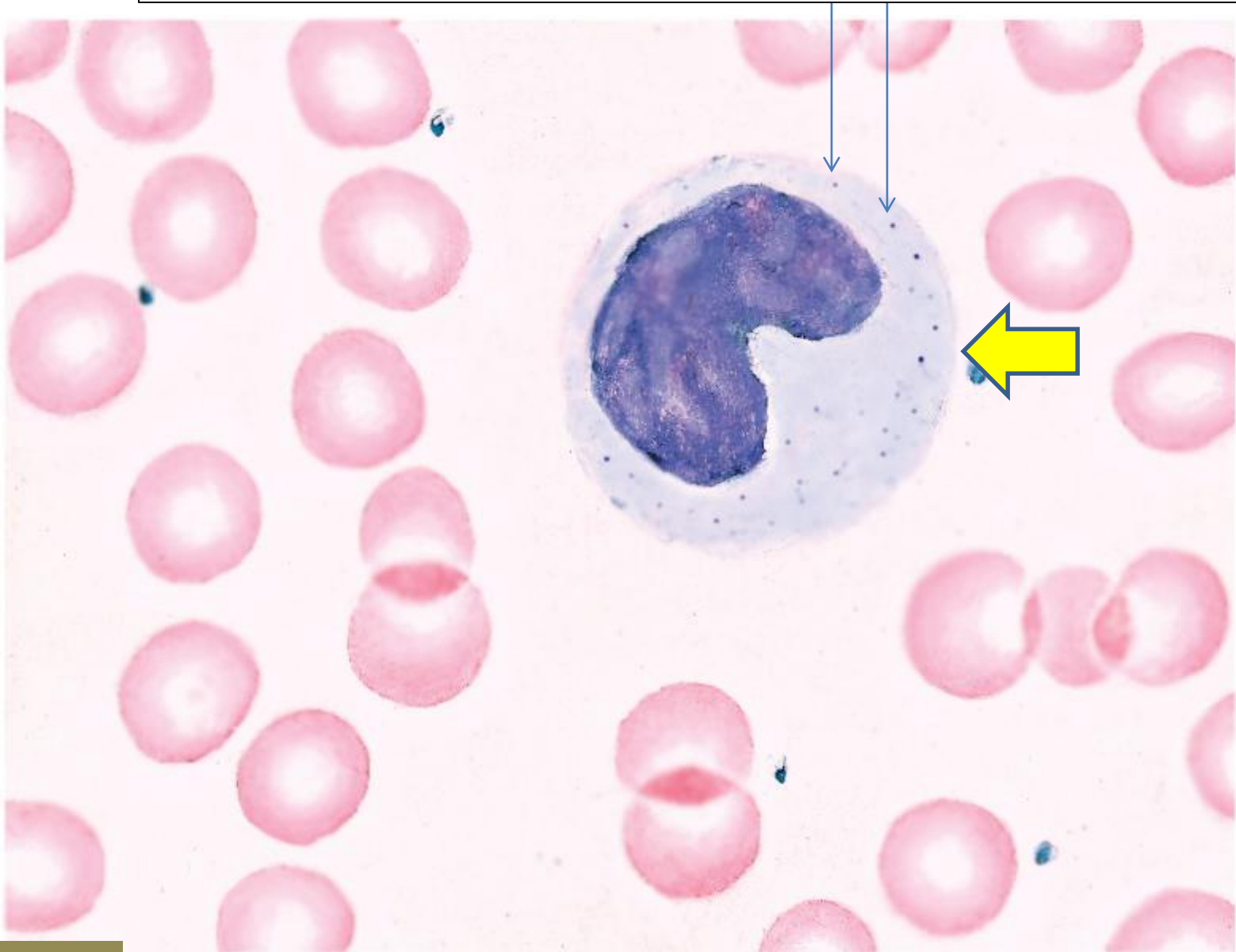


Small lymphocyte
Large lymphocyte

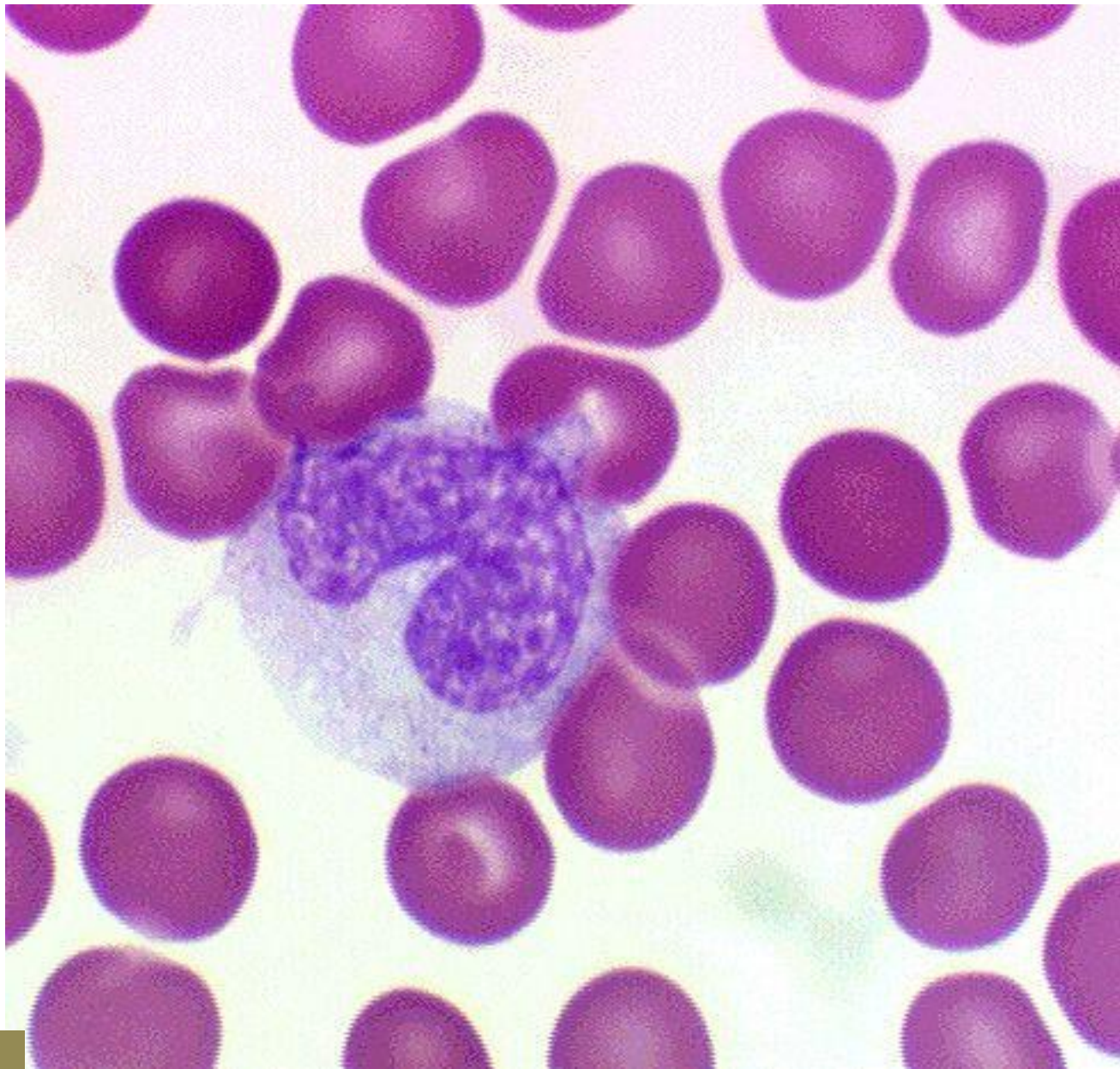


Eosinophil

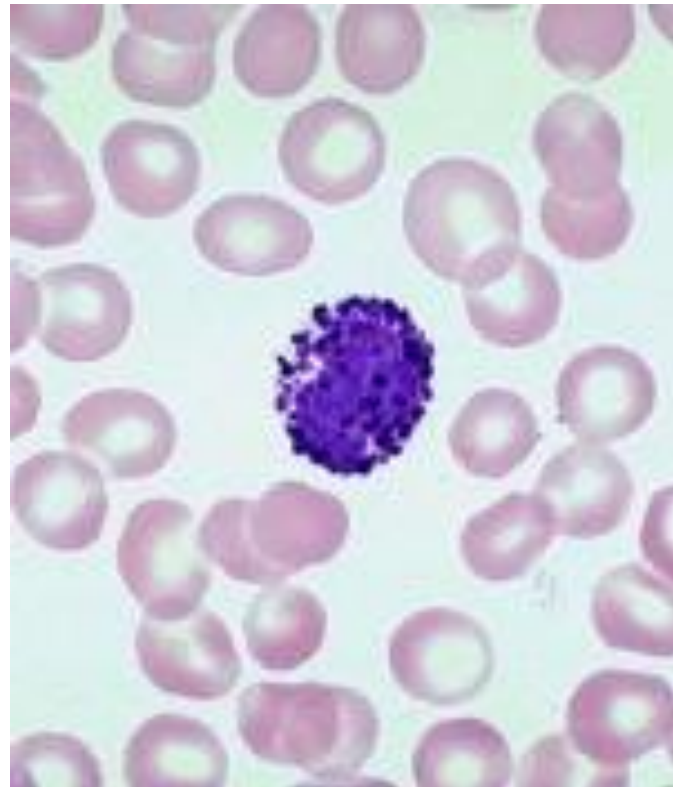
These are azurophilic non specific granules not specific granules



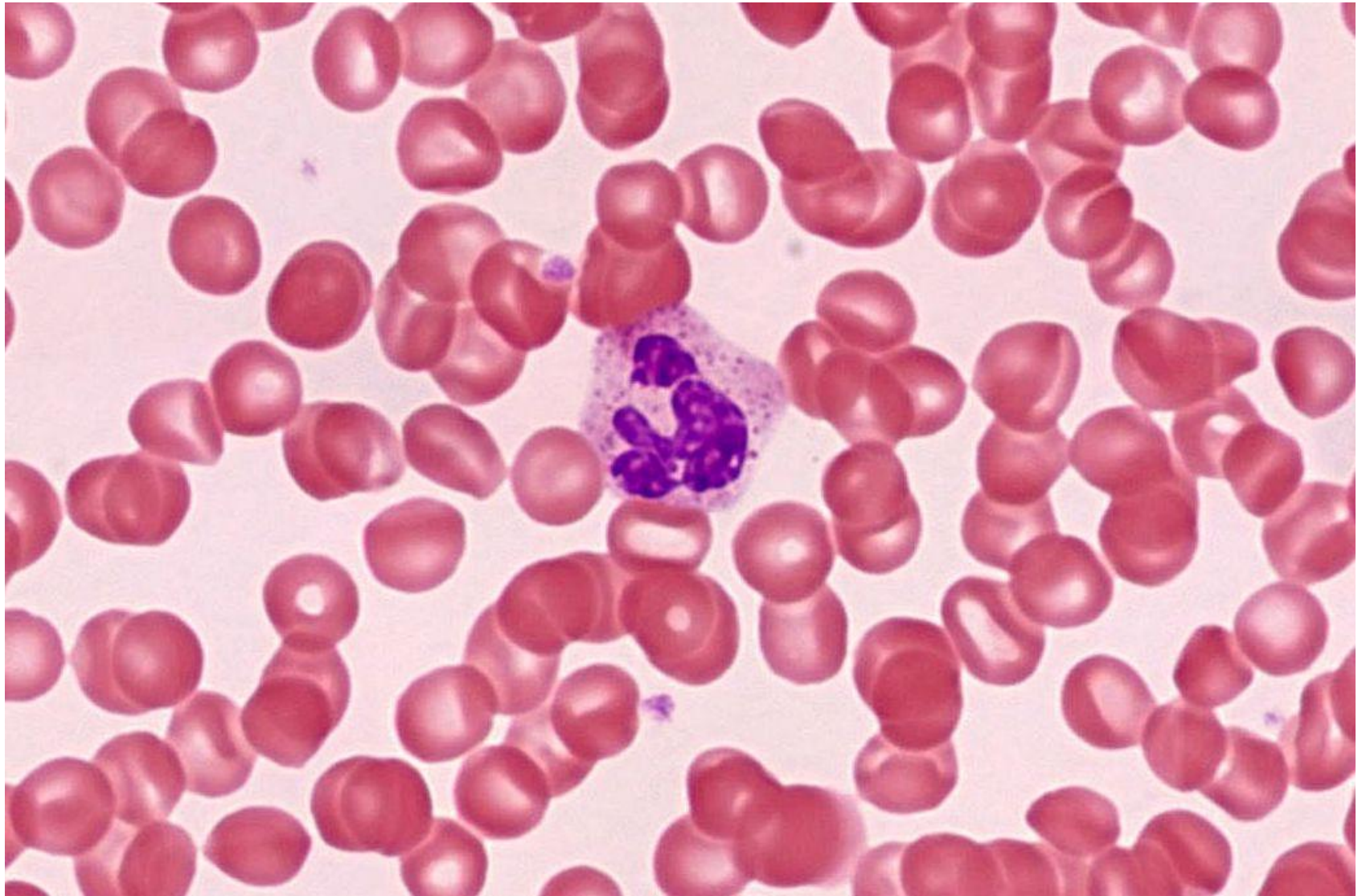
Monocyte



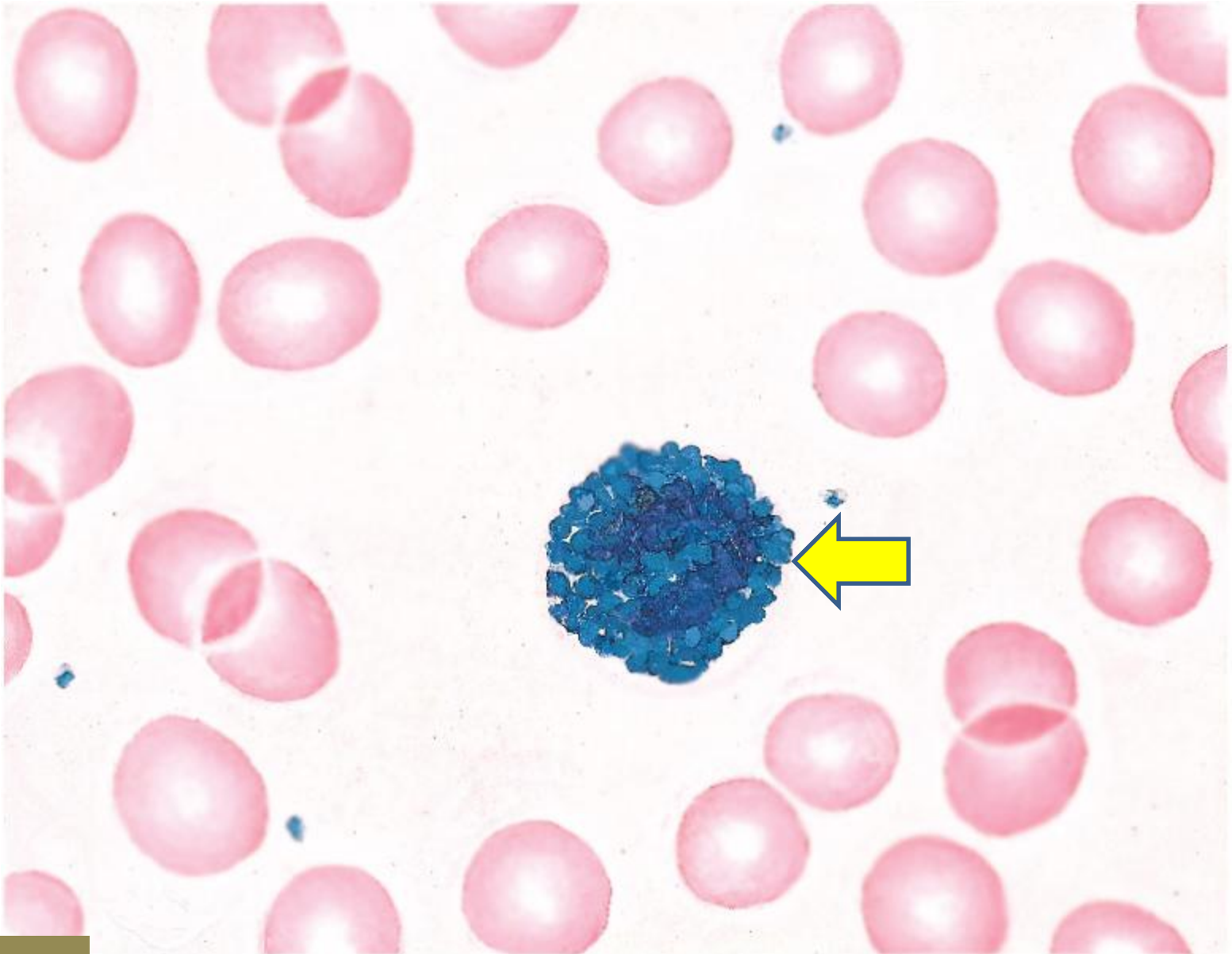
Monocyte



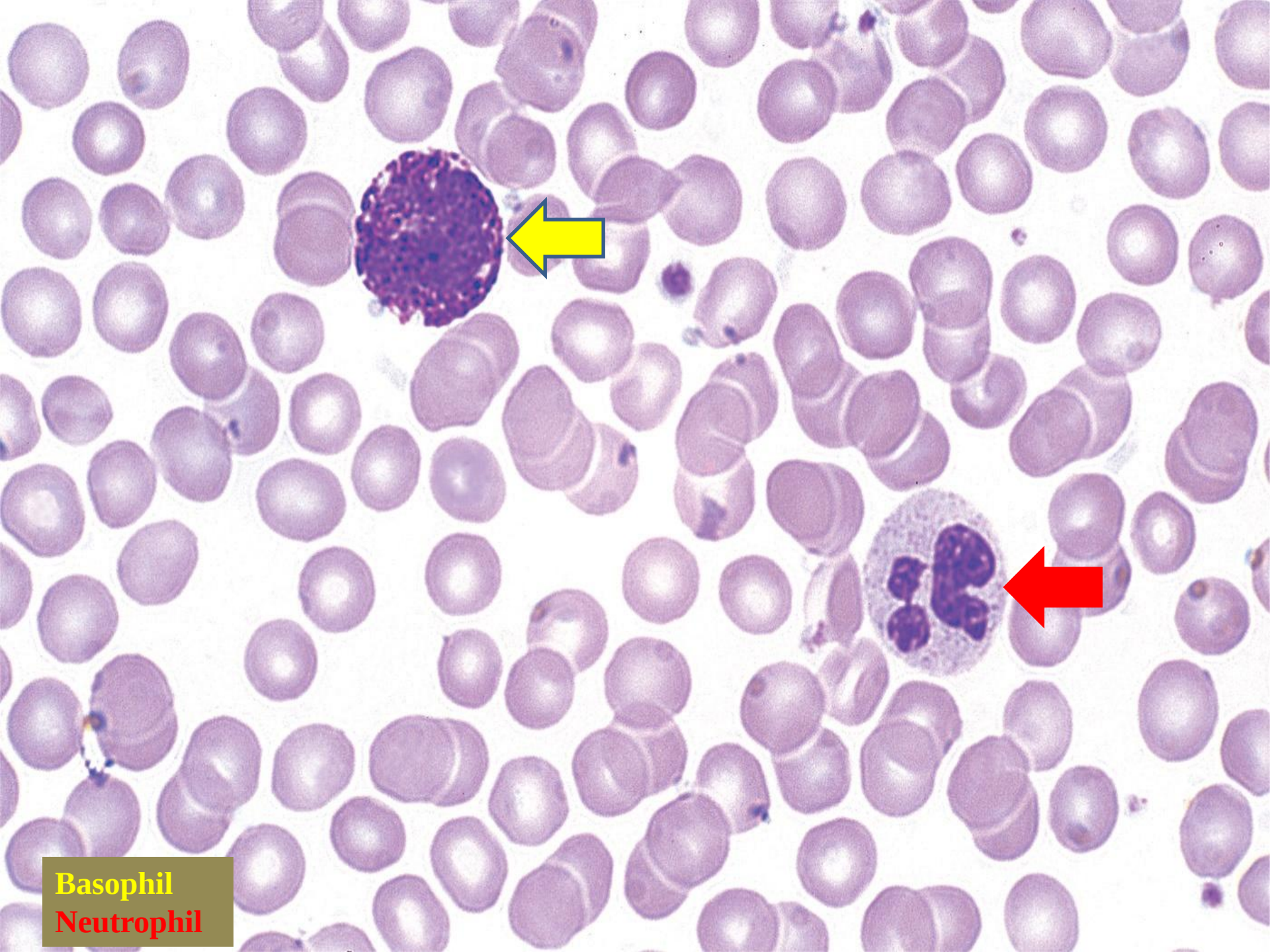
Basophil



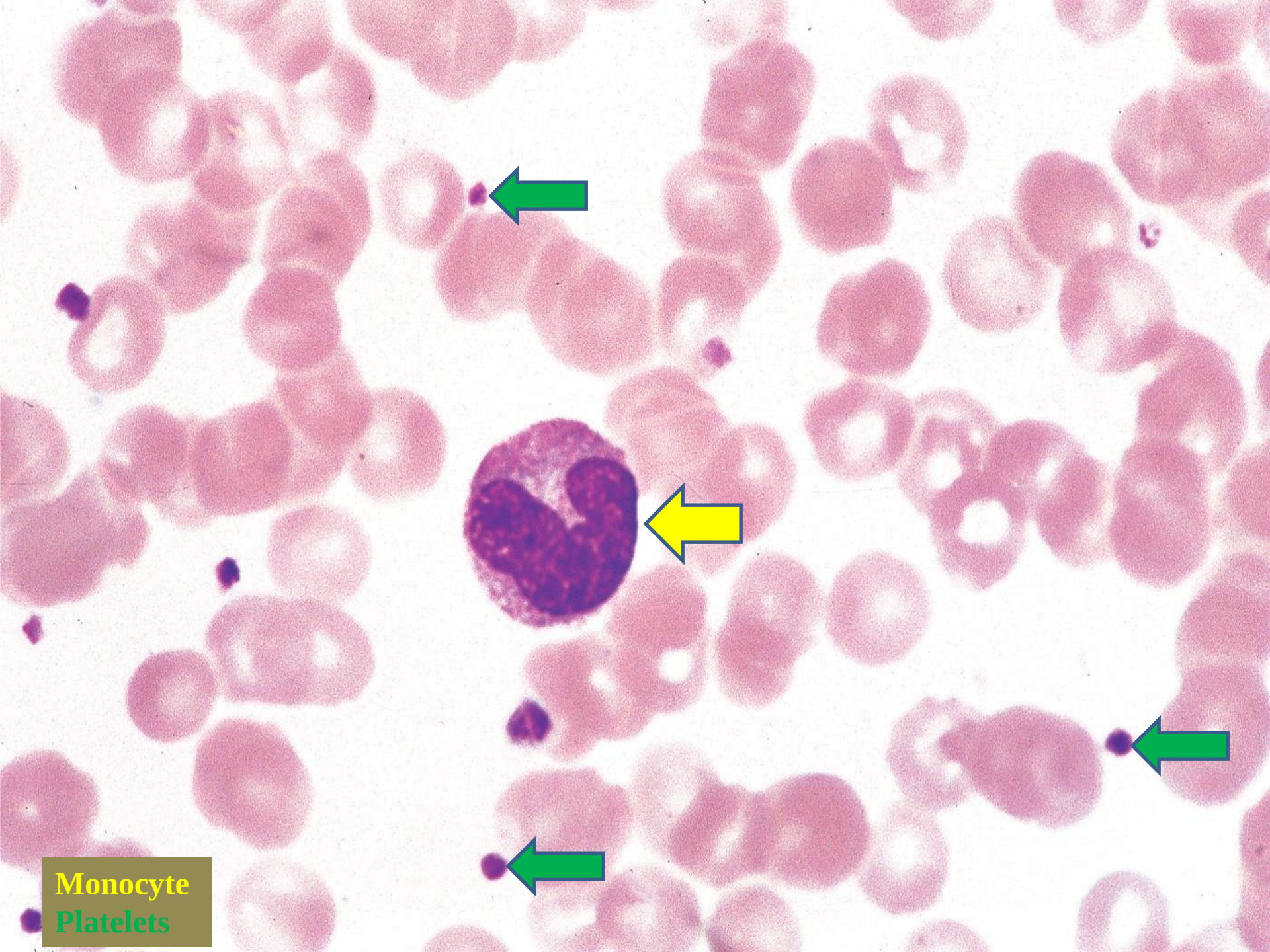
Neutrophil



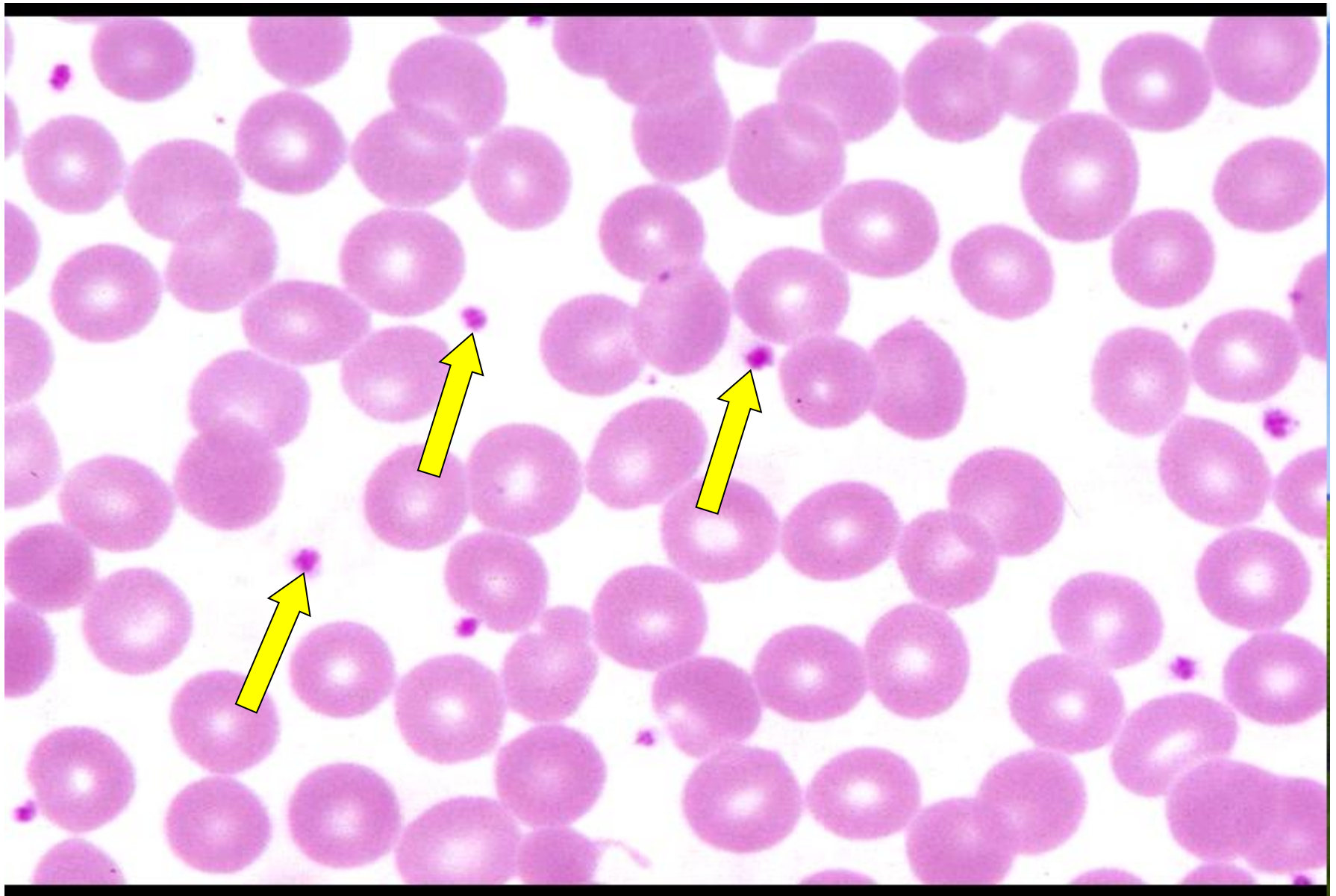
Basophil



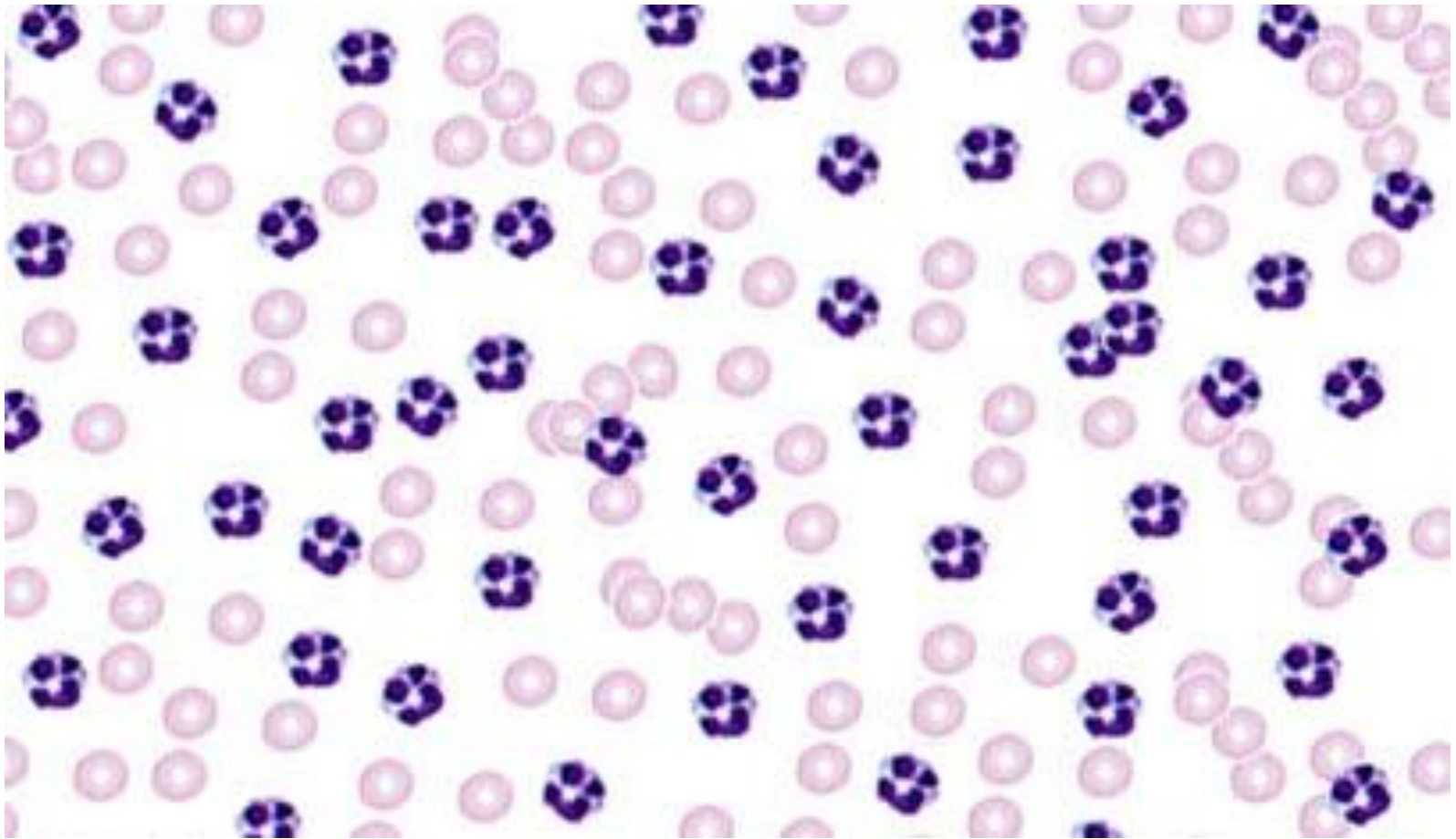
Basophil
Neutrophil



Monocyte
Platelets



Platelets

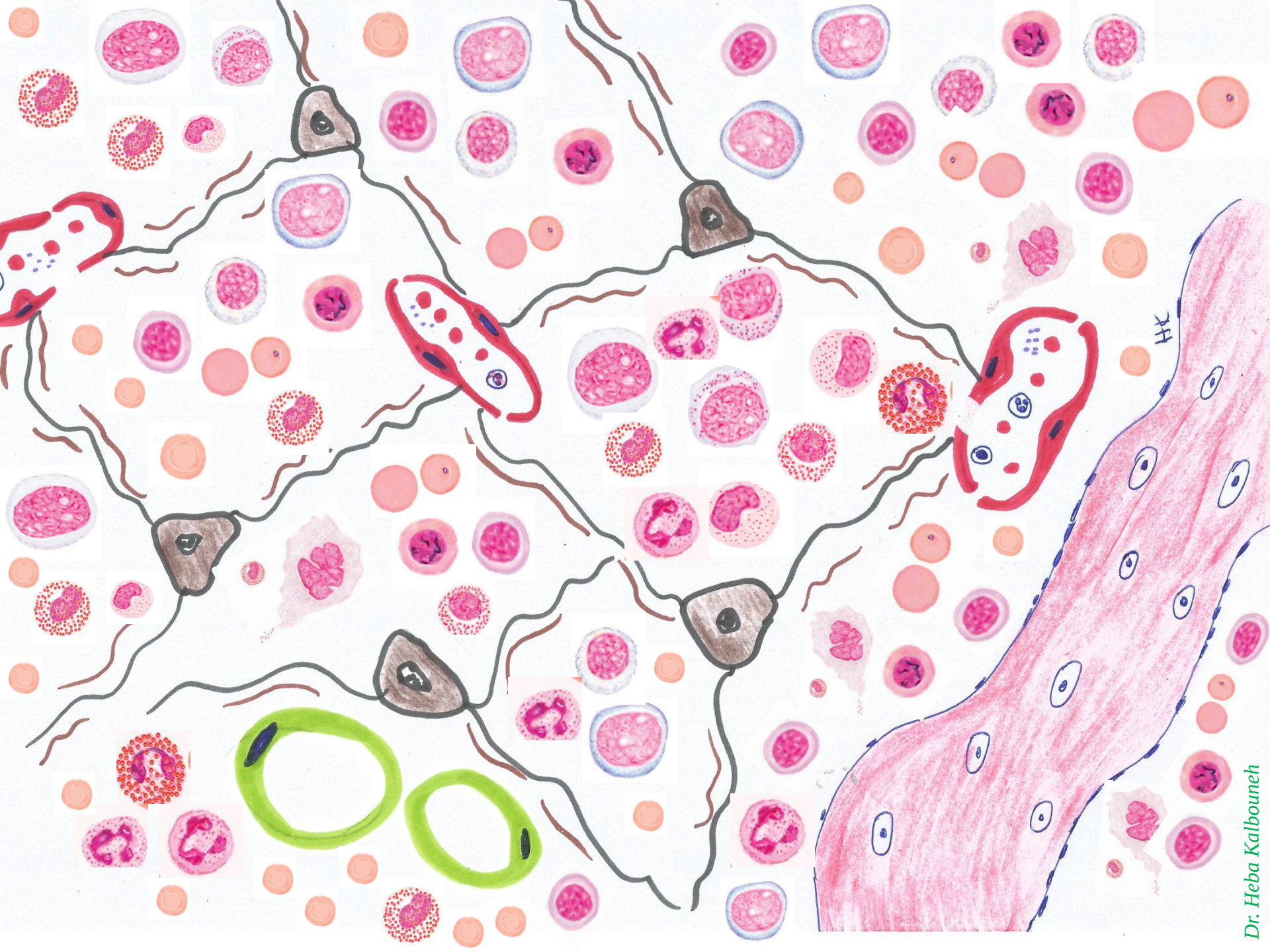


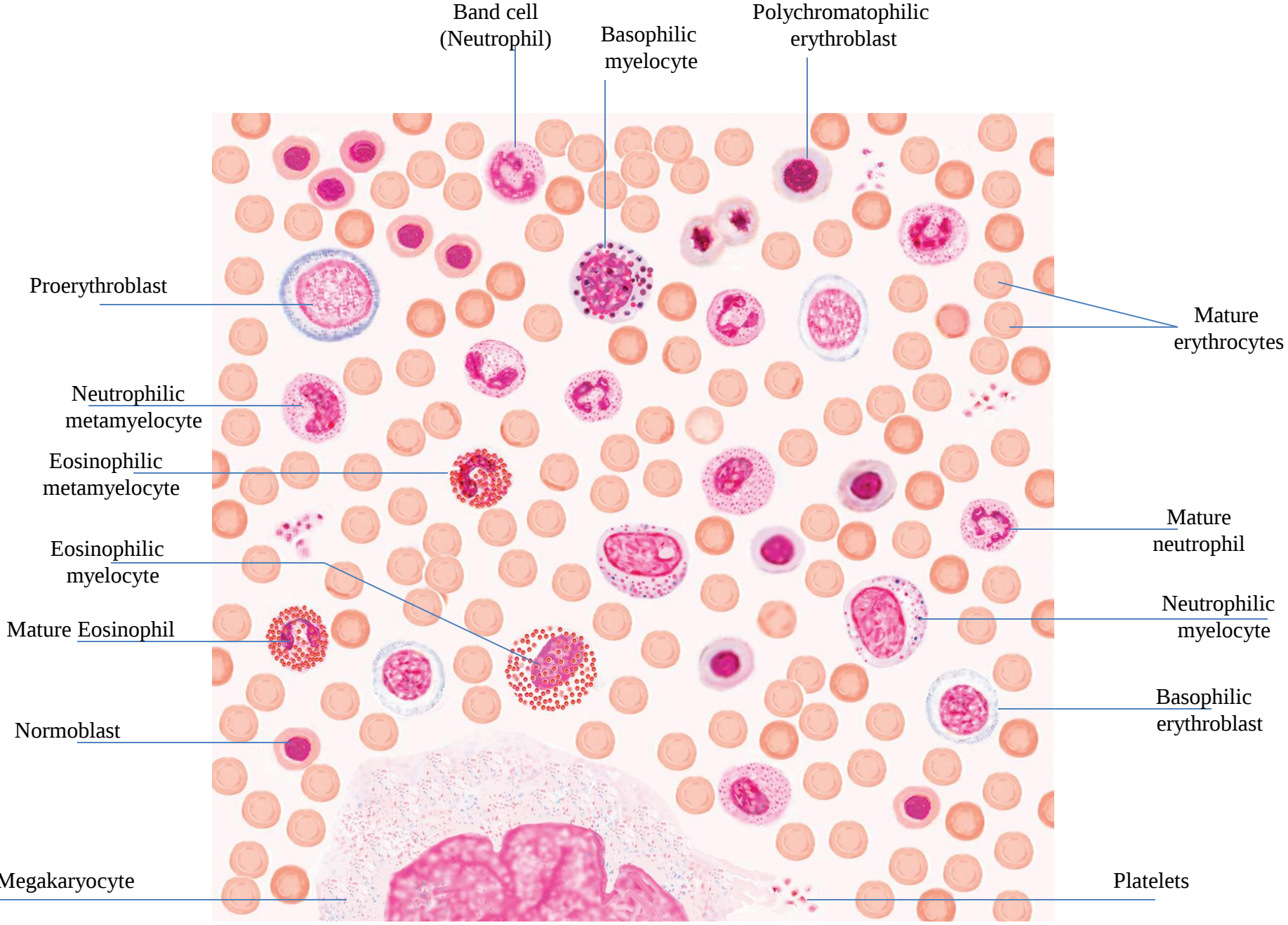
Don't Worry, Be Happy! ☺

Bone marrow

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

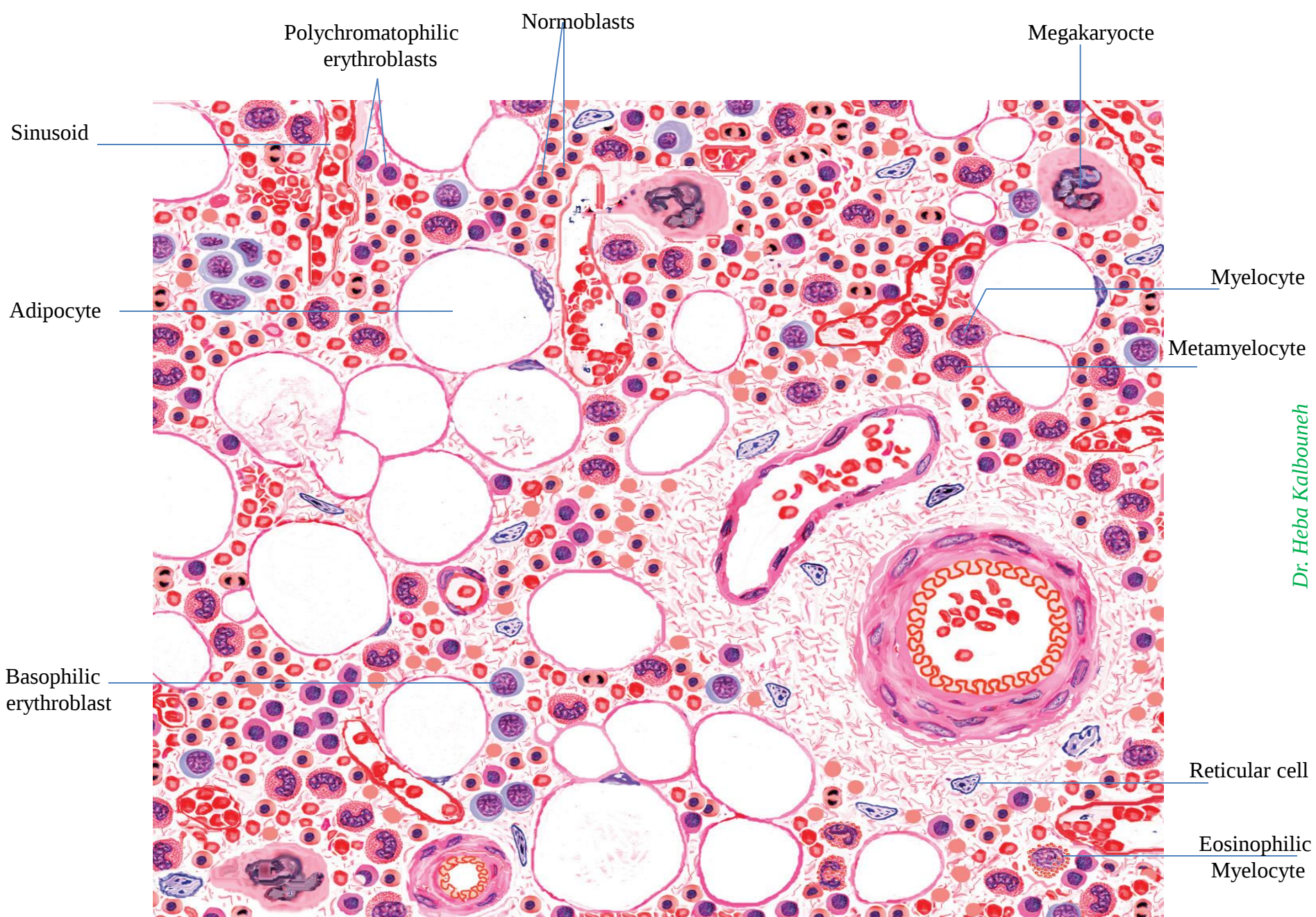
While yellow bone marrow consists mainly of adipocytes





Red Bone Marrow (Giemsa stain)

Dr. Heba Kalbouneh

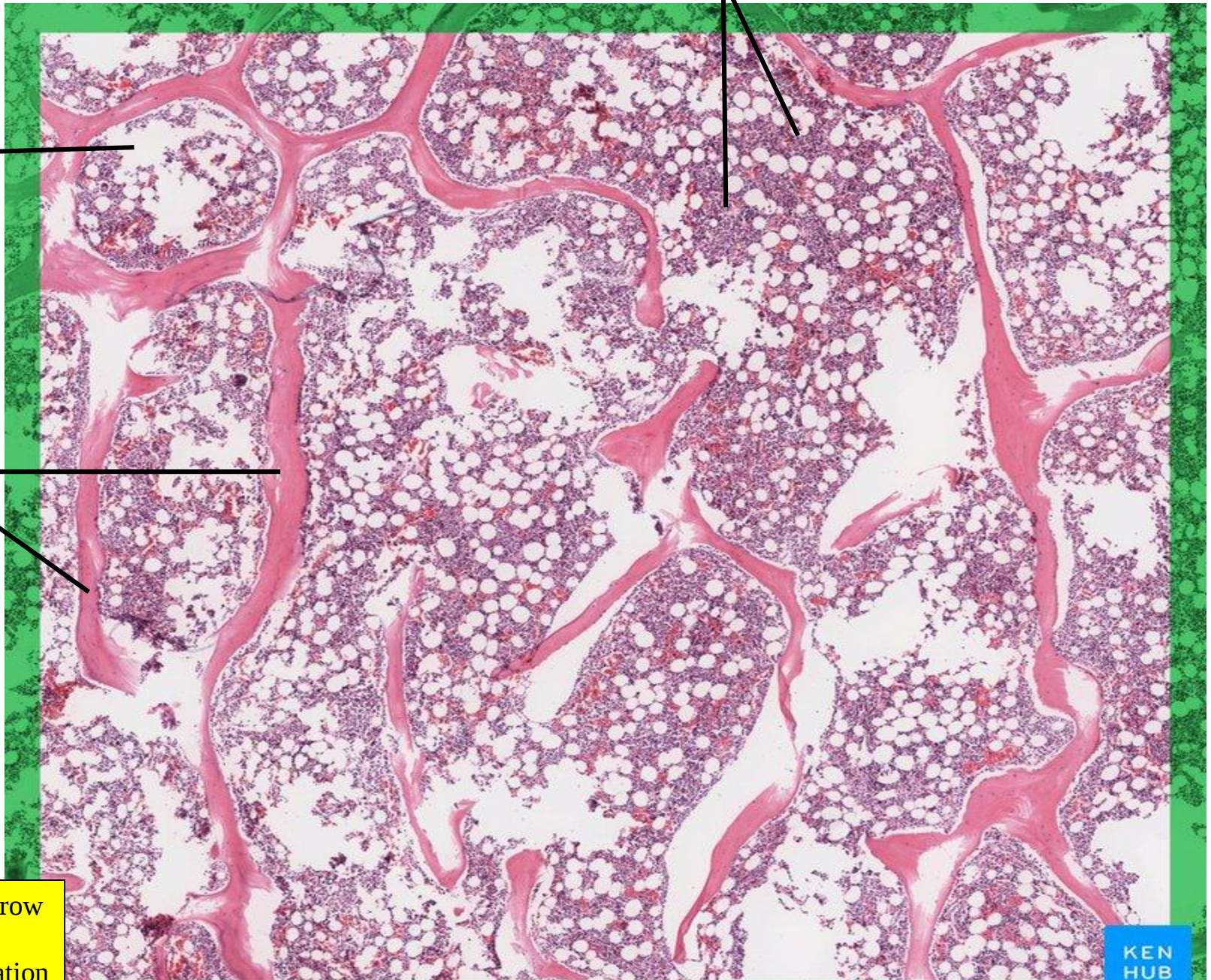


Red Bone Marrow (H&E)

Hematopoietic cords

Adipocytes

Trabeculae of
spongy bone



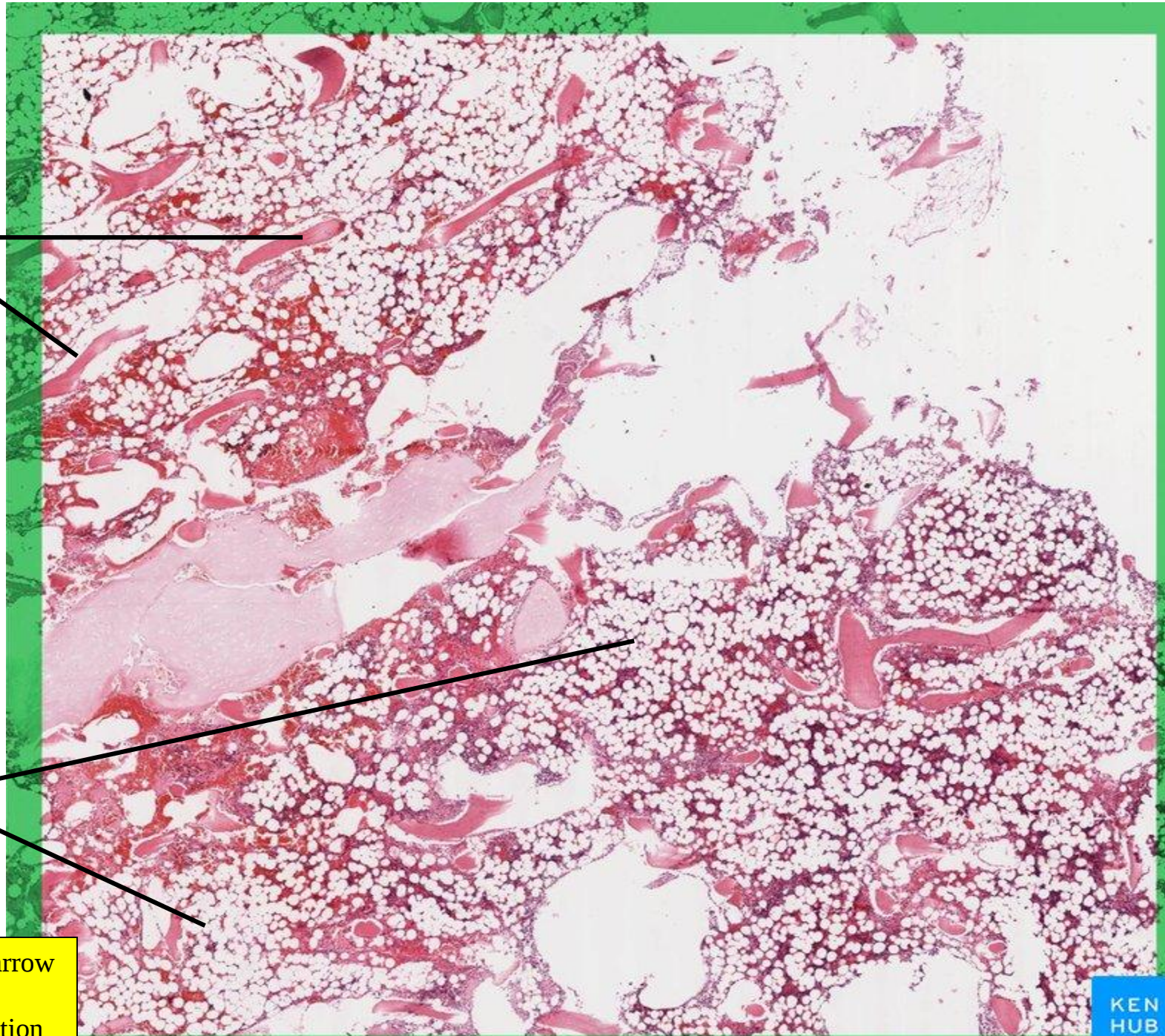
Red Bone Marrow
H&E
Low magnification

KEN
HUB

Trabeculae of
spongy bone

Adipocytes

Yellow Bone Marrow
H&E
Low magnification

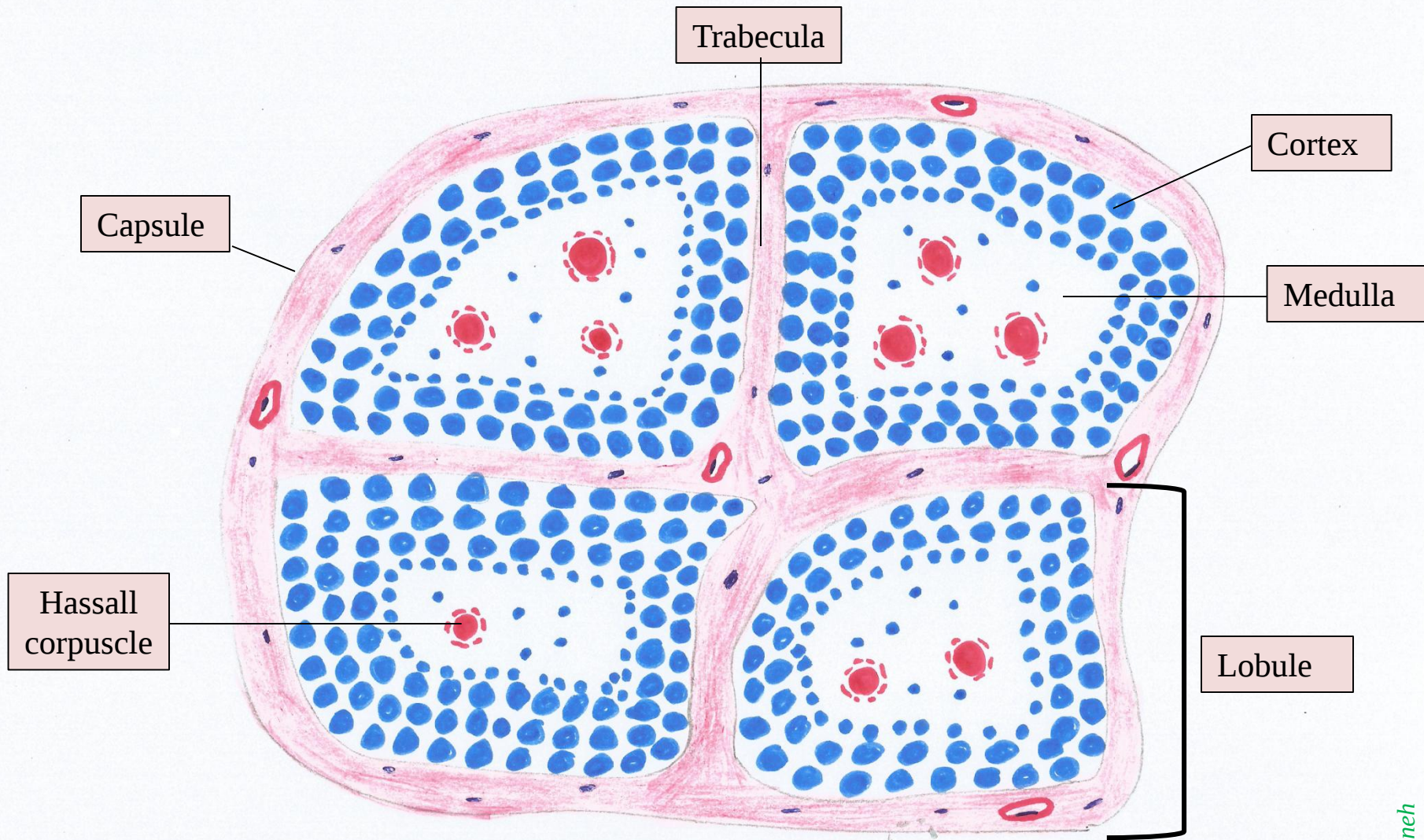


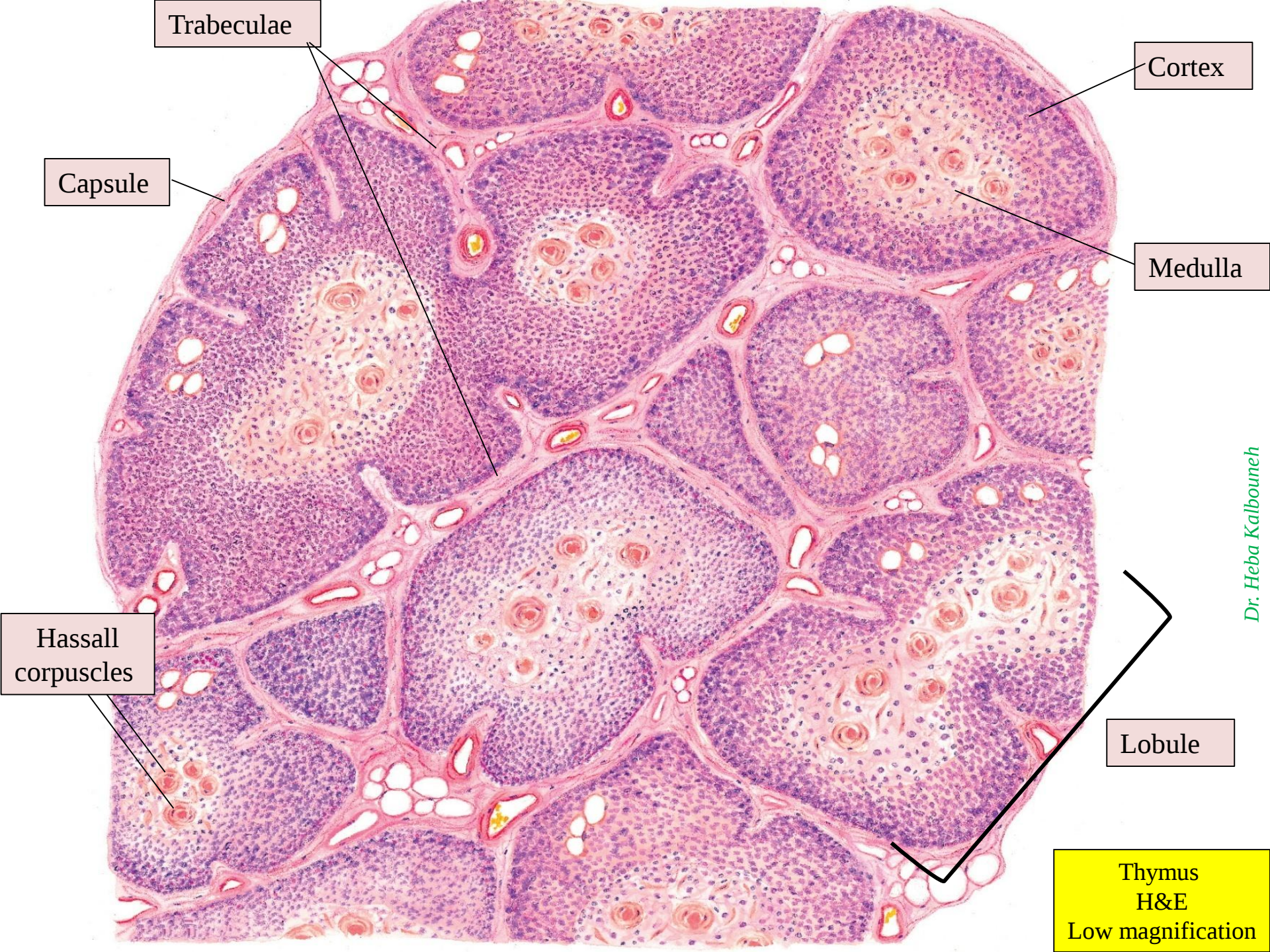
Thymus

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





Trabeculae

Cortex

Capsule

Medulla

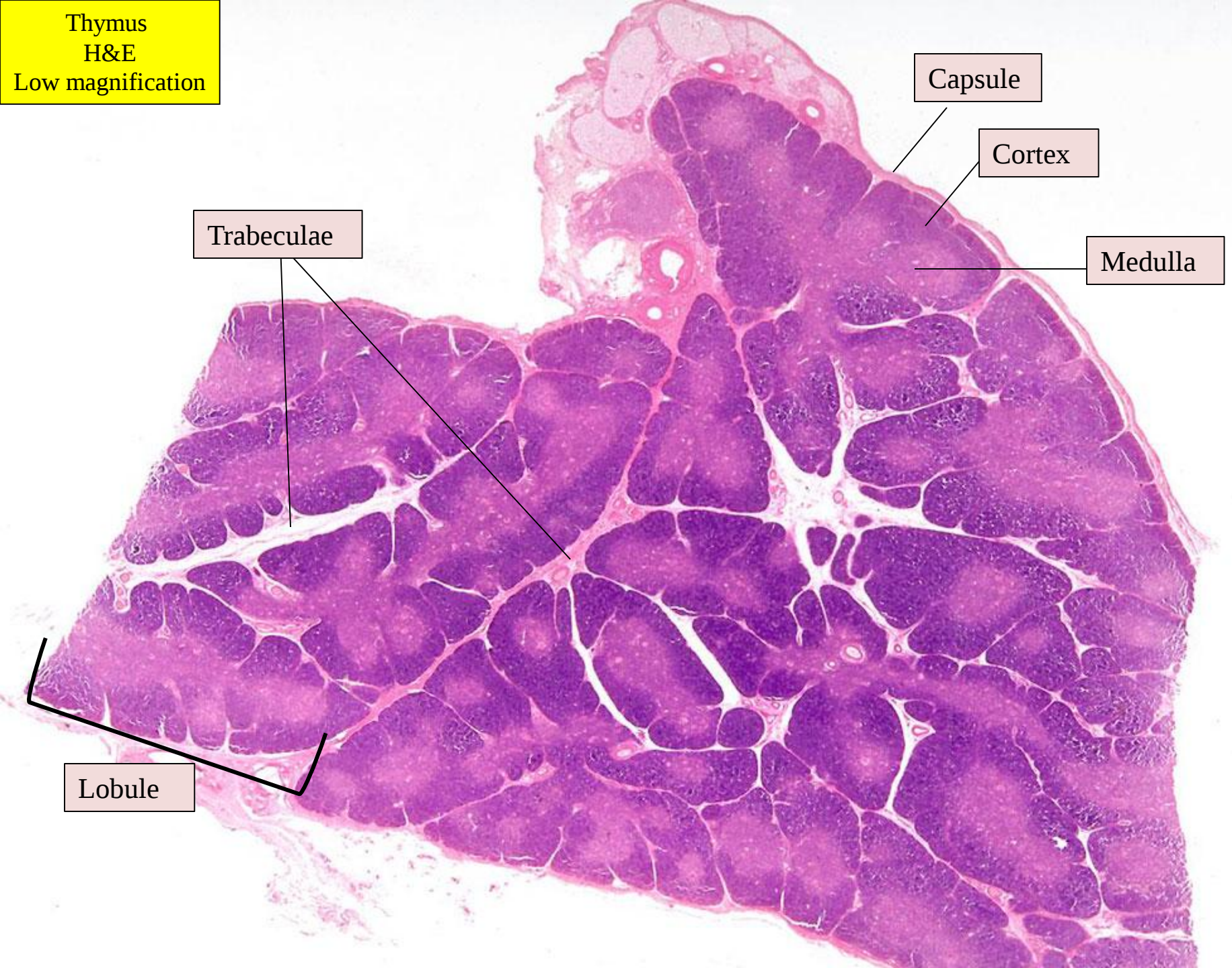
Hassall
corpuscles

Lobule

Thymus
H&E
Low magnification

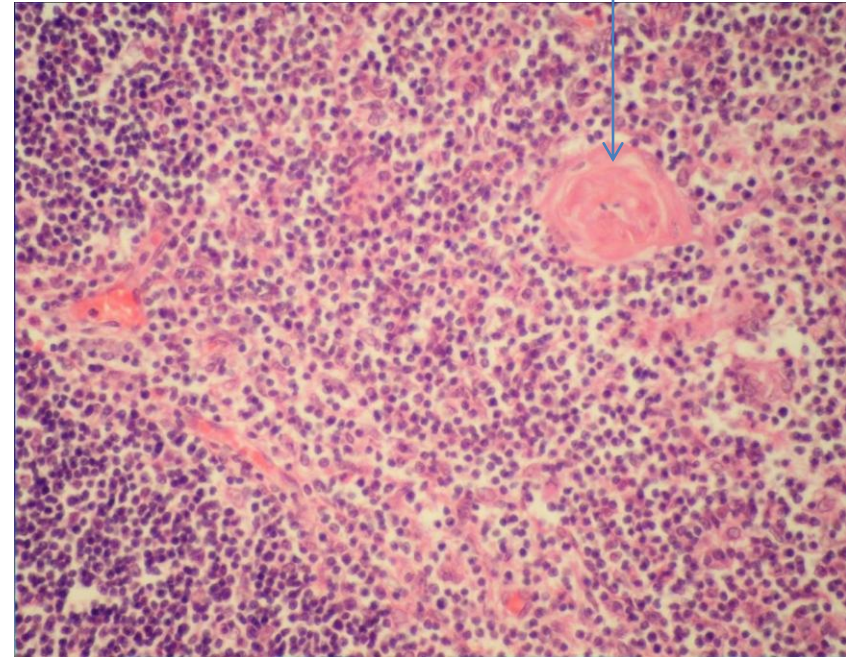
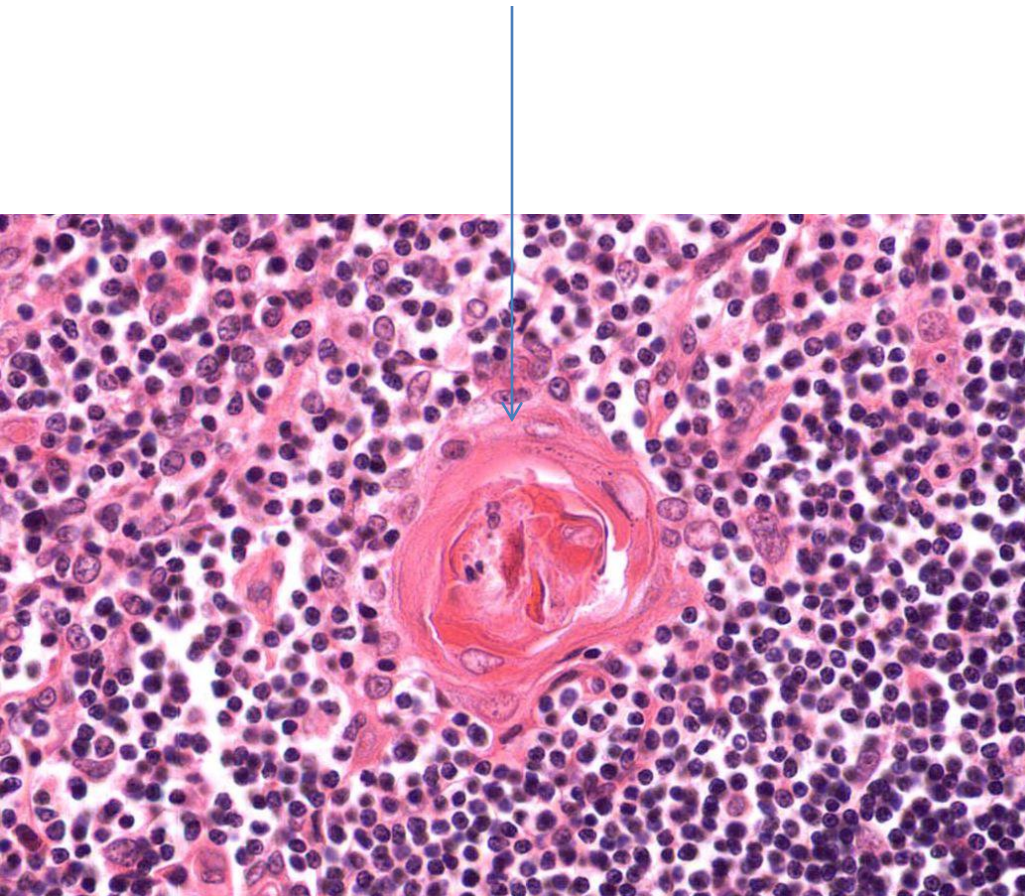
Dr. Heba Kalbouneh

Thymus
H&E
Low magnification

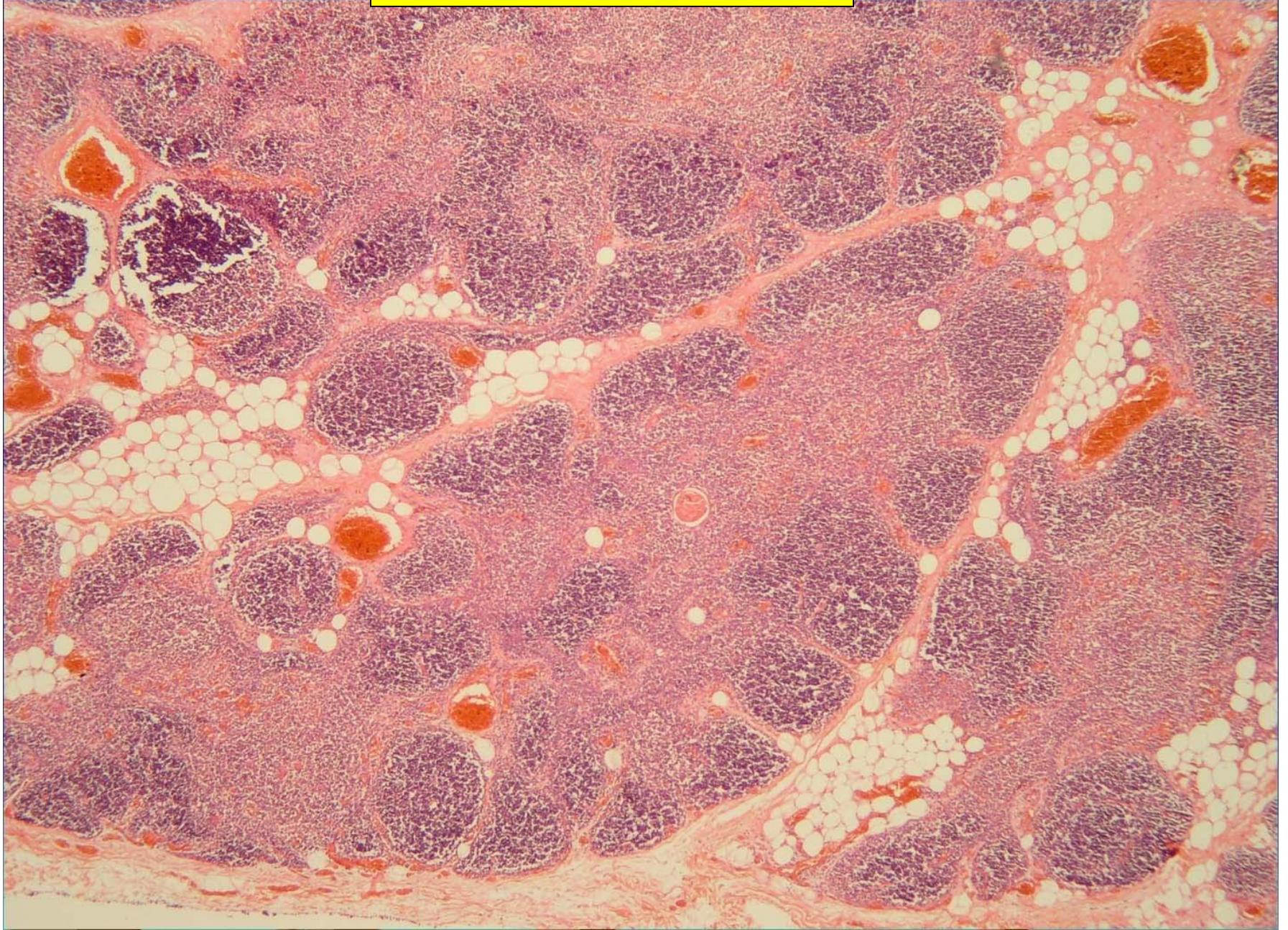


Thymic medulla
H&E
High magnification

Hassall
Corpuscle in medulla

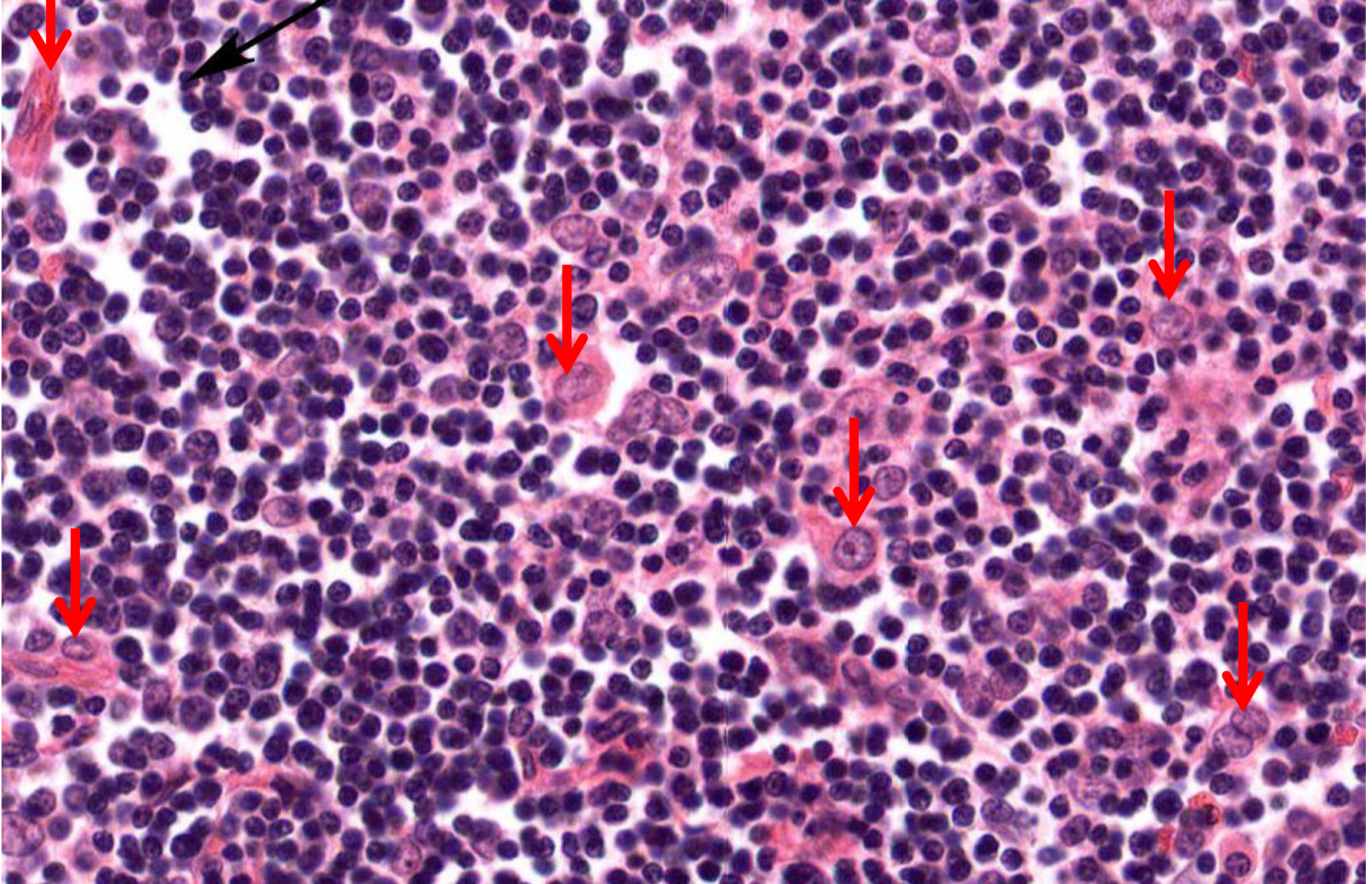


Involved Thymus
H&E
Low magnification



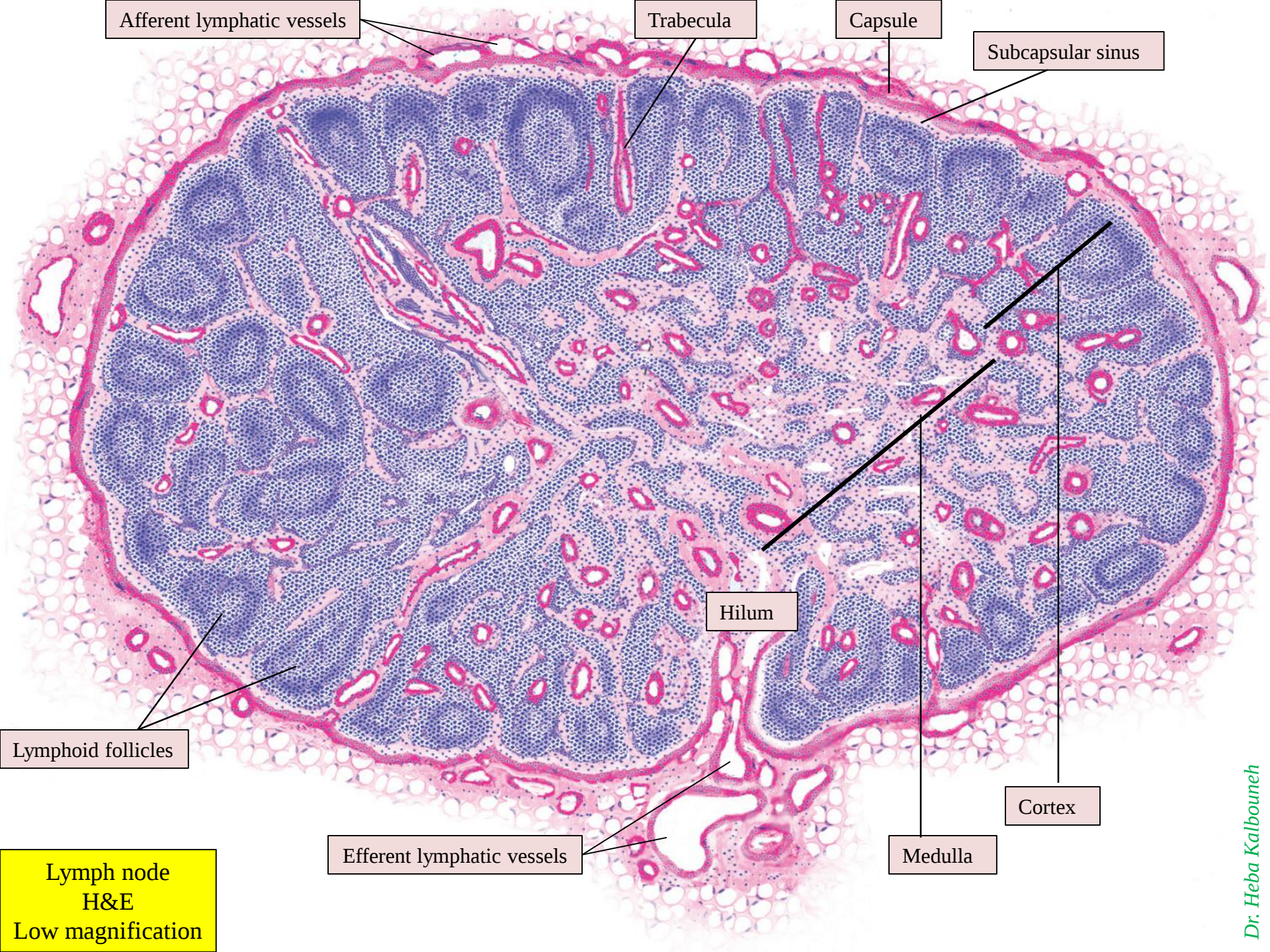
Epithelial reticular cells (Thymus)

What are the dark blue/purple-stained nuclei?



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.



Afferent lymphatic vessels

Trabecula

Capsule

Subcapsular sinus

Hilum

Lymphoid follicles

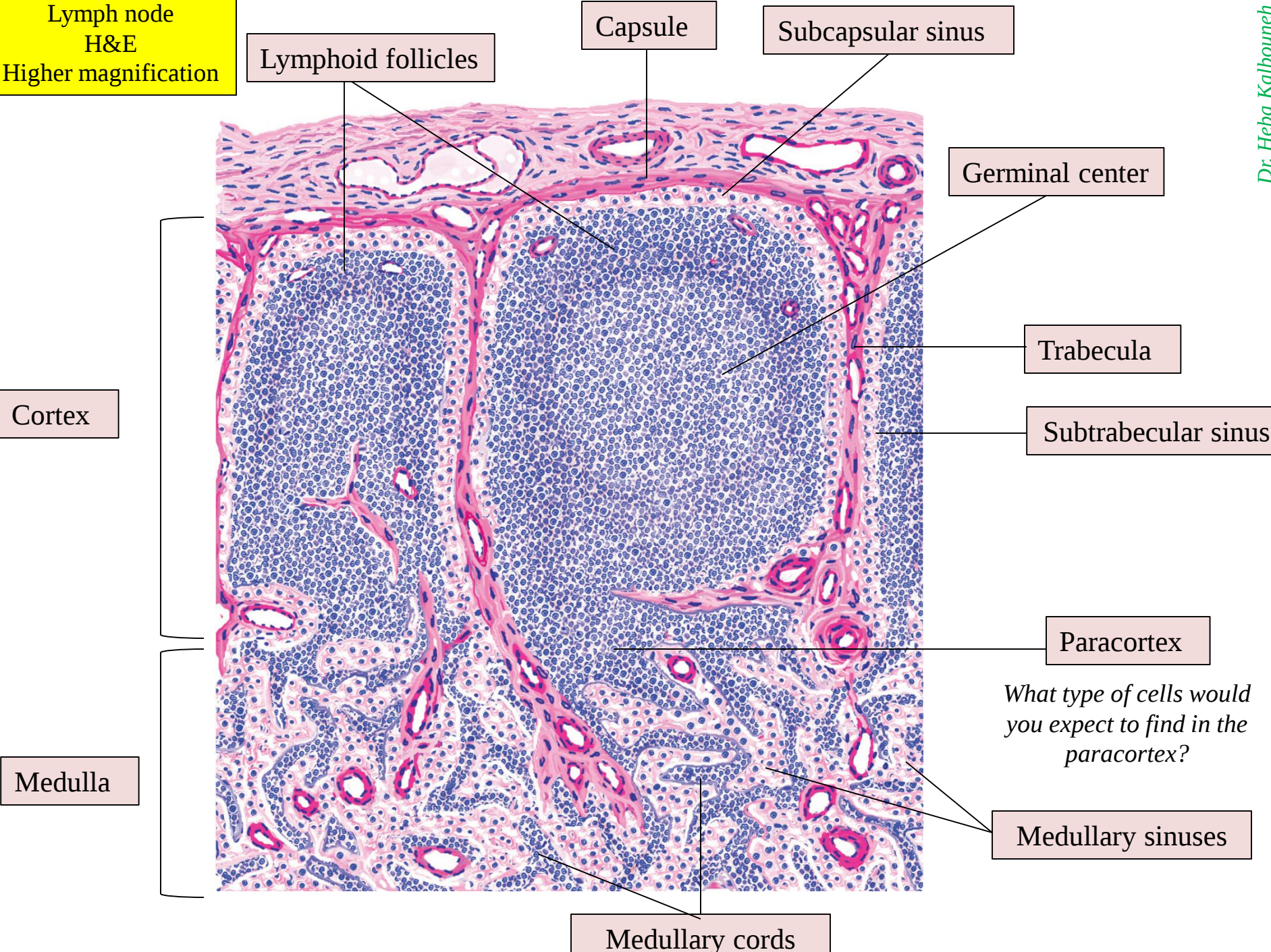
Efferent lymphatic vessels

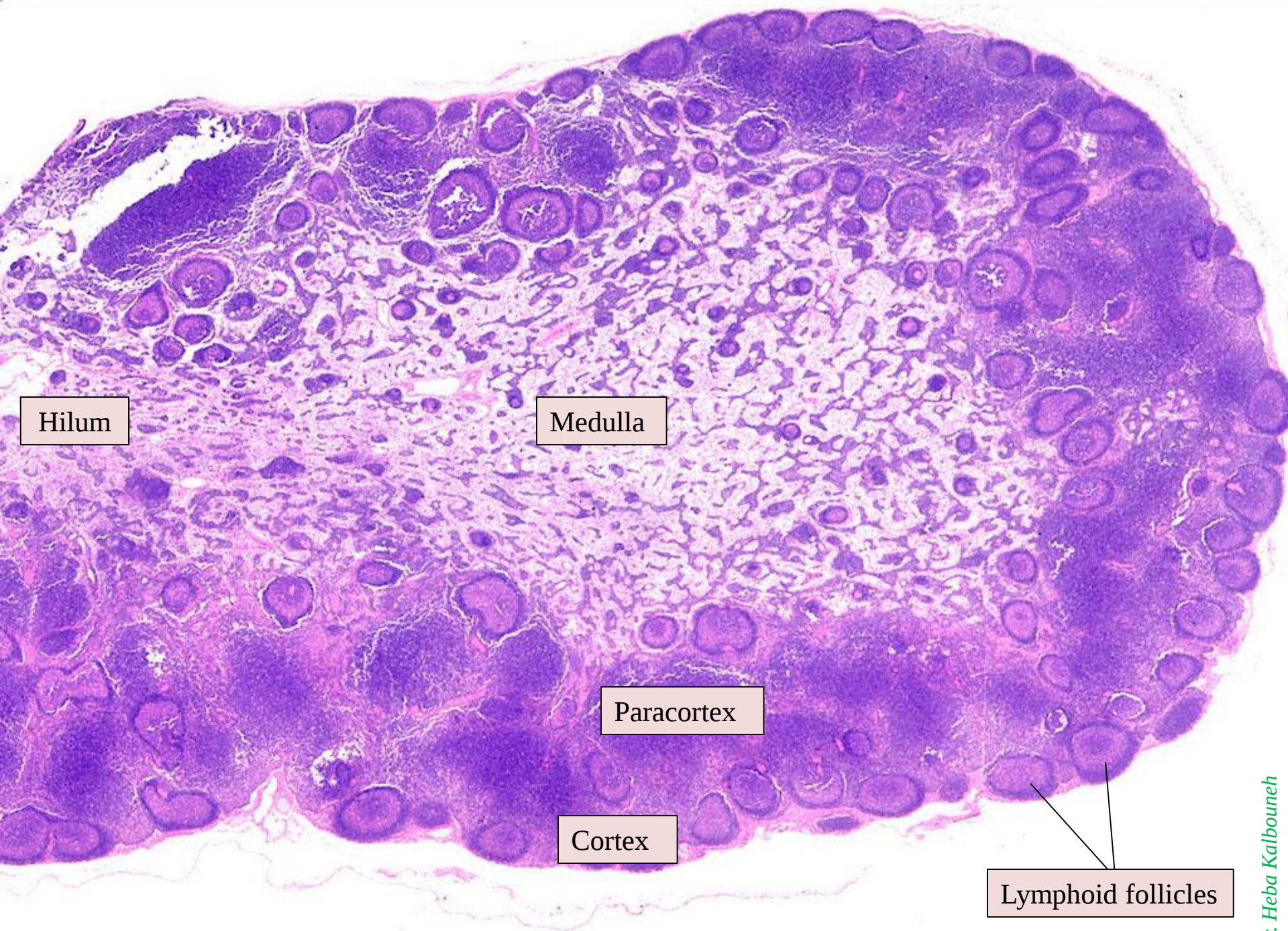
Medulla

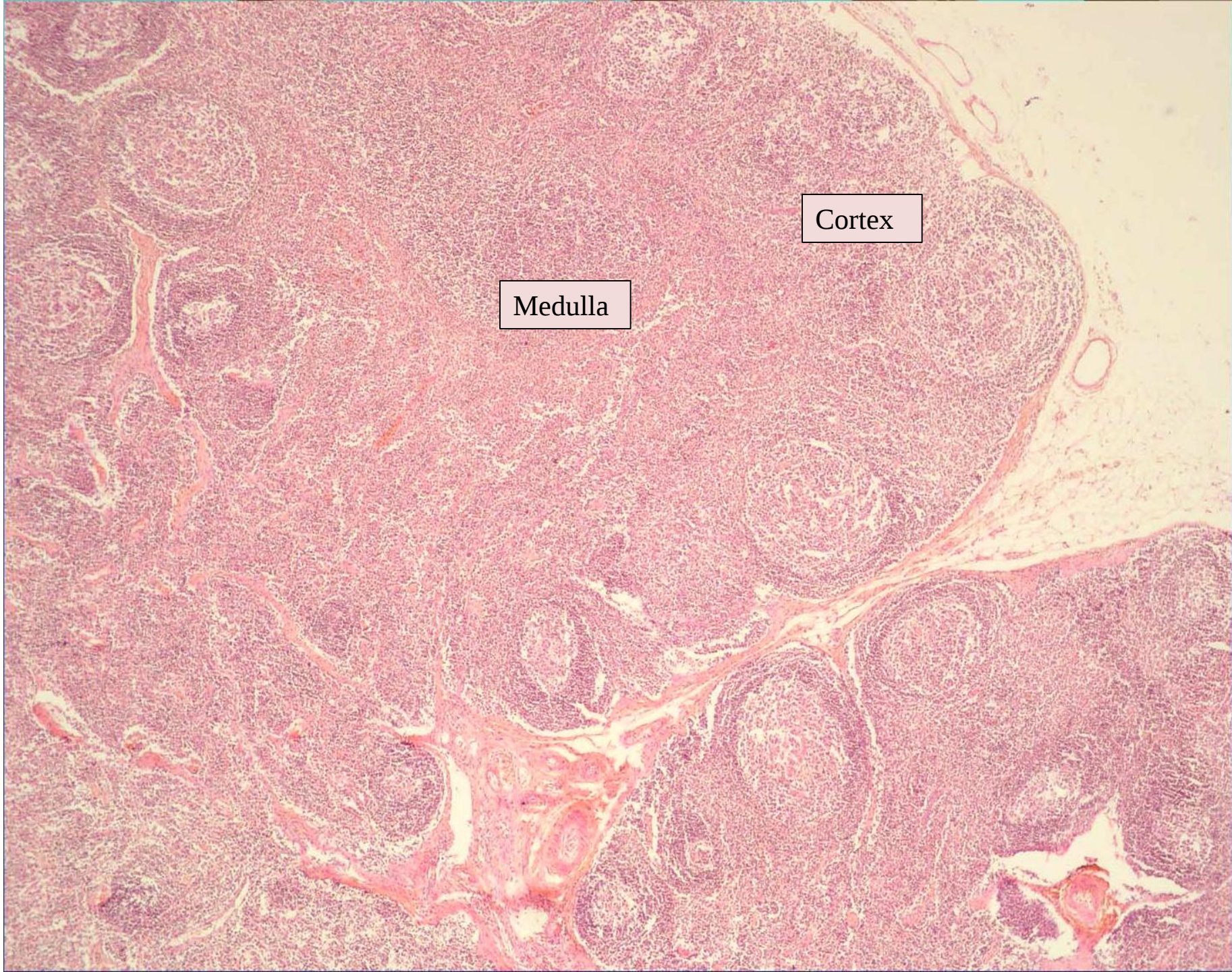
Cortex

Lymph node
H&E
Low magnification

Lymph node
H&E
Higher magnification





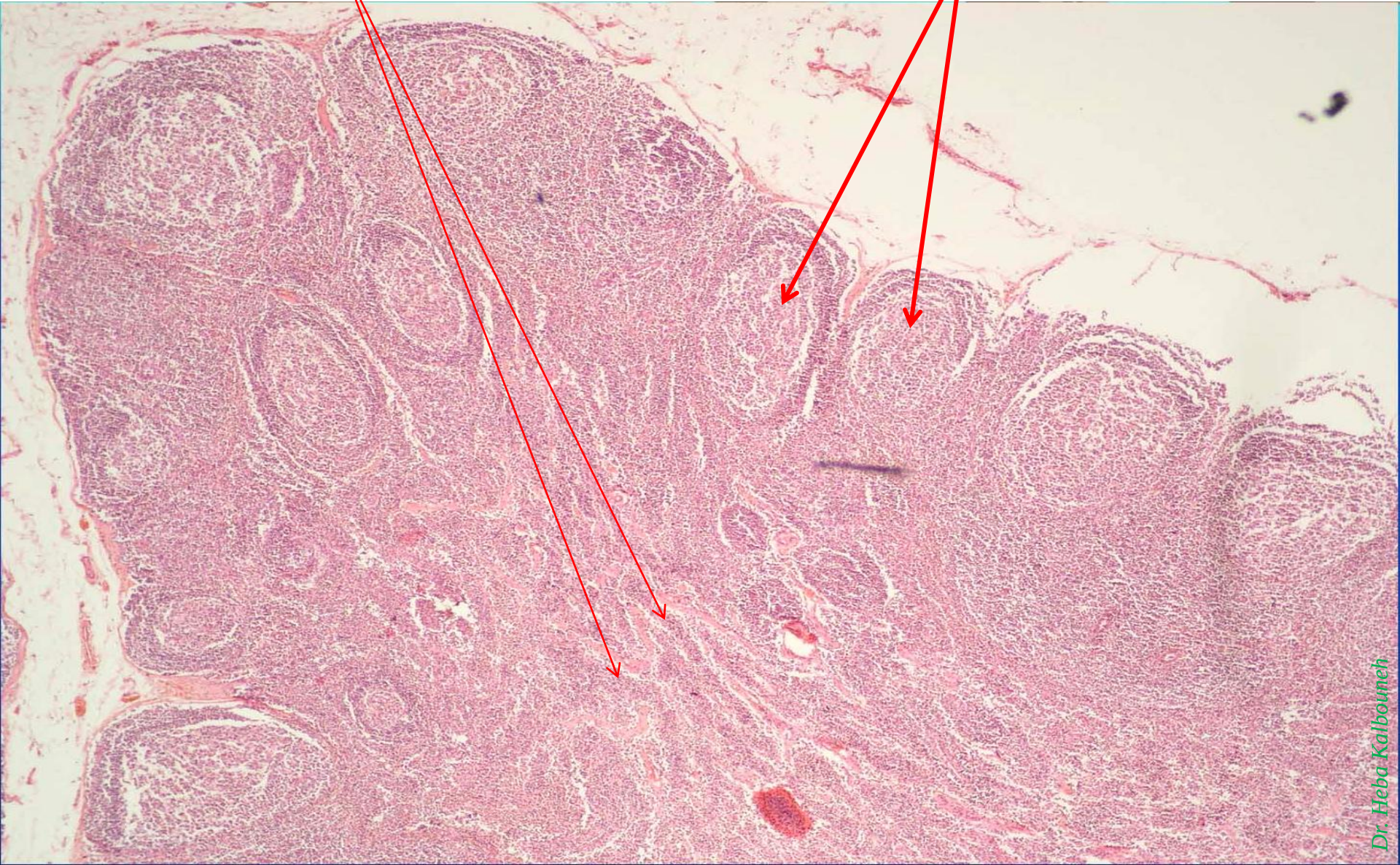


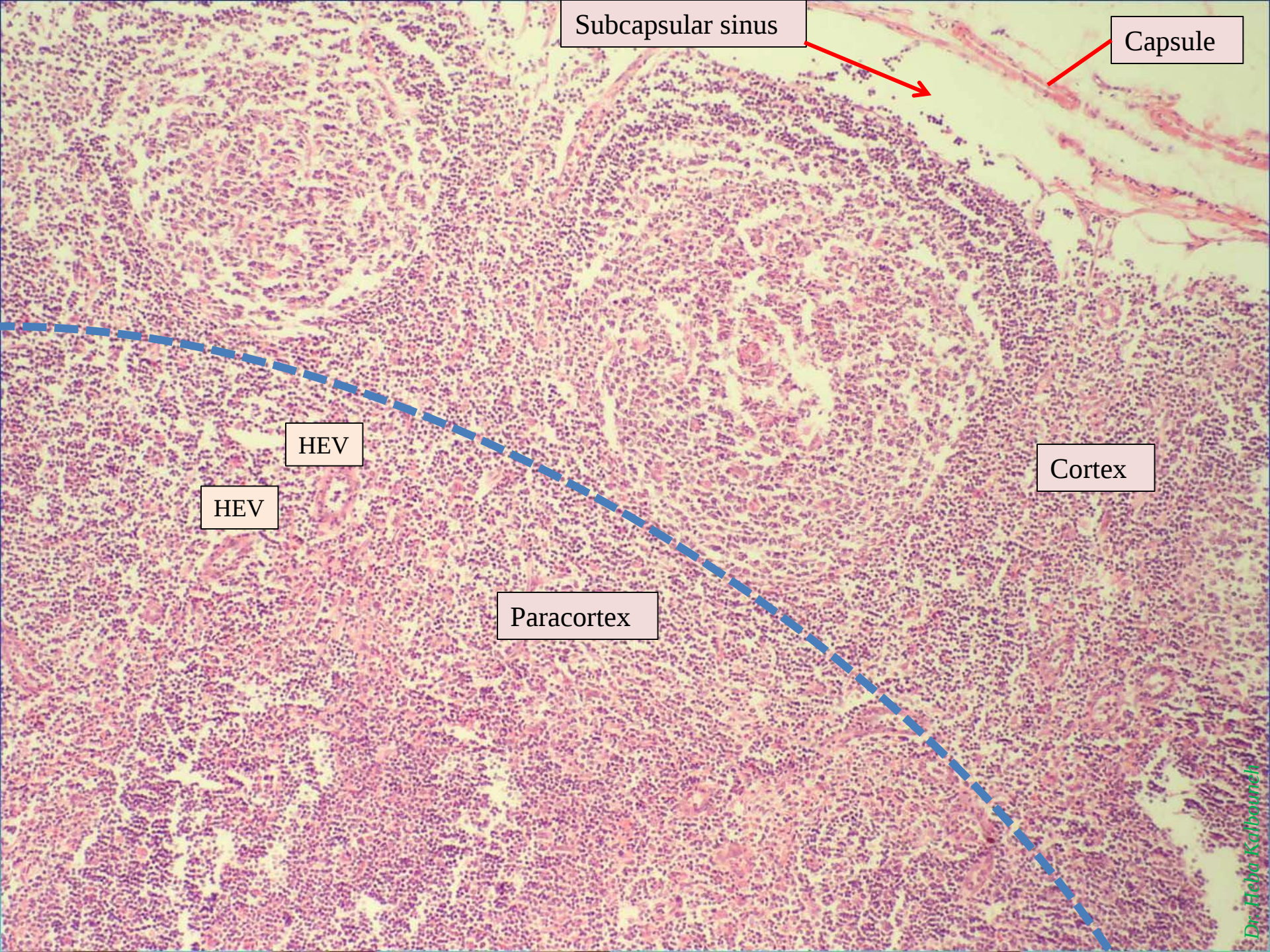
Cortex

Medulla

Medullary cords

Lymphoid follicles





Subcapsular sinus

Capsule

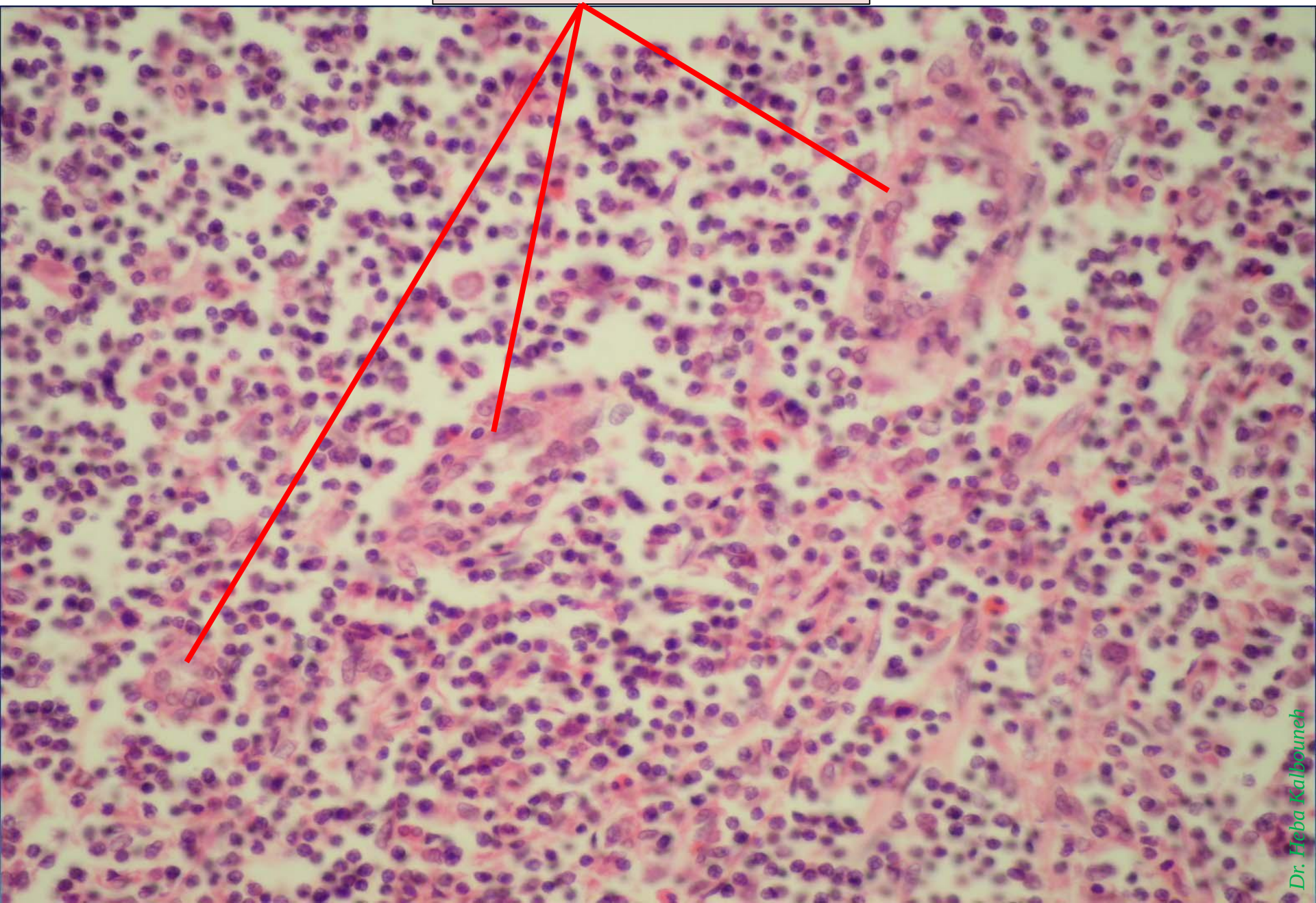
HEV

HEV

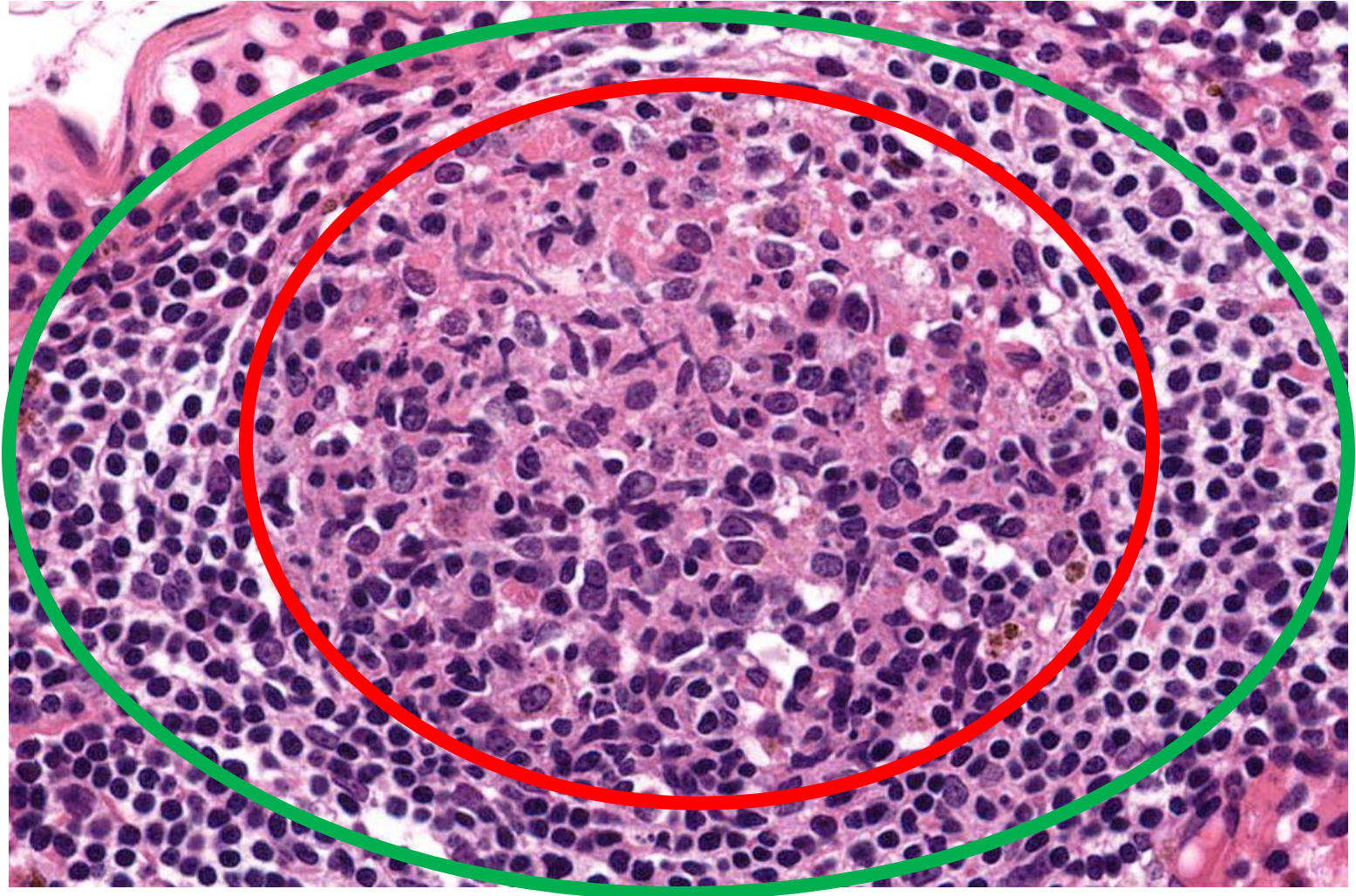
Cortex

Paracortex

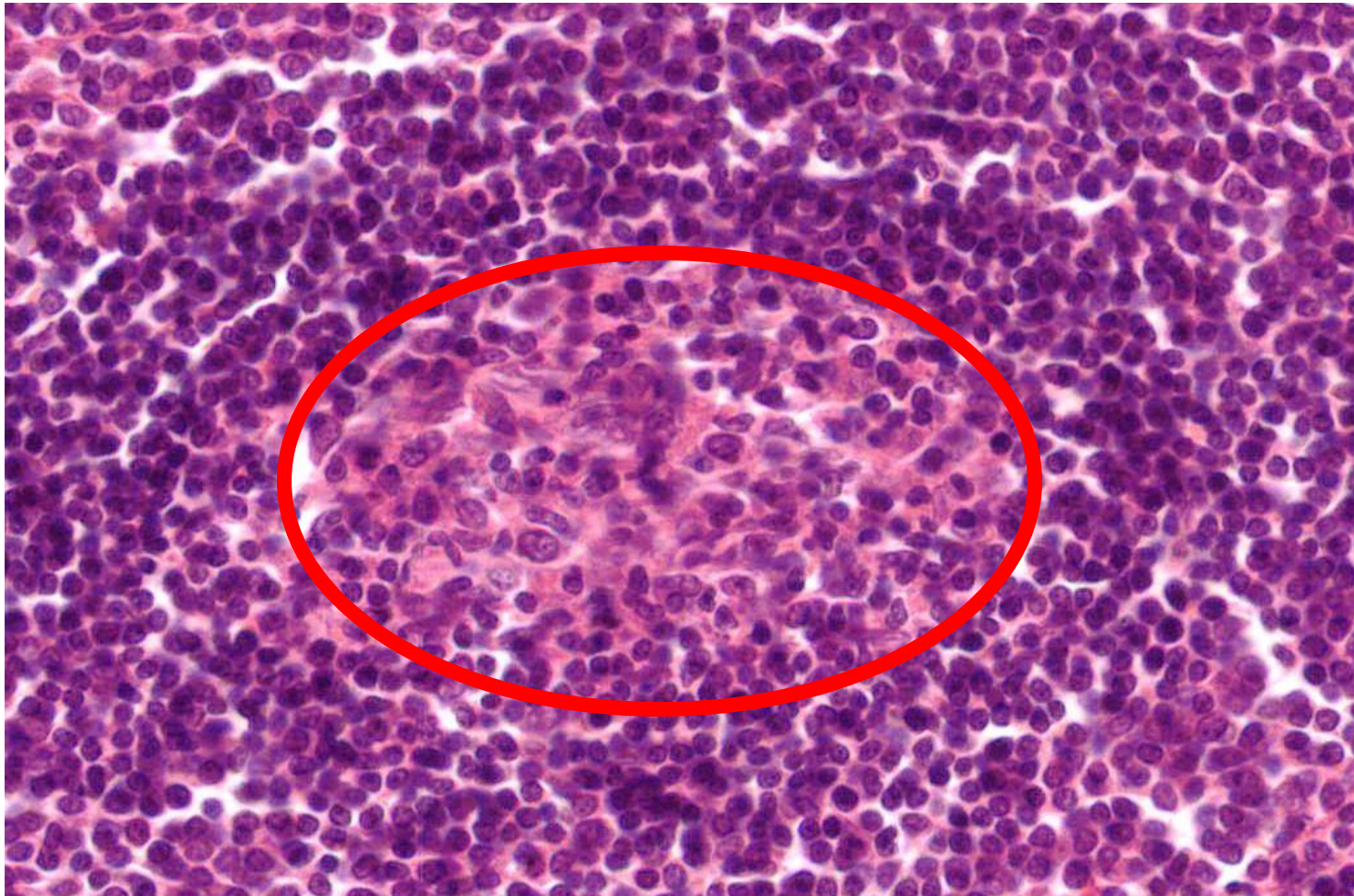
HEVs in paracortex



Germinal center

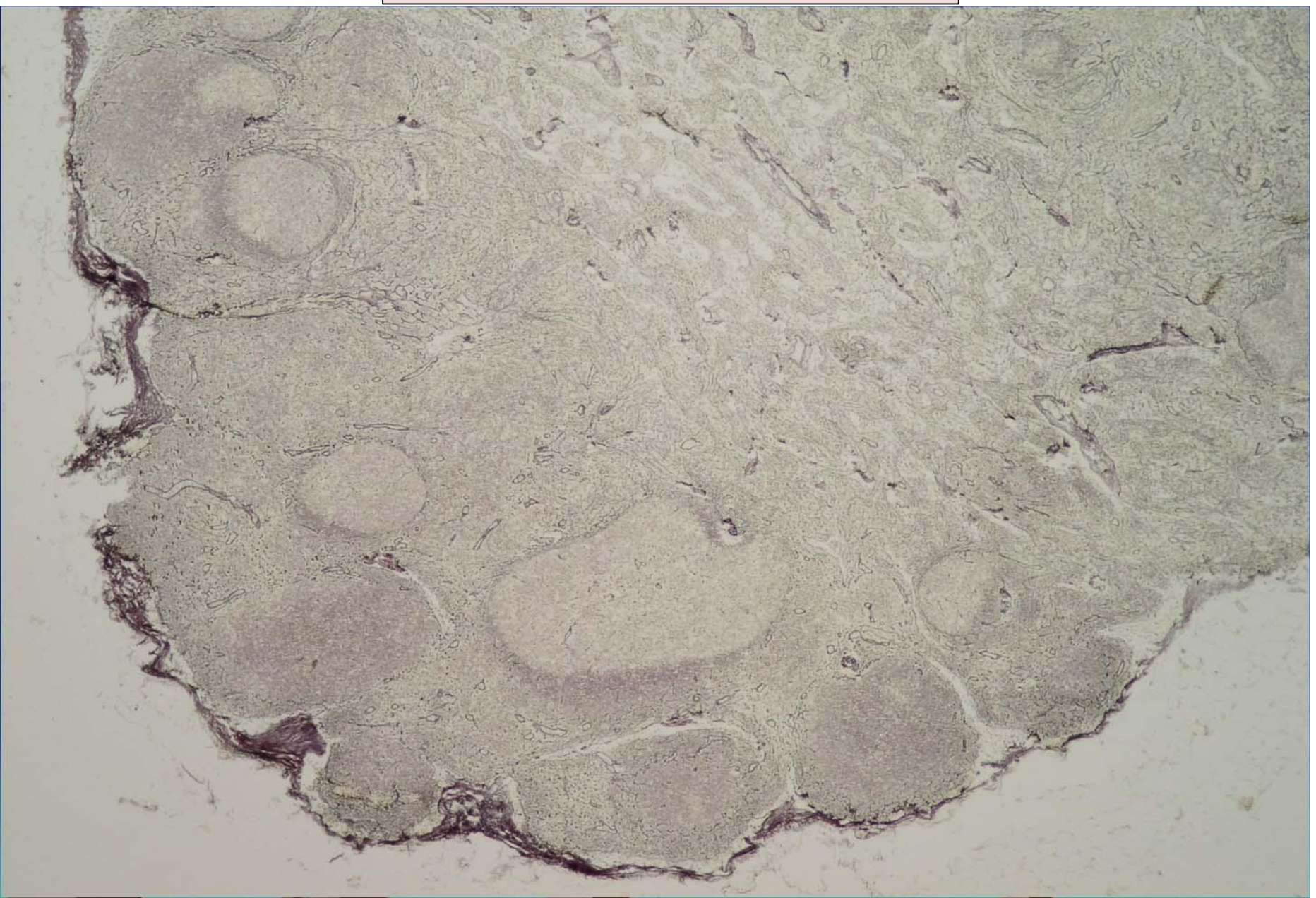


Germinal center



Lymph node- Silver Stain

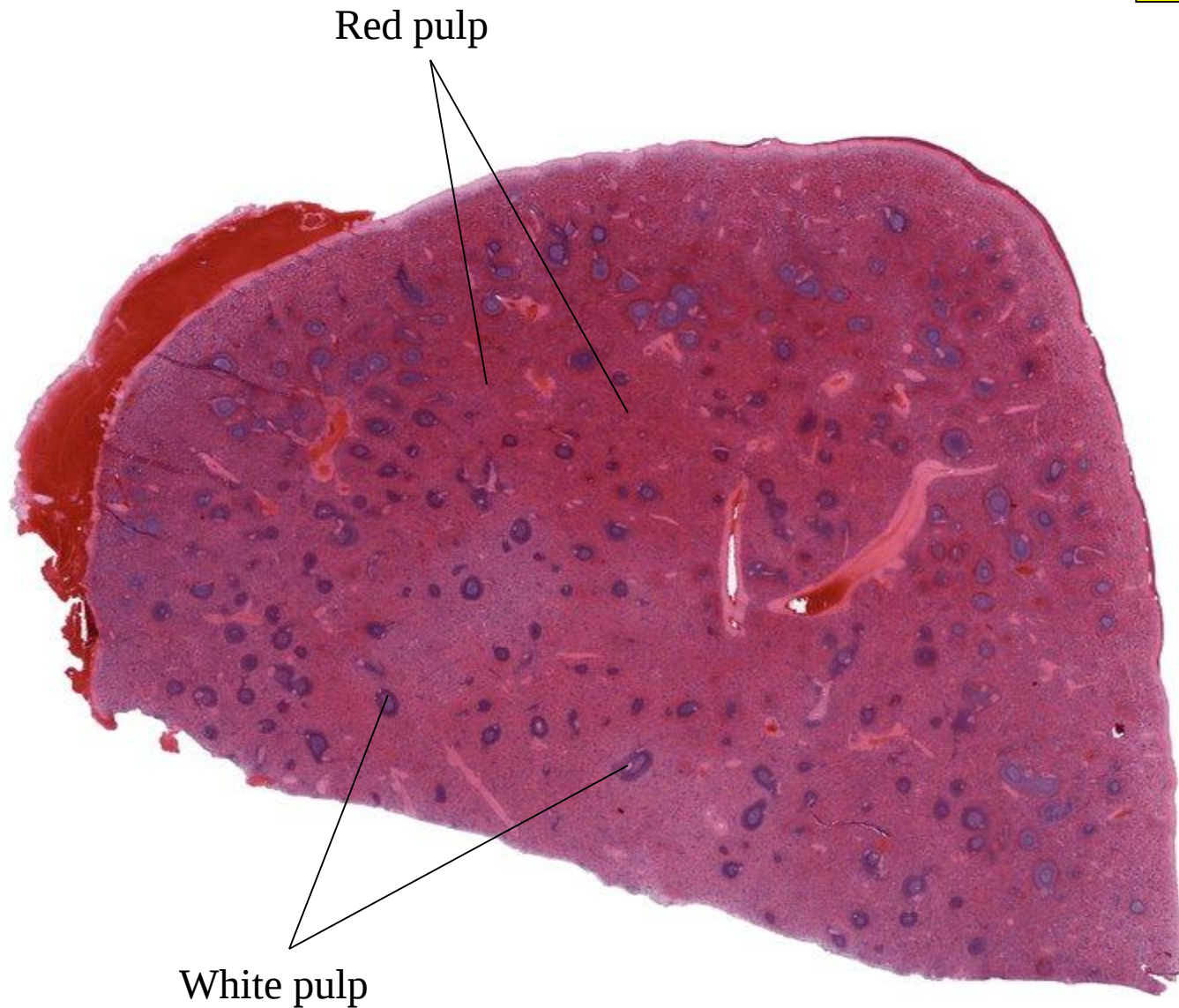
Remember: reticular fibers are argyrophilic



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

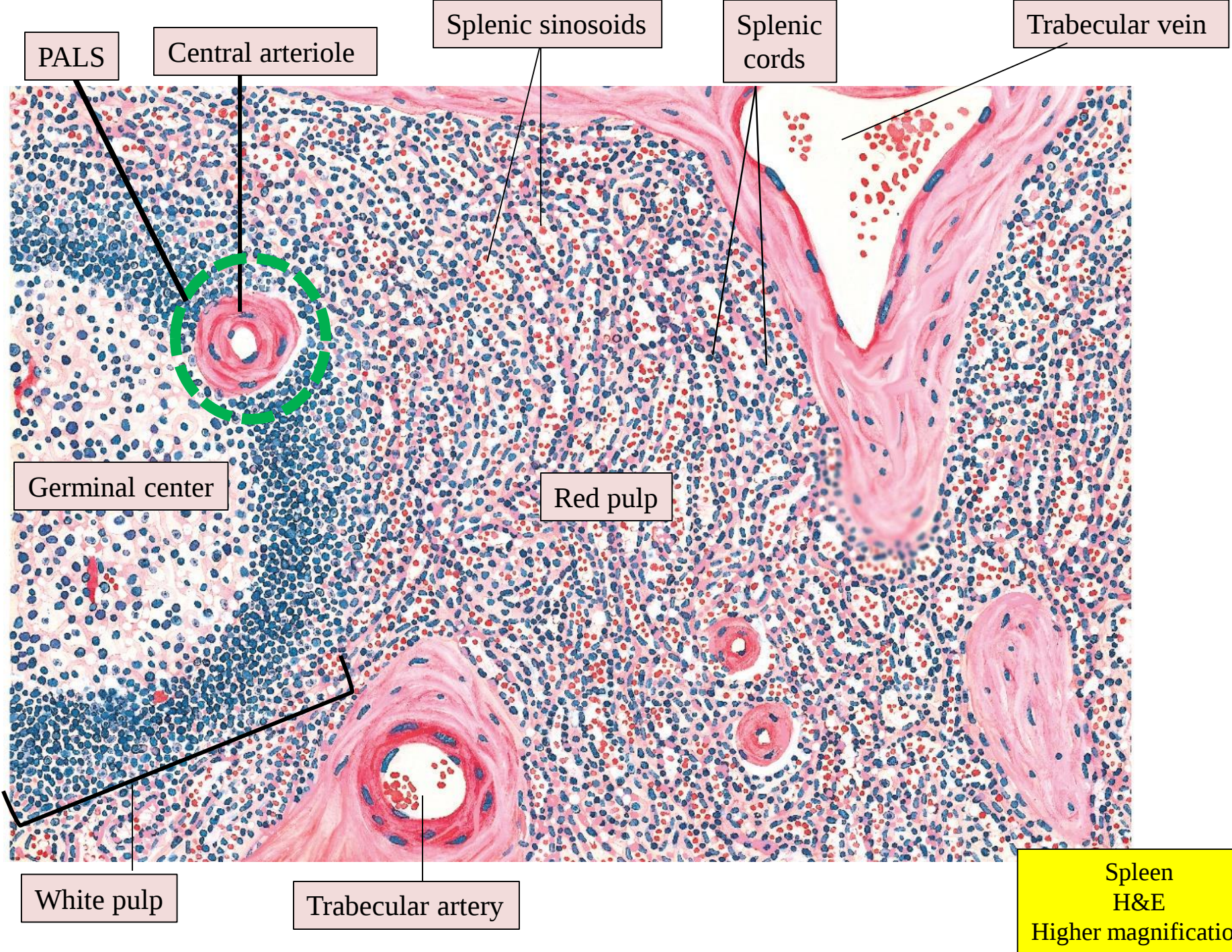
PALS

Trabeculae
containing
trabecular
artery and
vein

Lymphoid follicle
(white pulp)

Red pulp



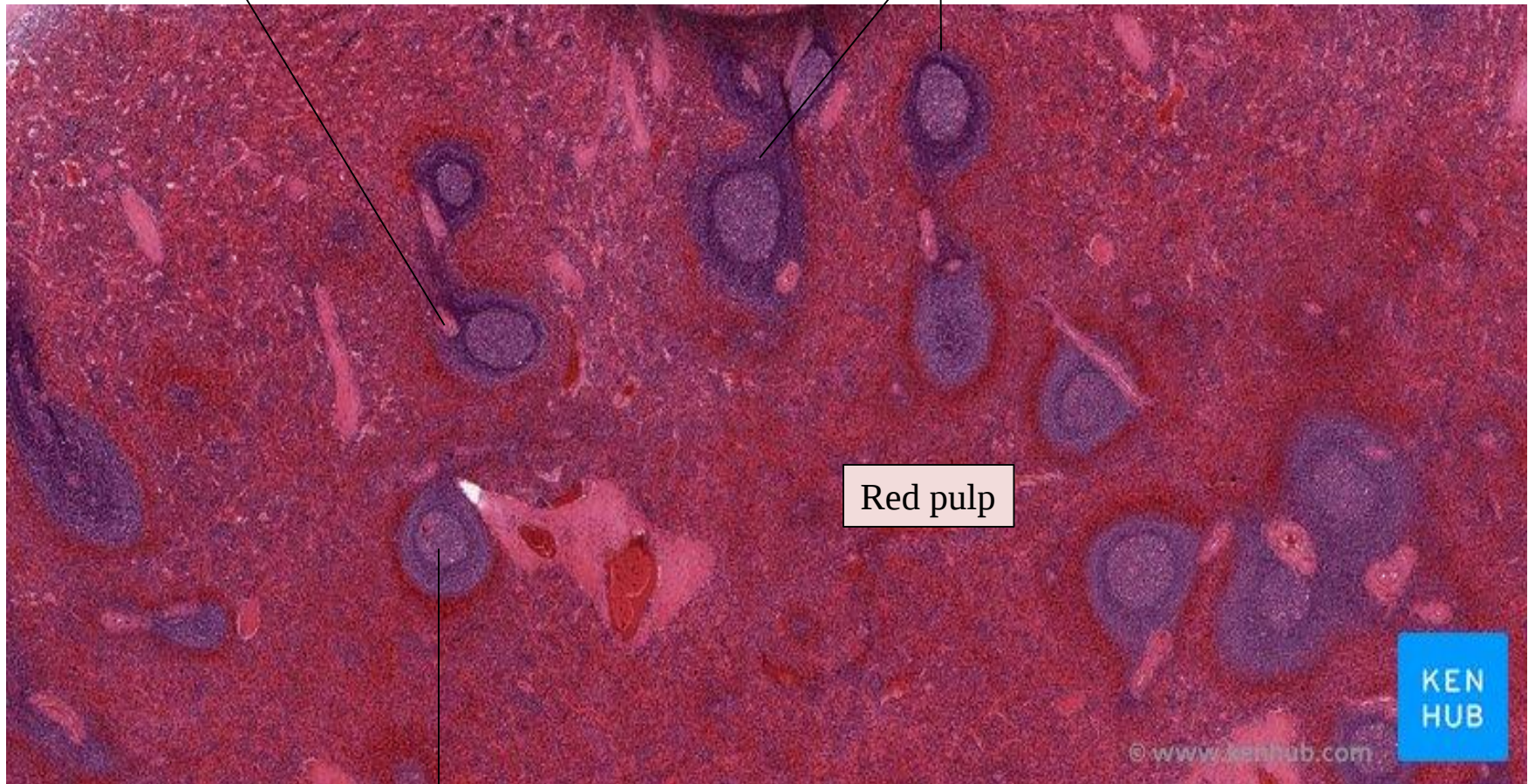


Central arteriole

Lymphoid follicle
(white pulp)

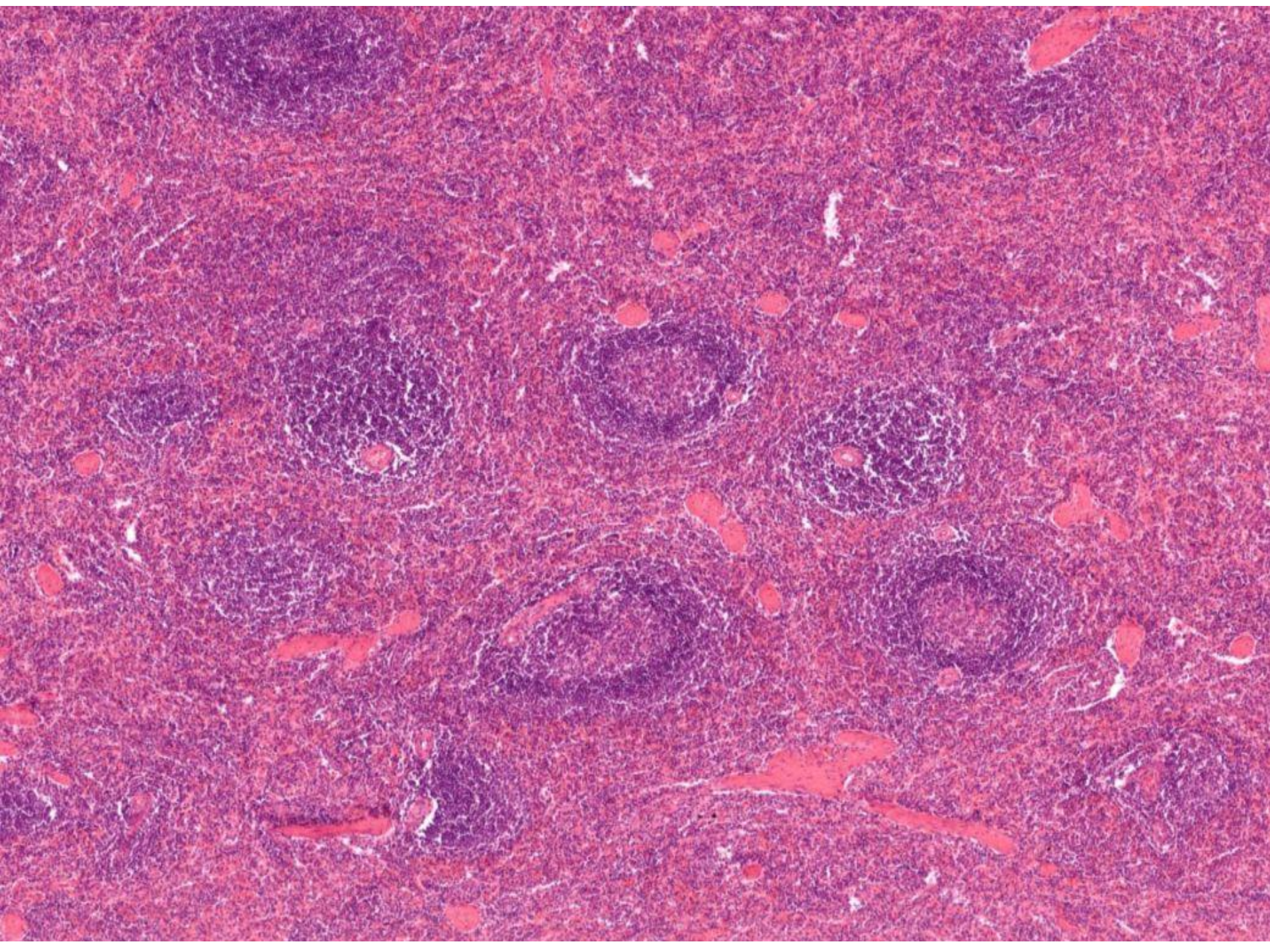
Red pulp

Germinal center



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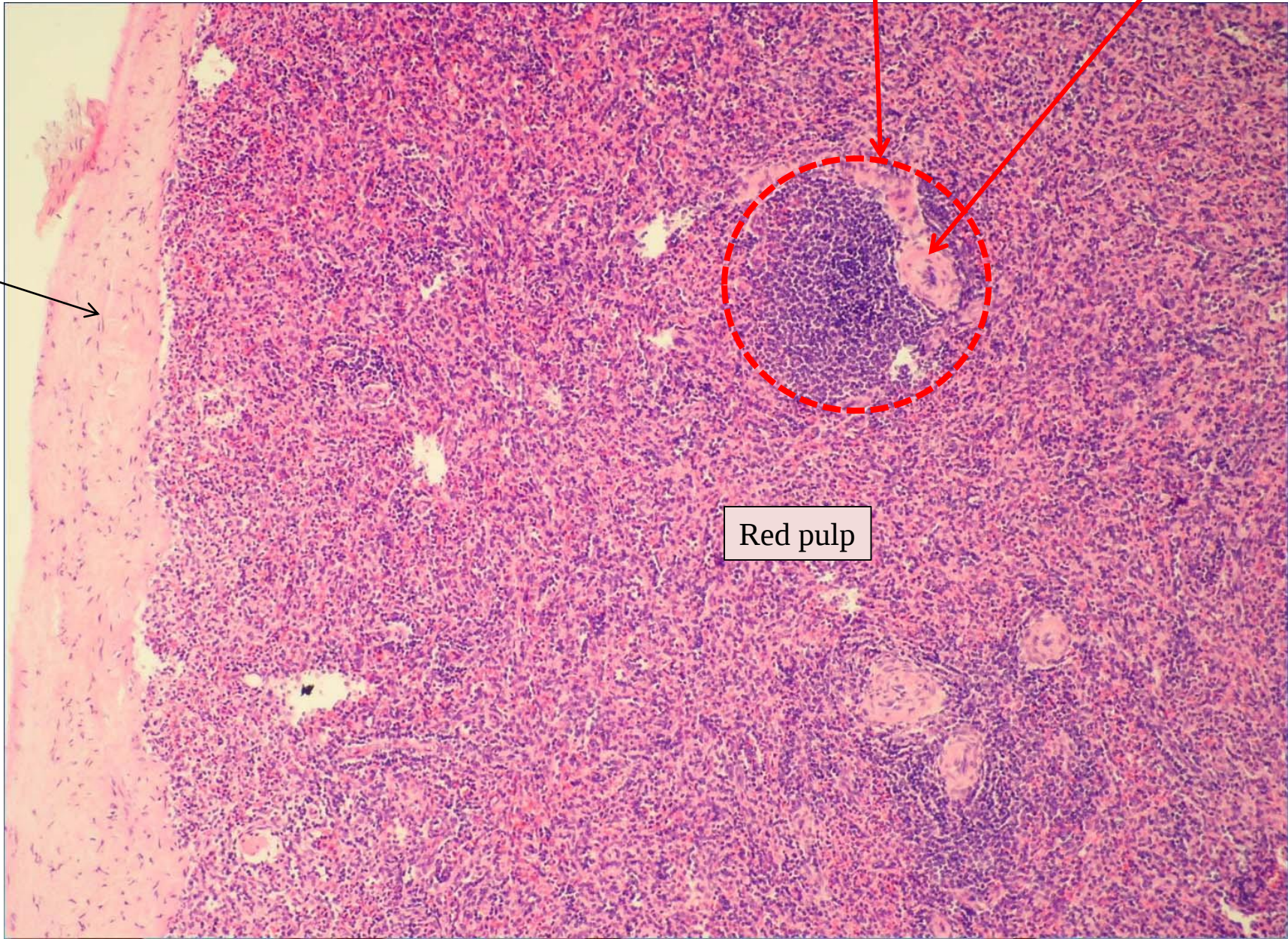


Capsule

Lymphoid follicle
(white pulp)

Central arteriole

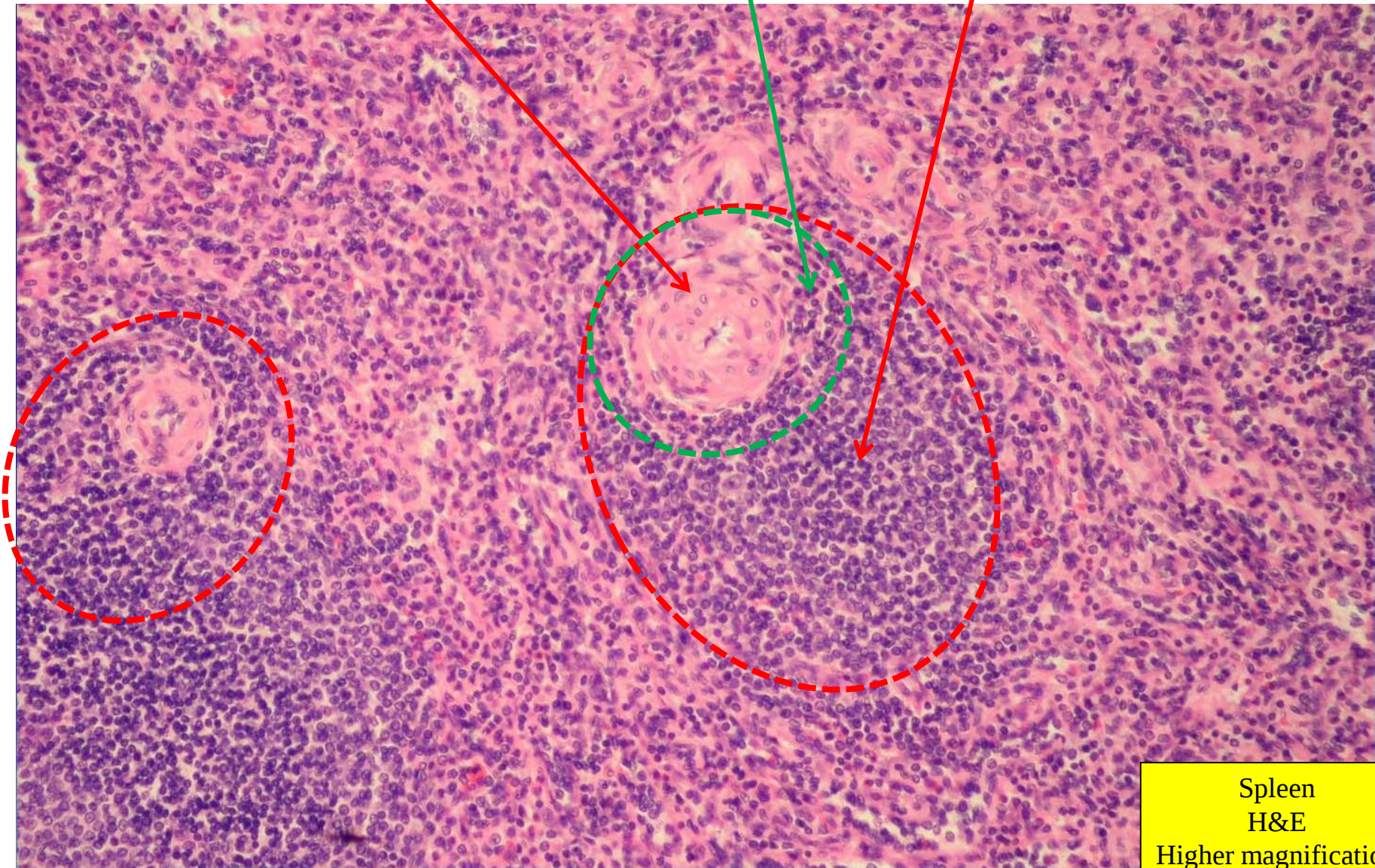
Red pulp



Central arteriole

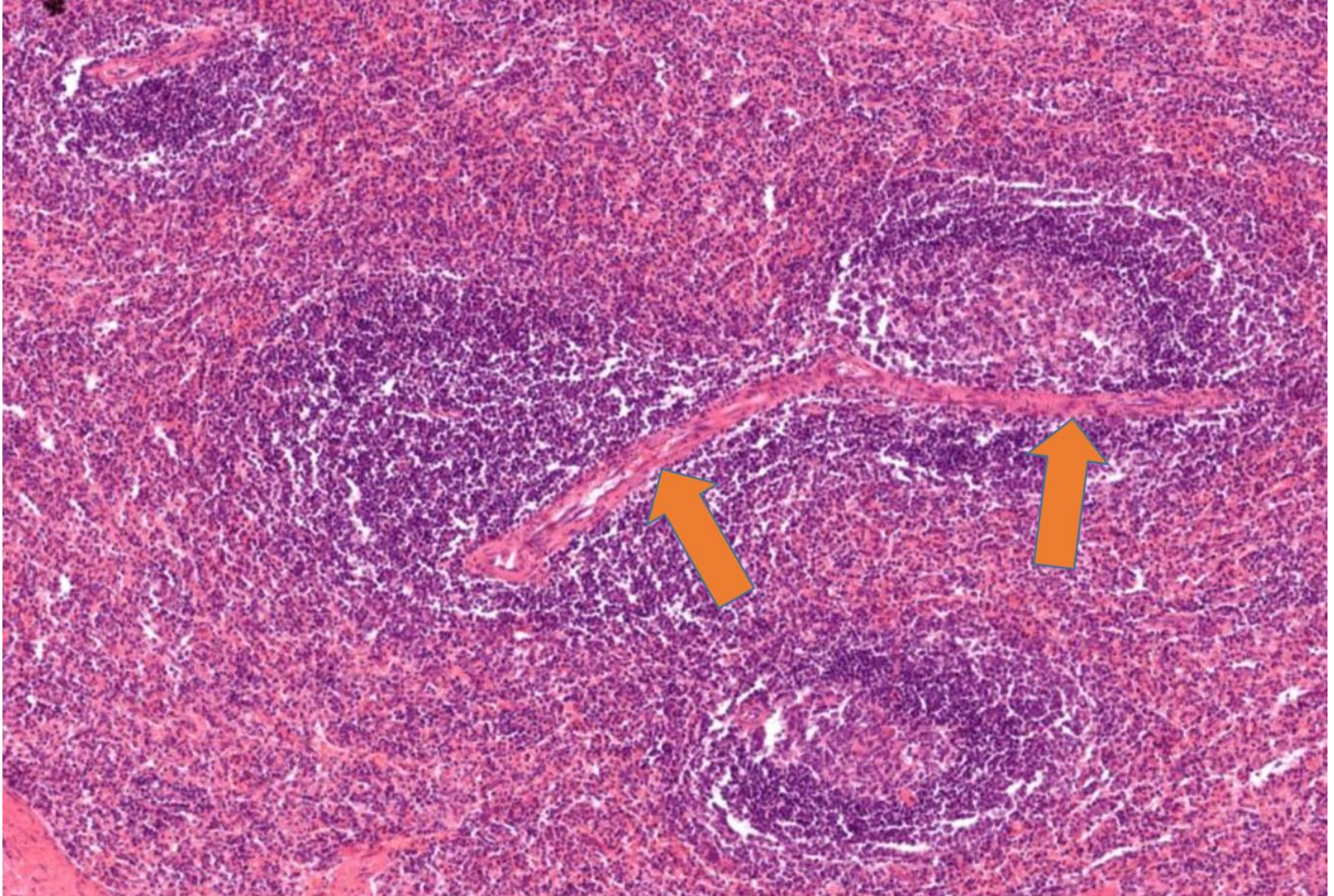
PALS

Lymphoid follicle
(white pulp)



Spleen
H&E
Higher magnification

Central arteriole



Palatine tonsils

Palatine tonsils

Stratified non-keratinized
squamous epithelium

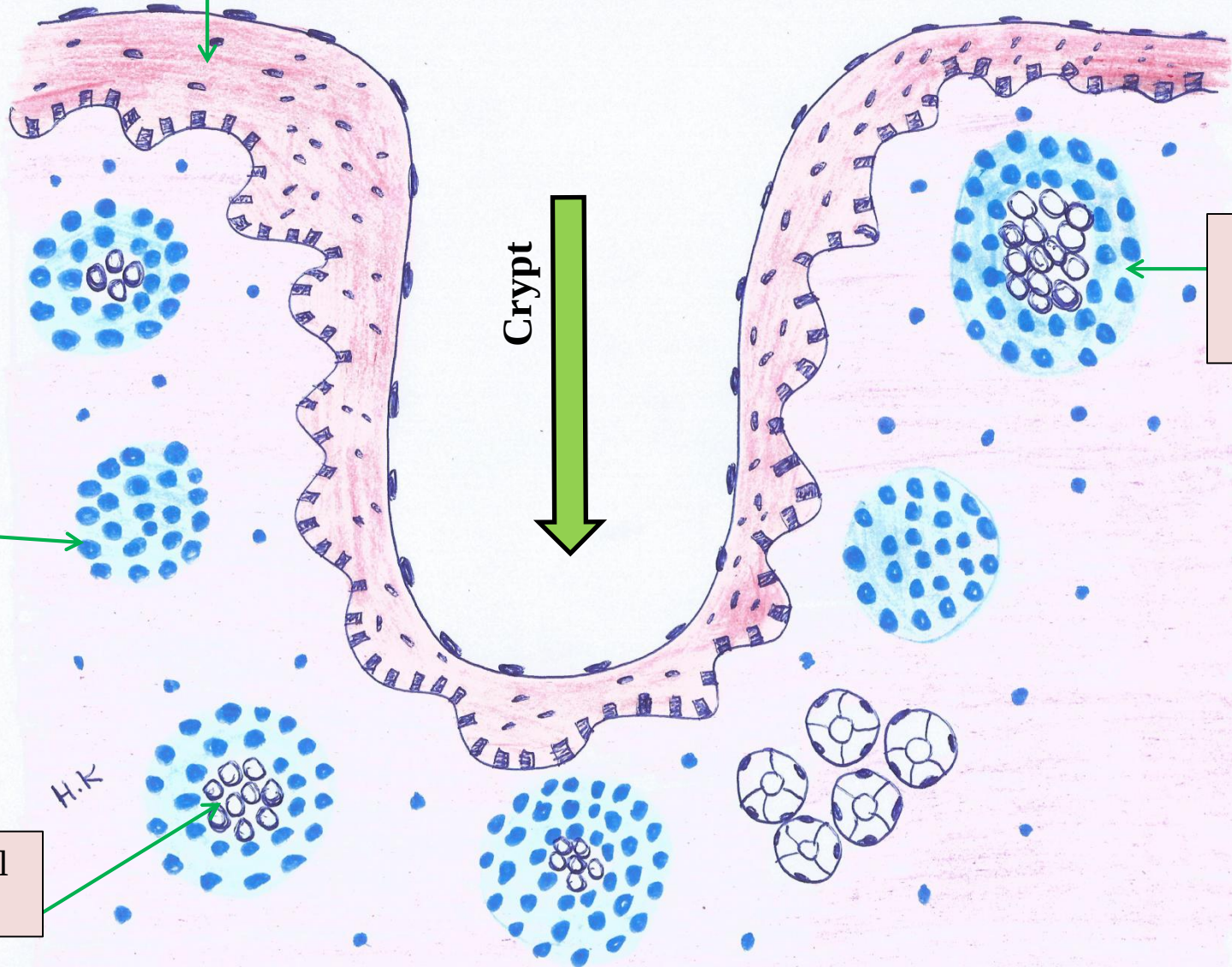
Crypt

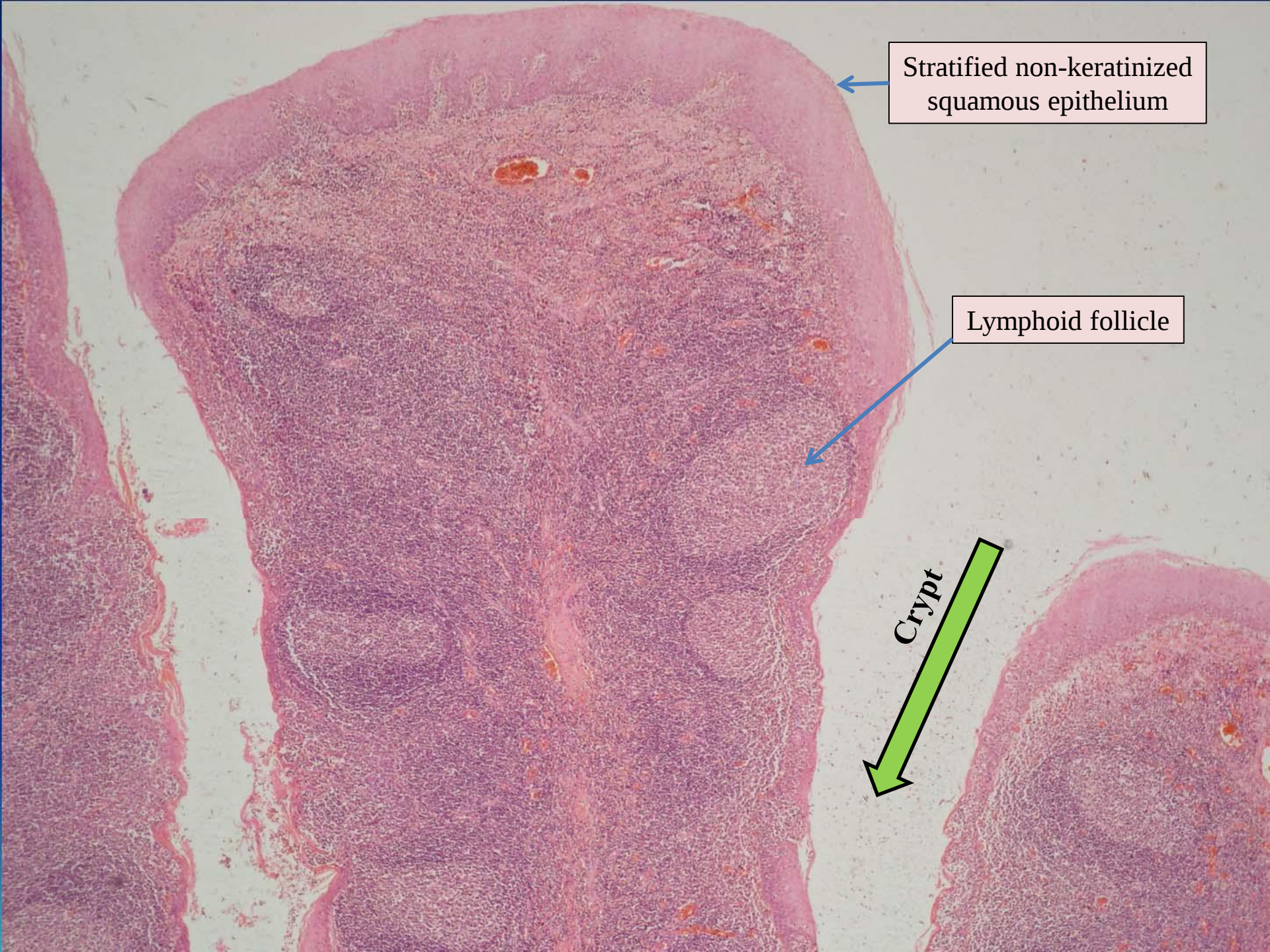
Secondary
Lymphoid
follicle

Primary
Lymphoid
follicle

Germinal
center

H.K



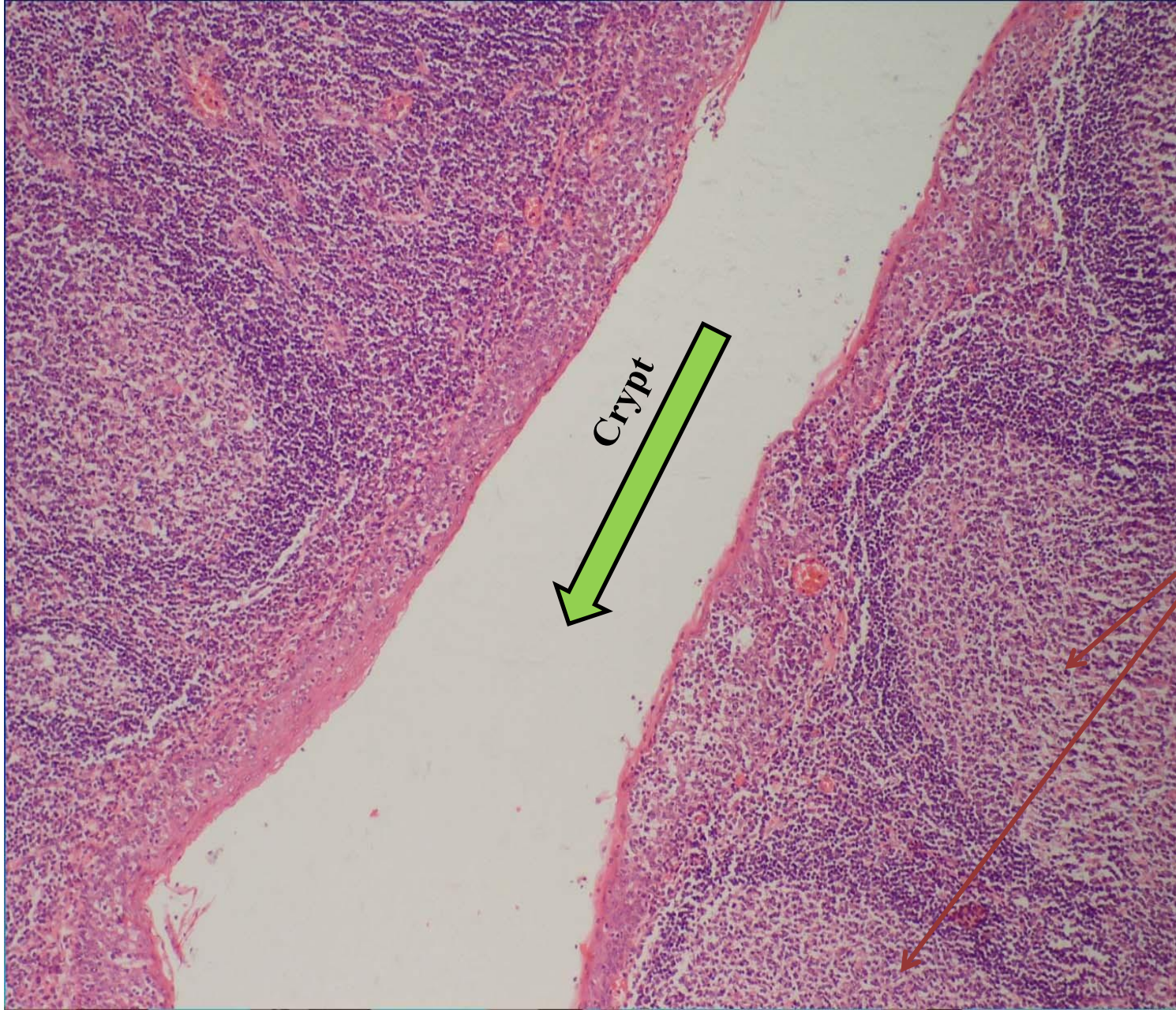


Stratified non-keratinized
squamous epithelium

Lymphoid follicle

Crypt

**Crypt
(base)**

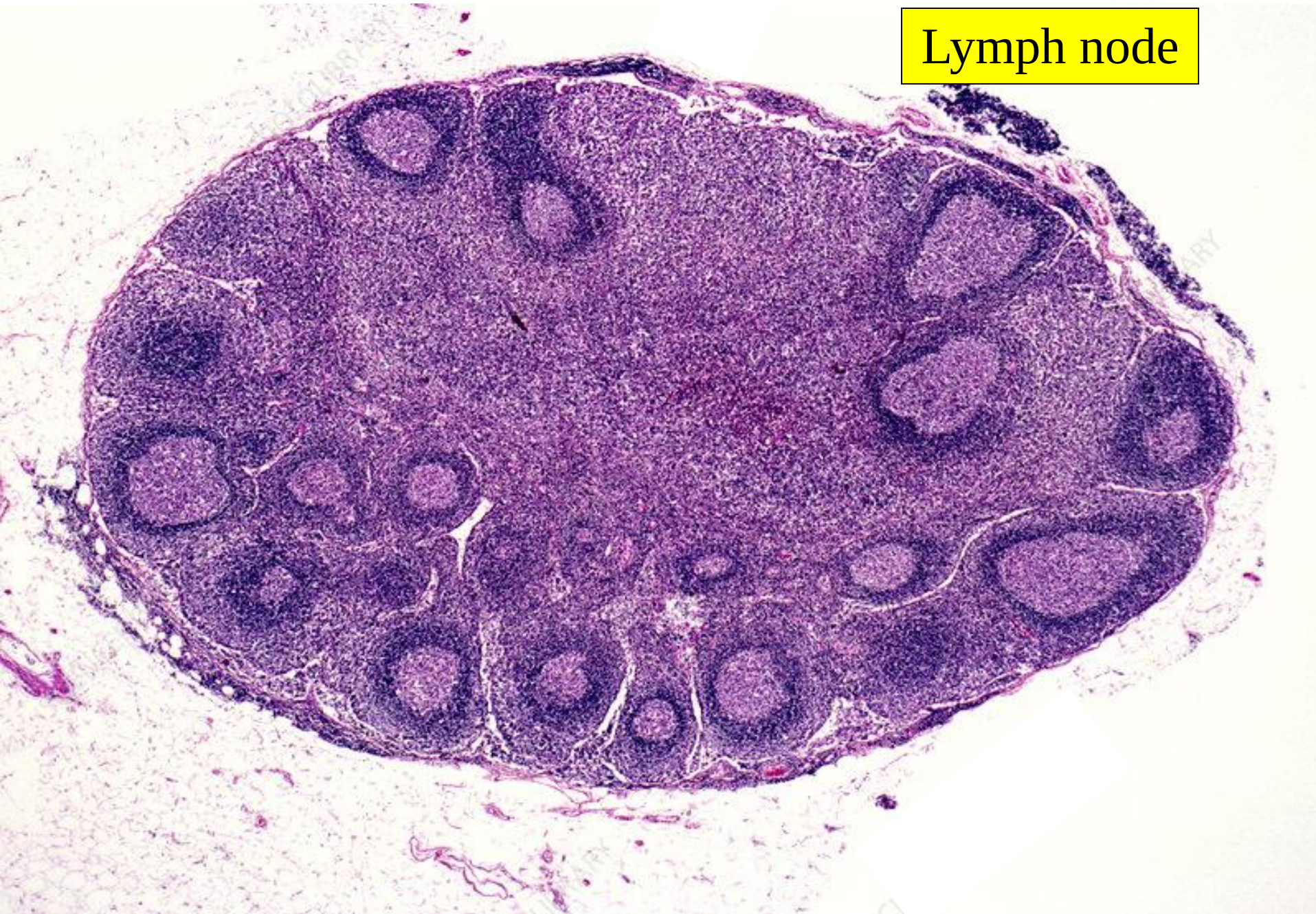


Crypt

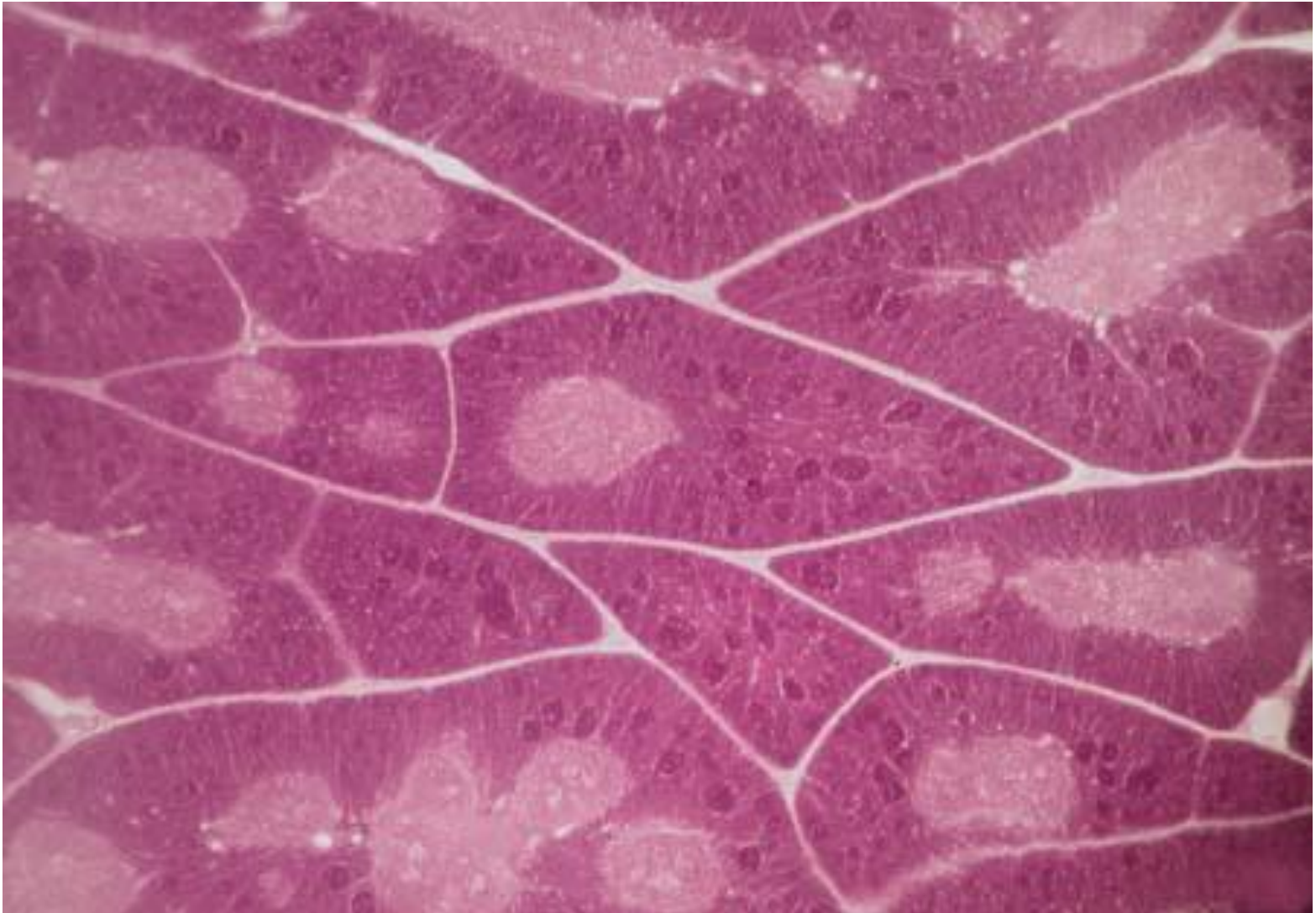
Lymphoid
follicles

Identify

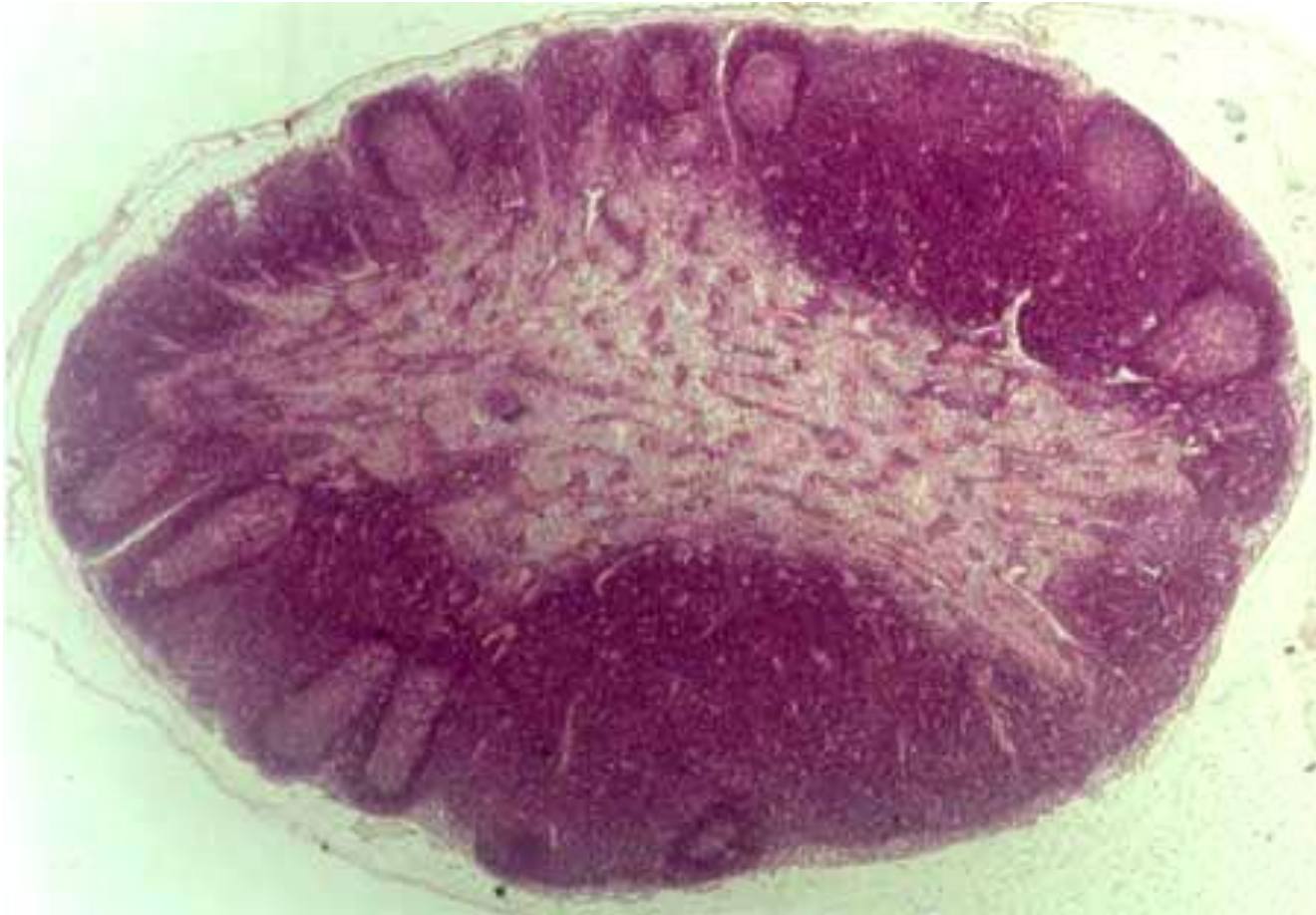
Lymph node



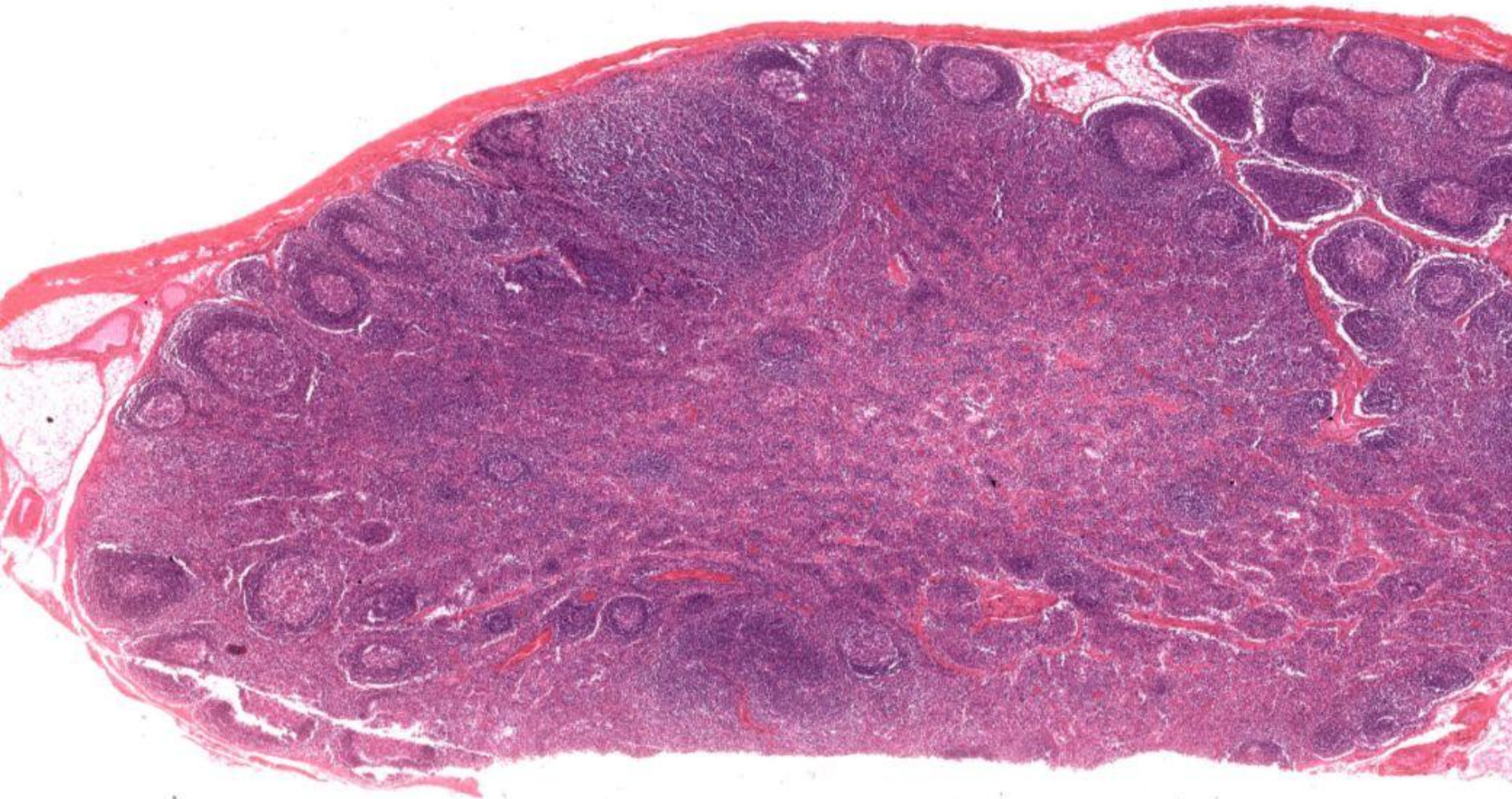
Thymus



Lymph node



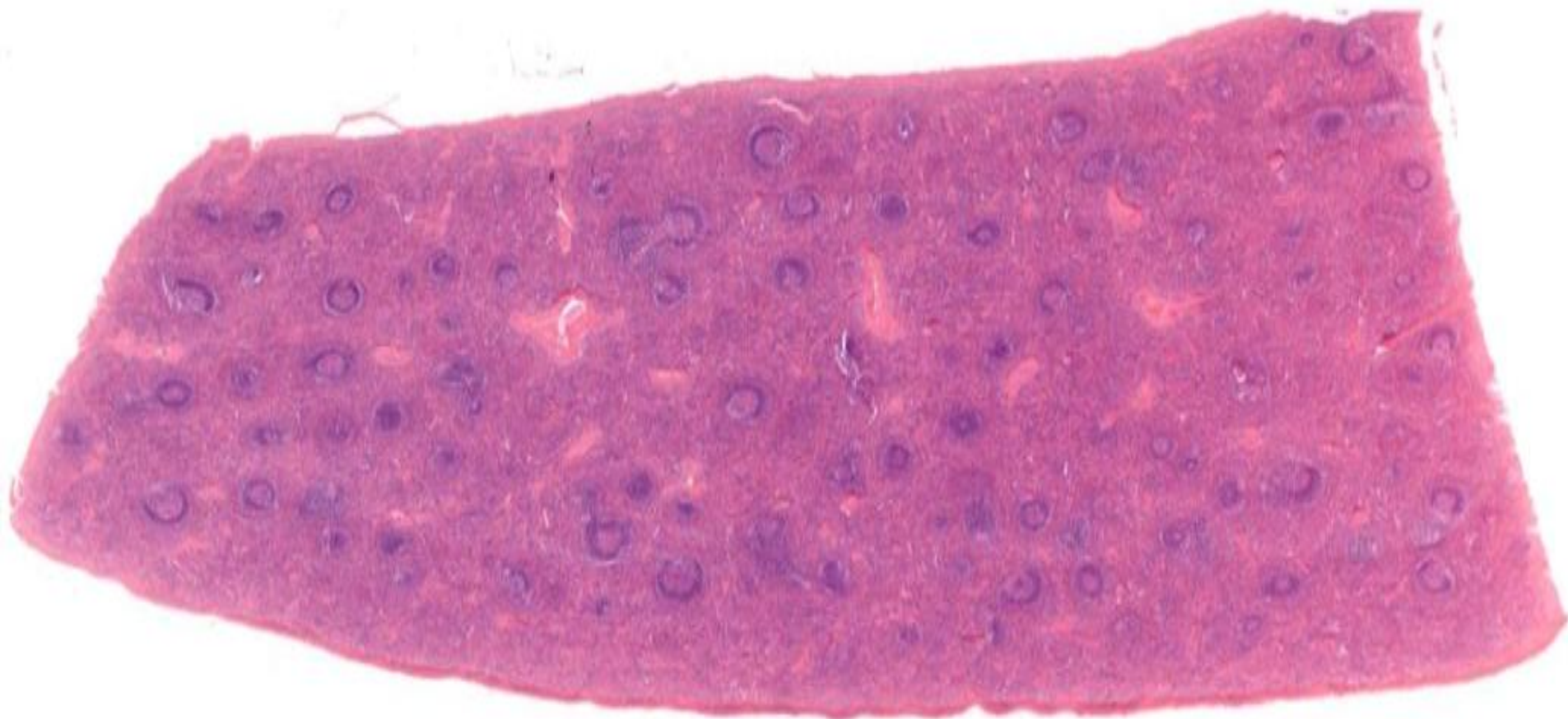
Lymph node



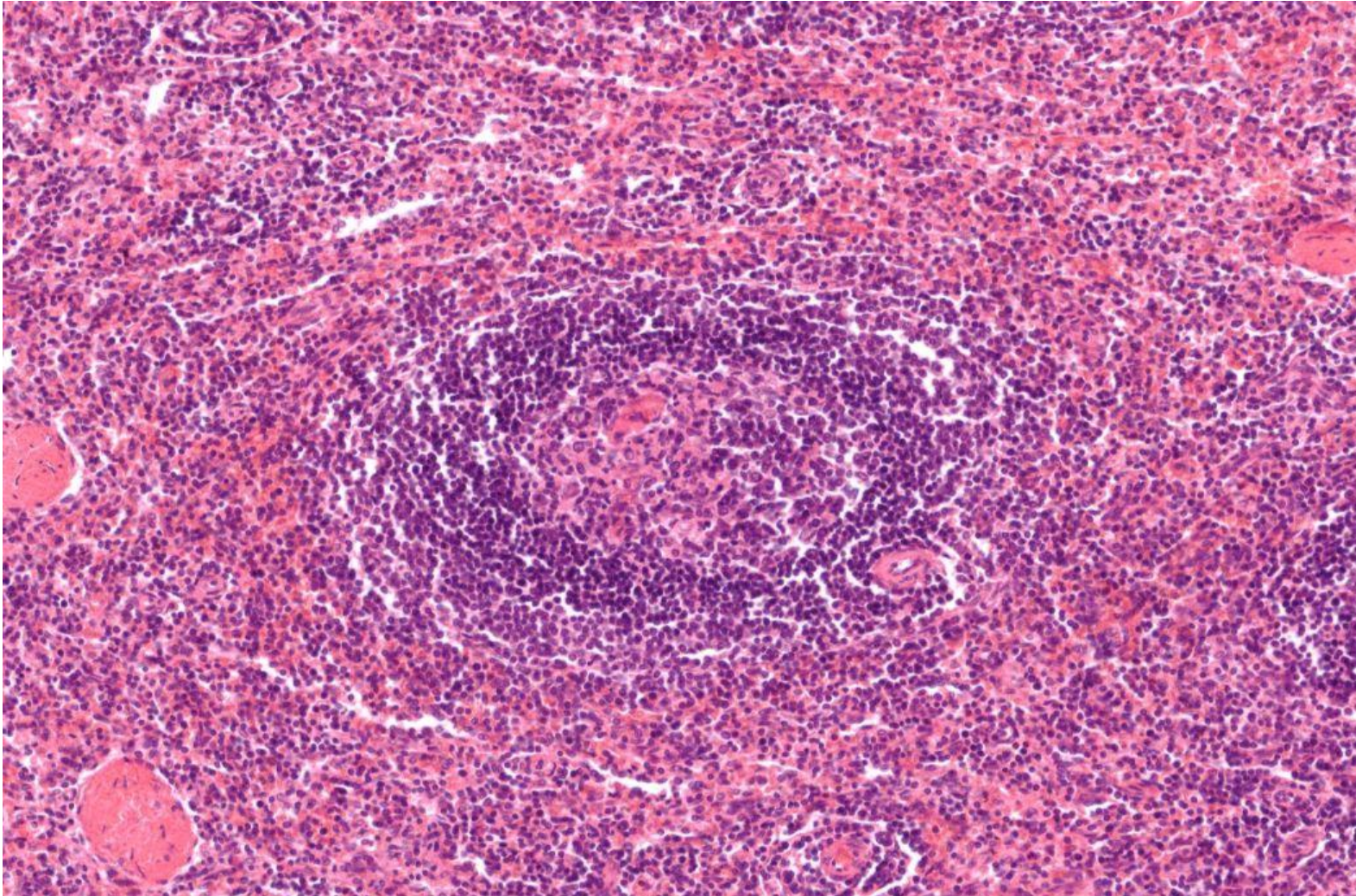
Palatine tonsils



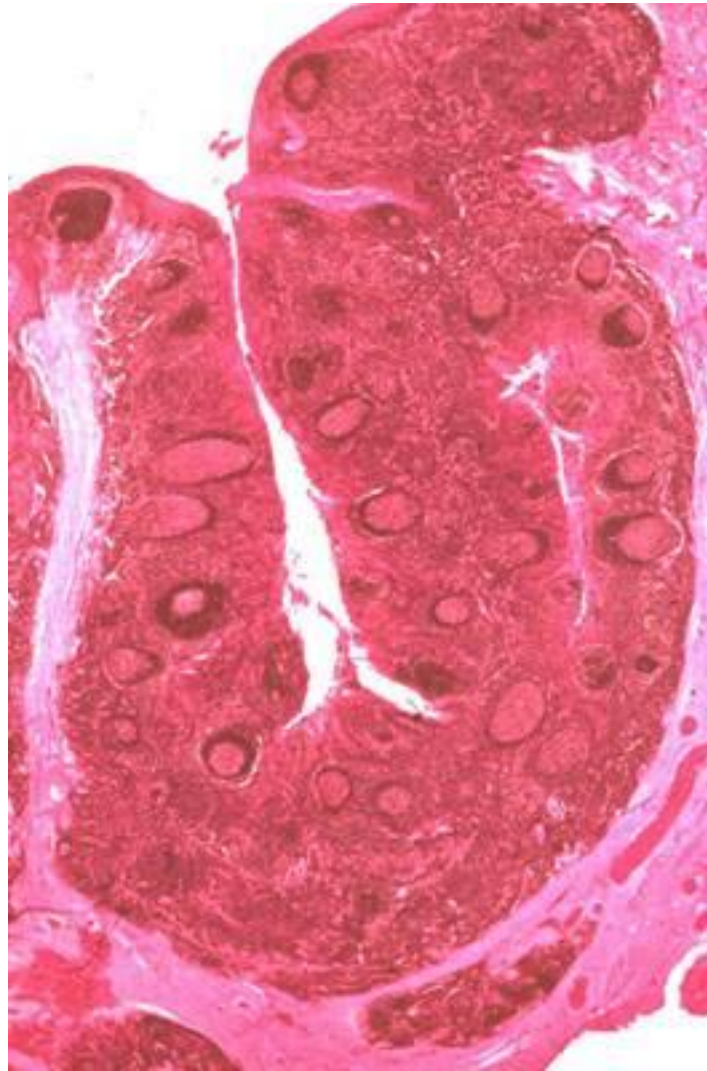
Spleen



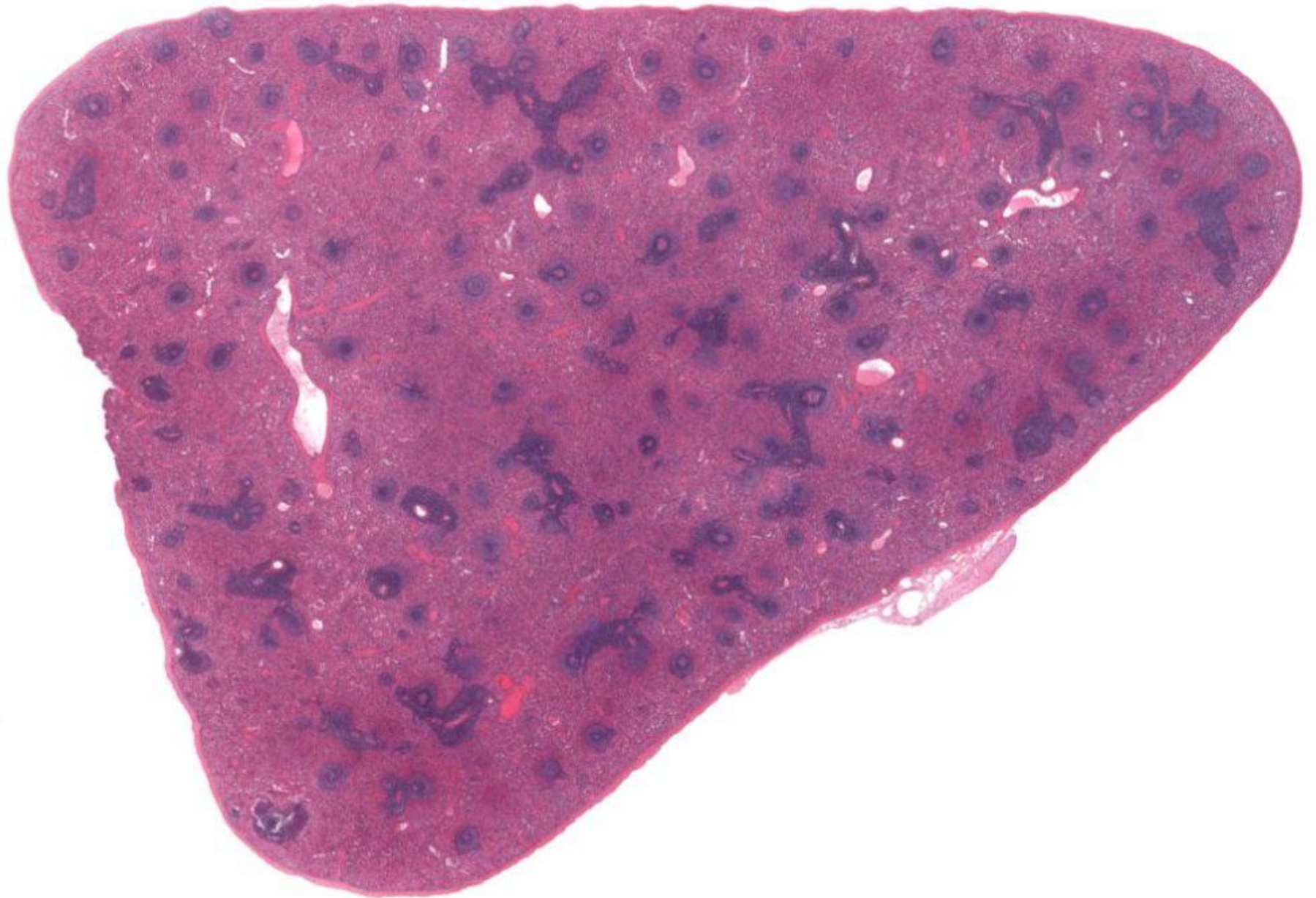
Spleen



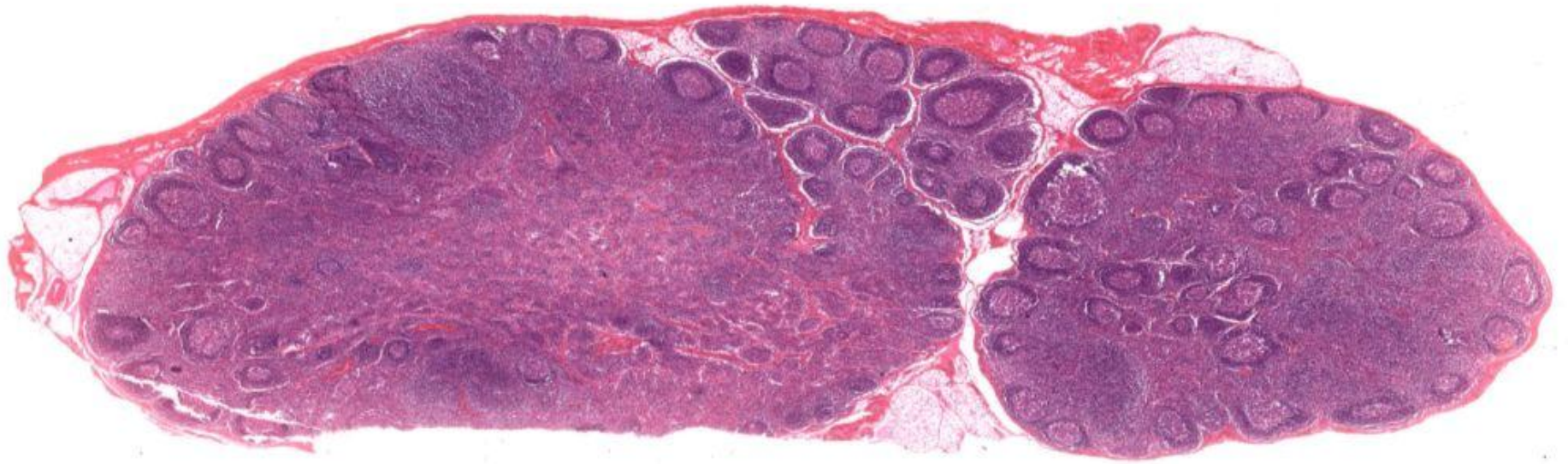
Palatine tonsils



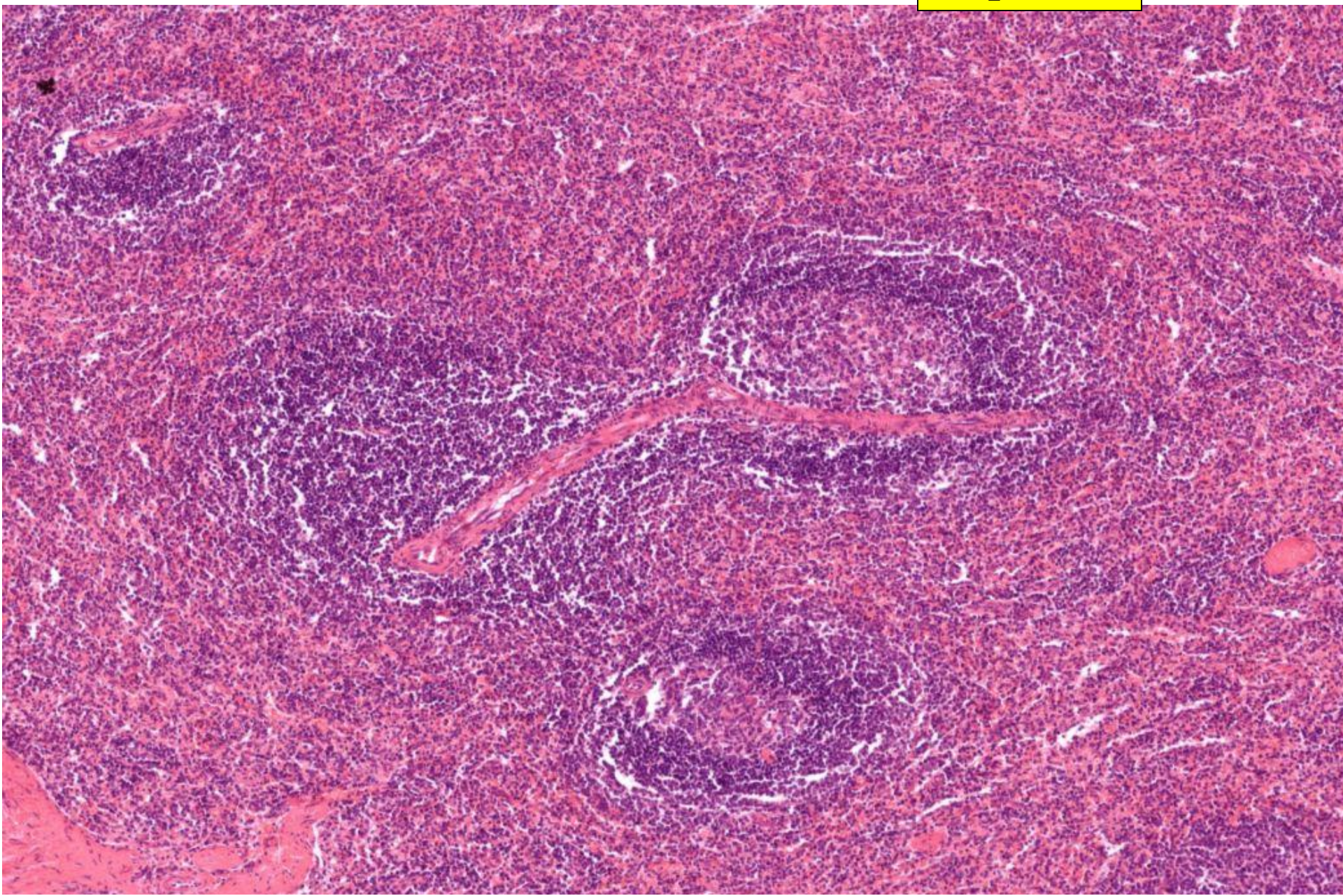
Spleen



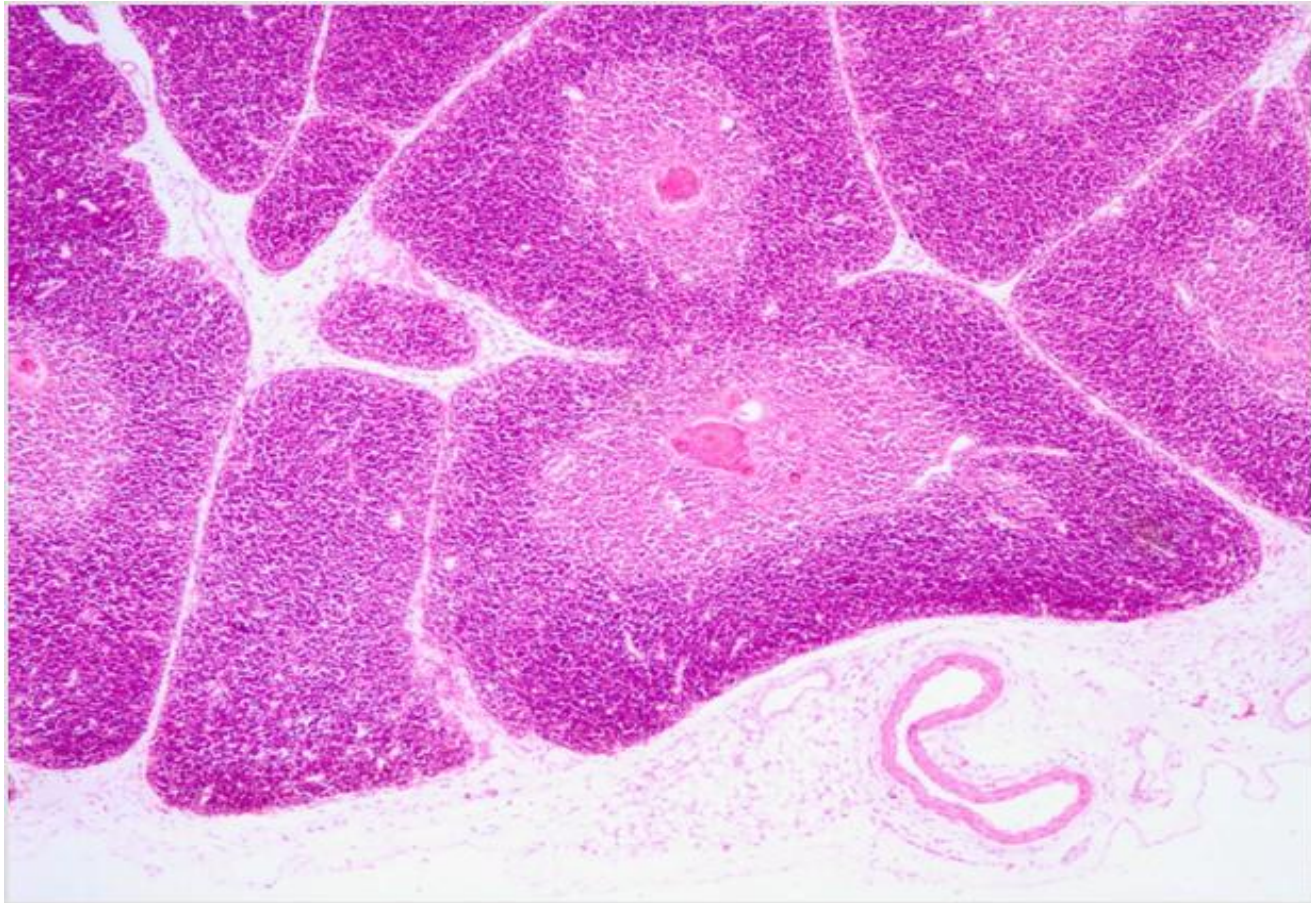
Lymph node



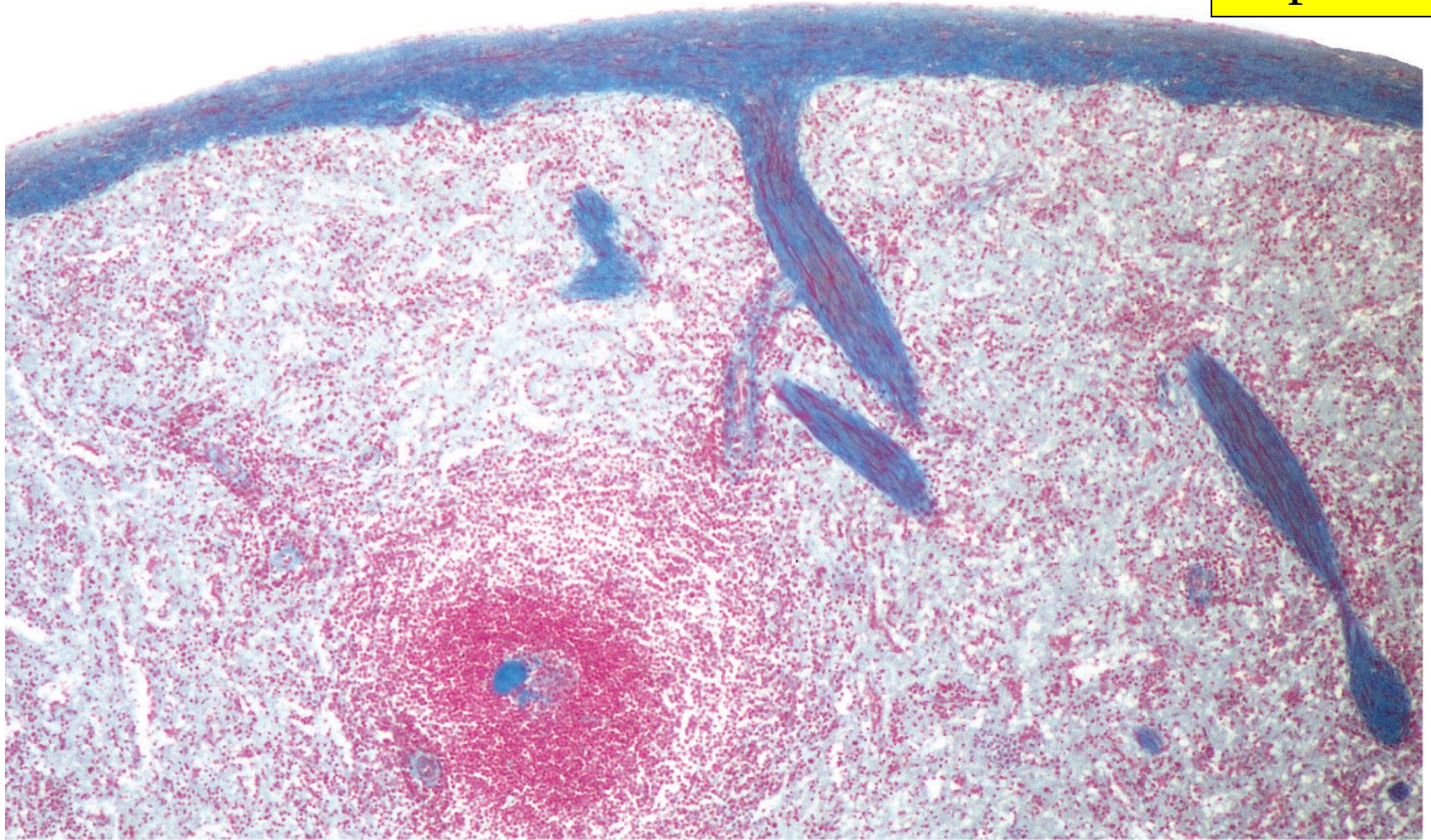
Spleen



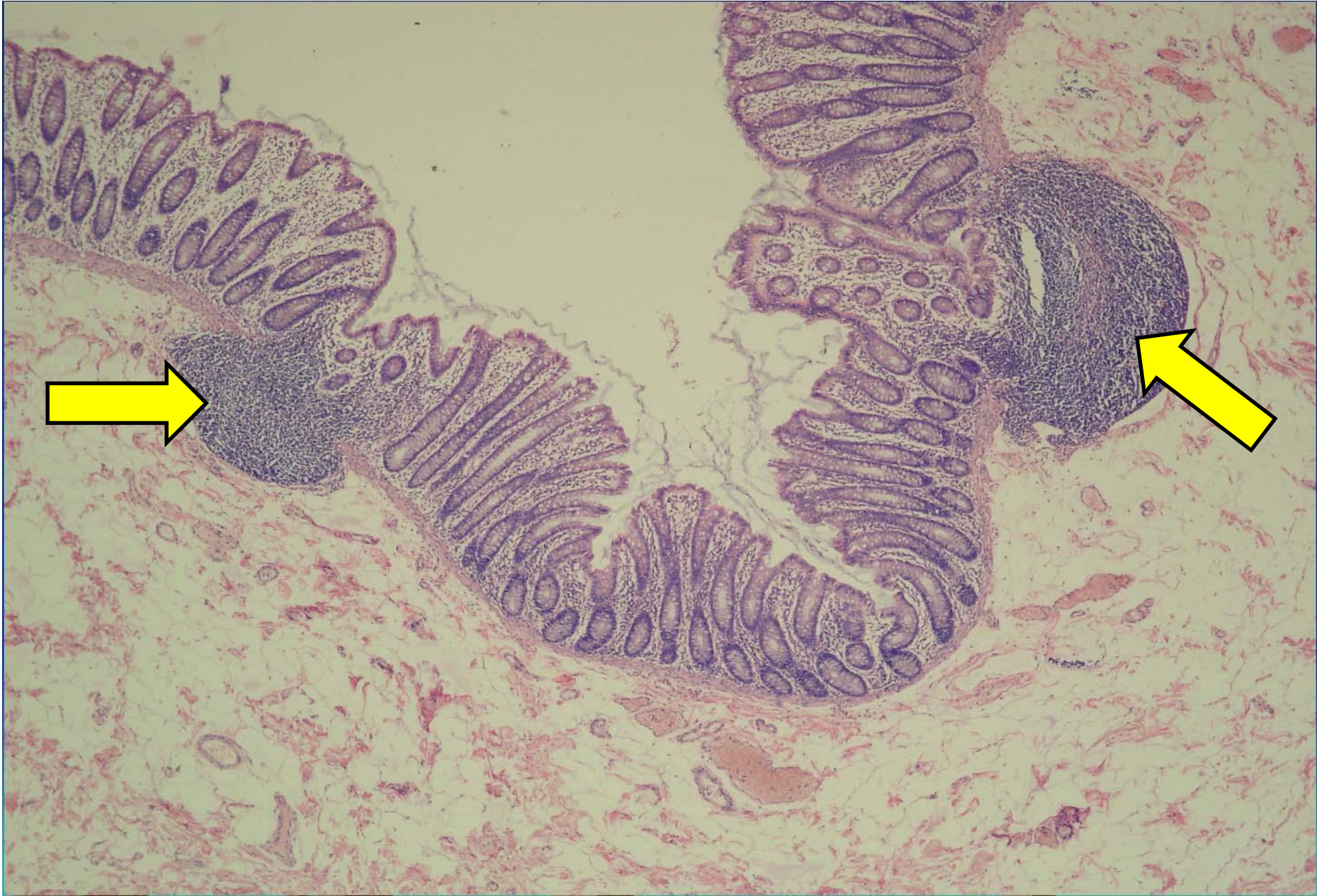
Thymus



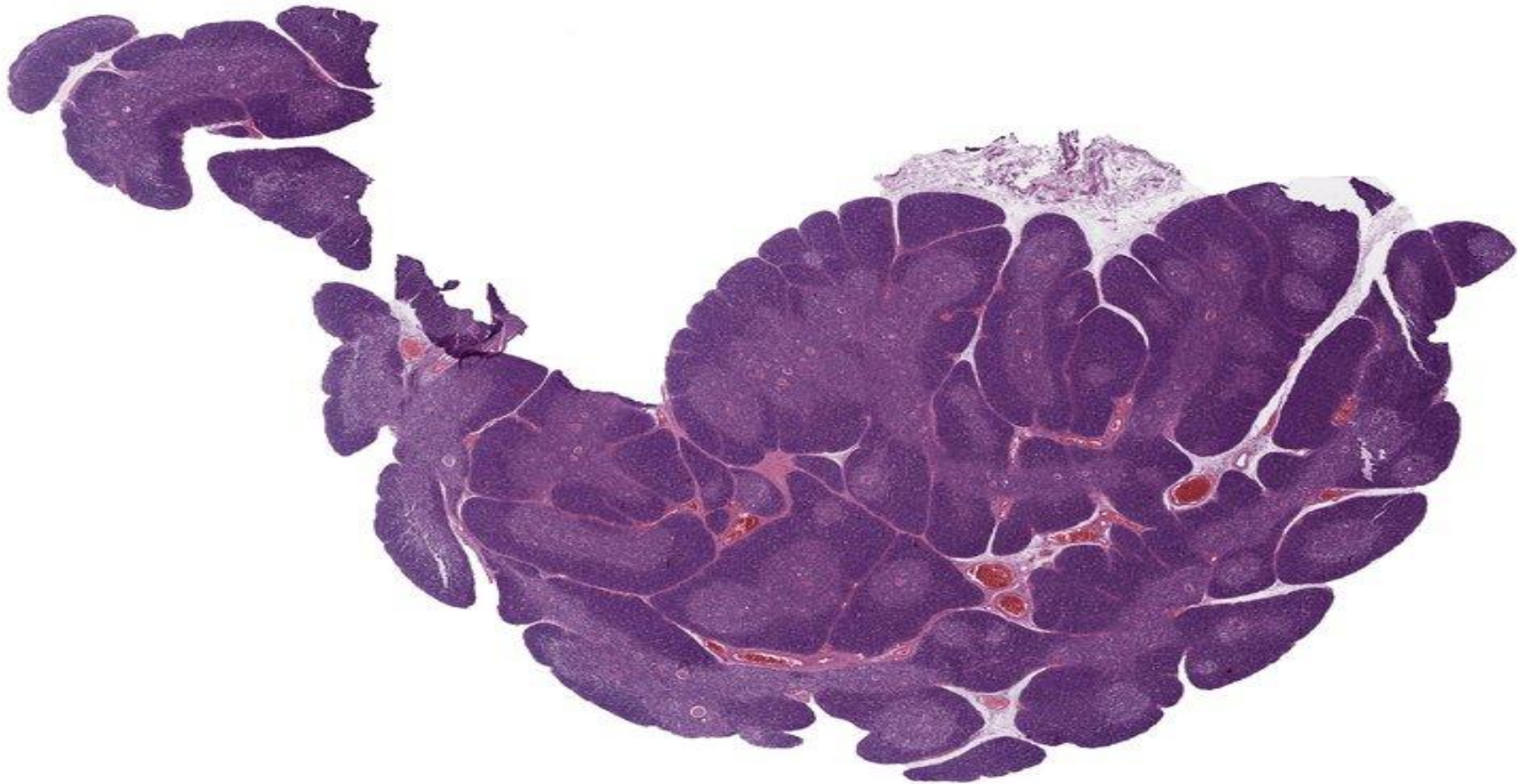
Spleen



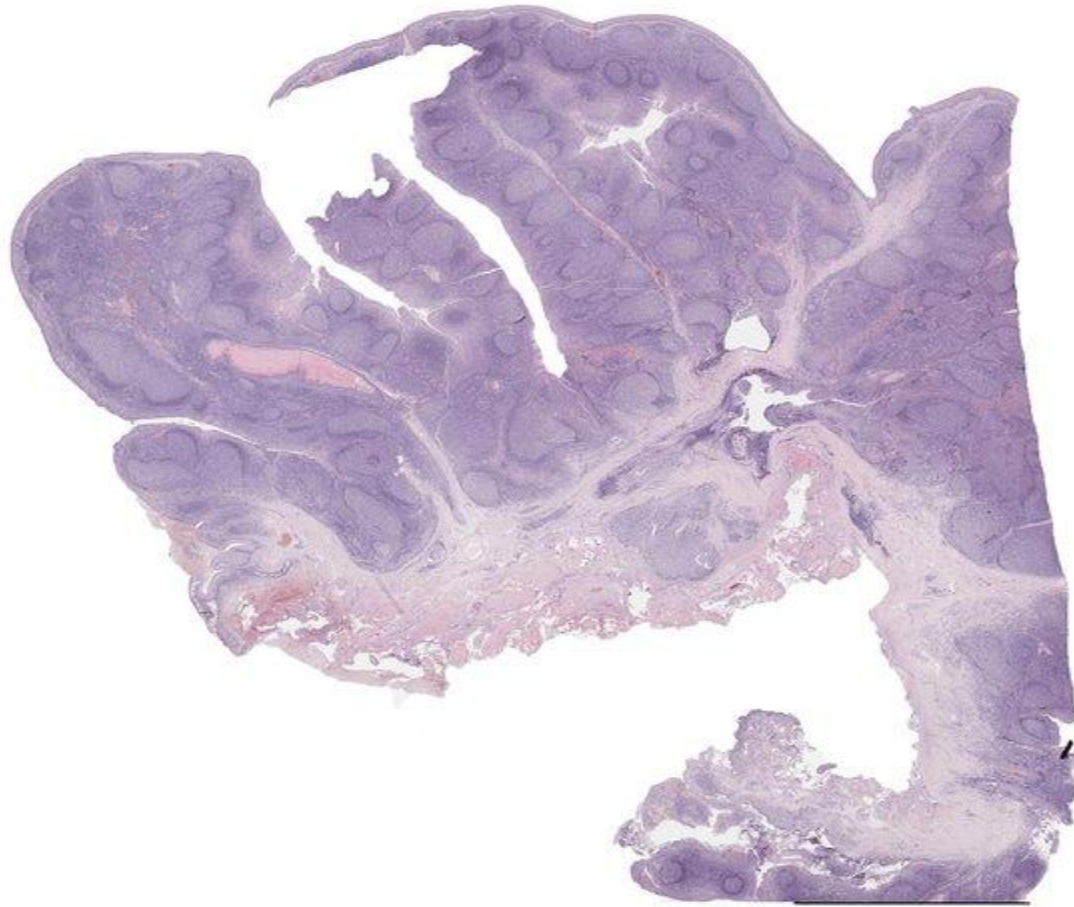
Solitary Lymphatic nodules (diffuse lymphatic tissue



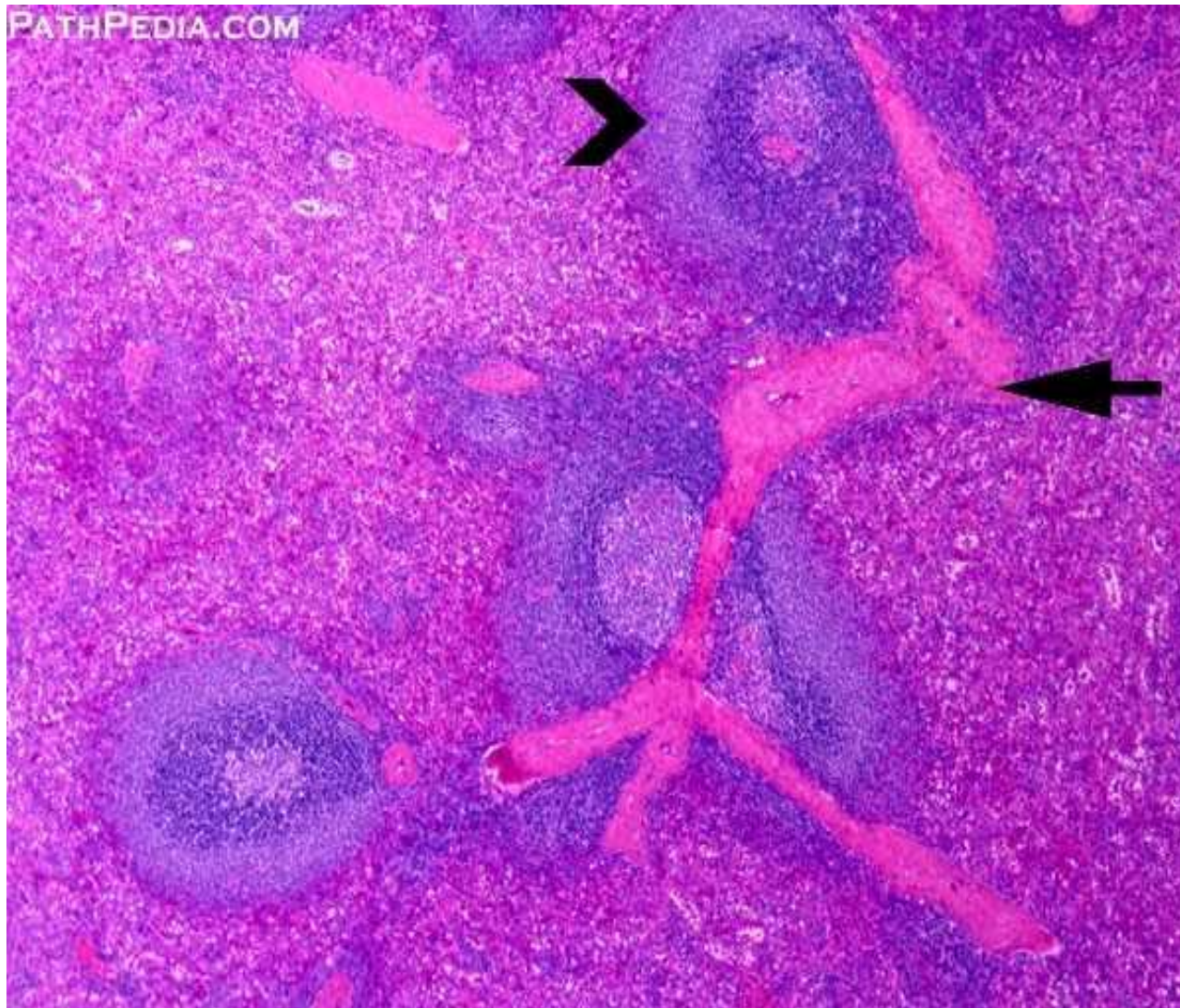
Thymus



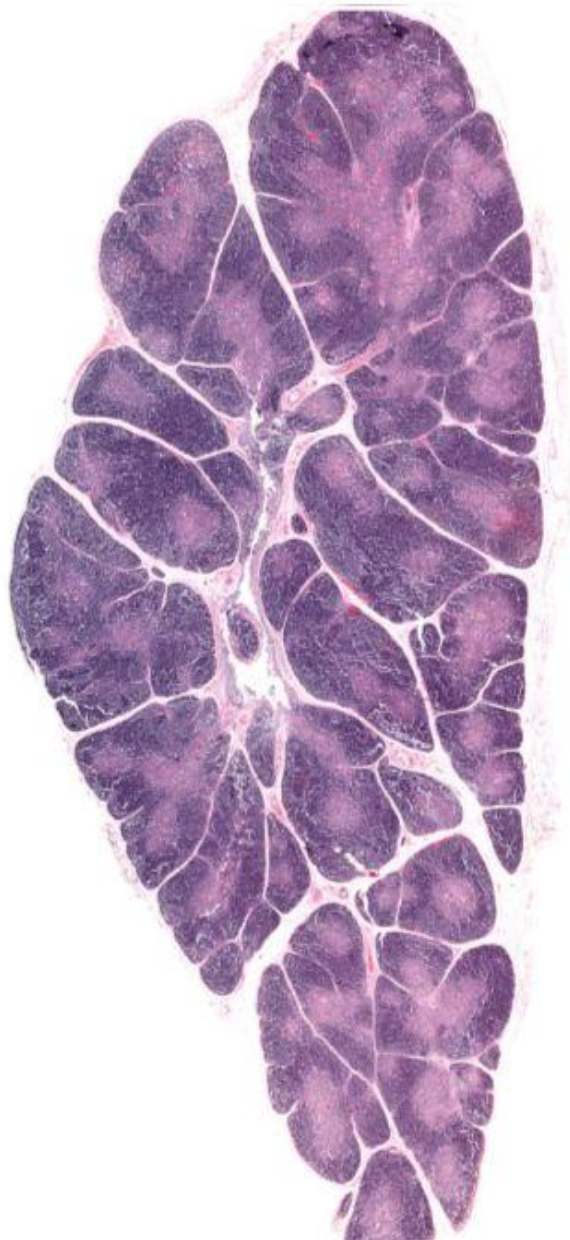
Palatine tonsils

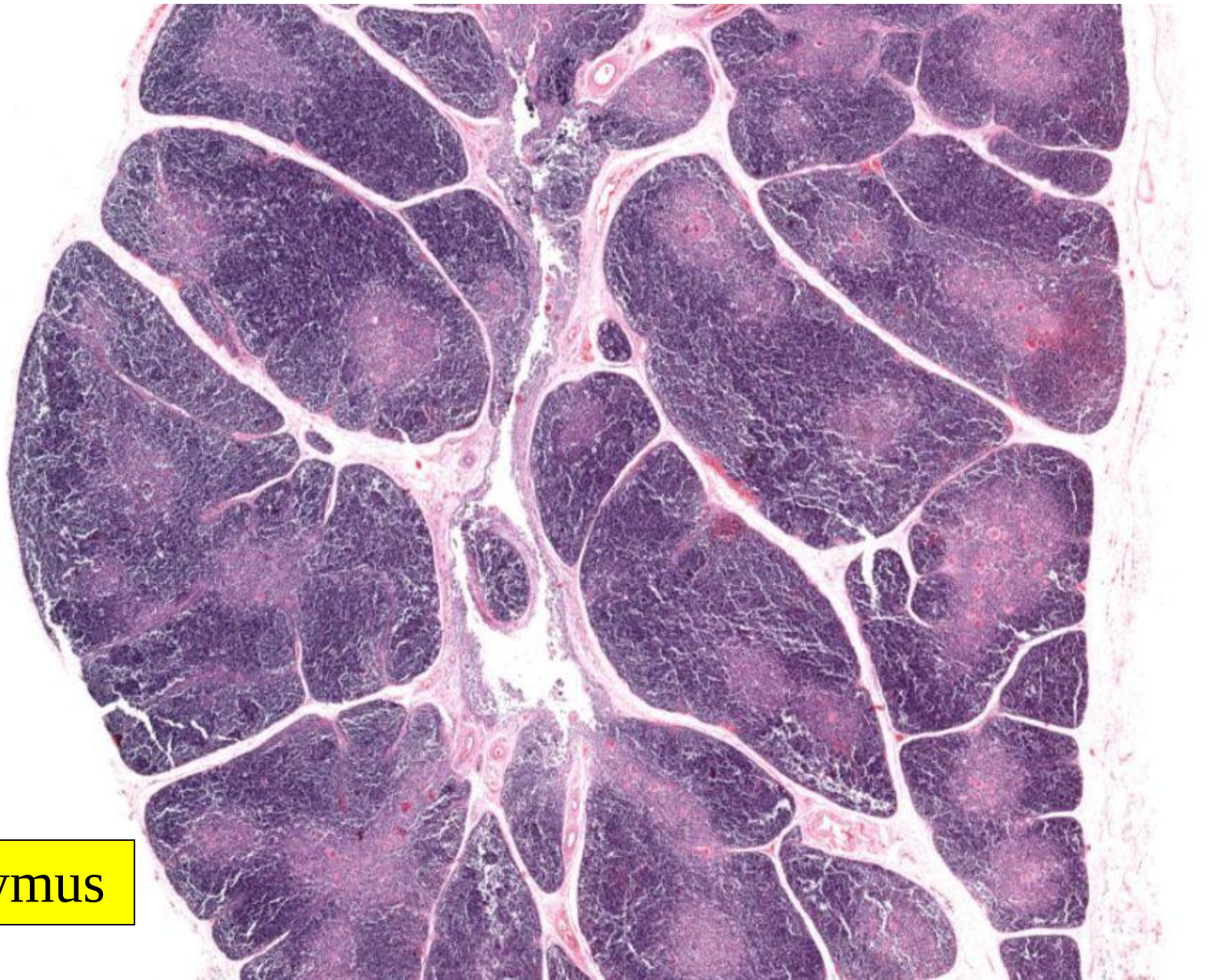


Spleen



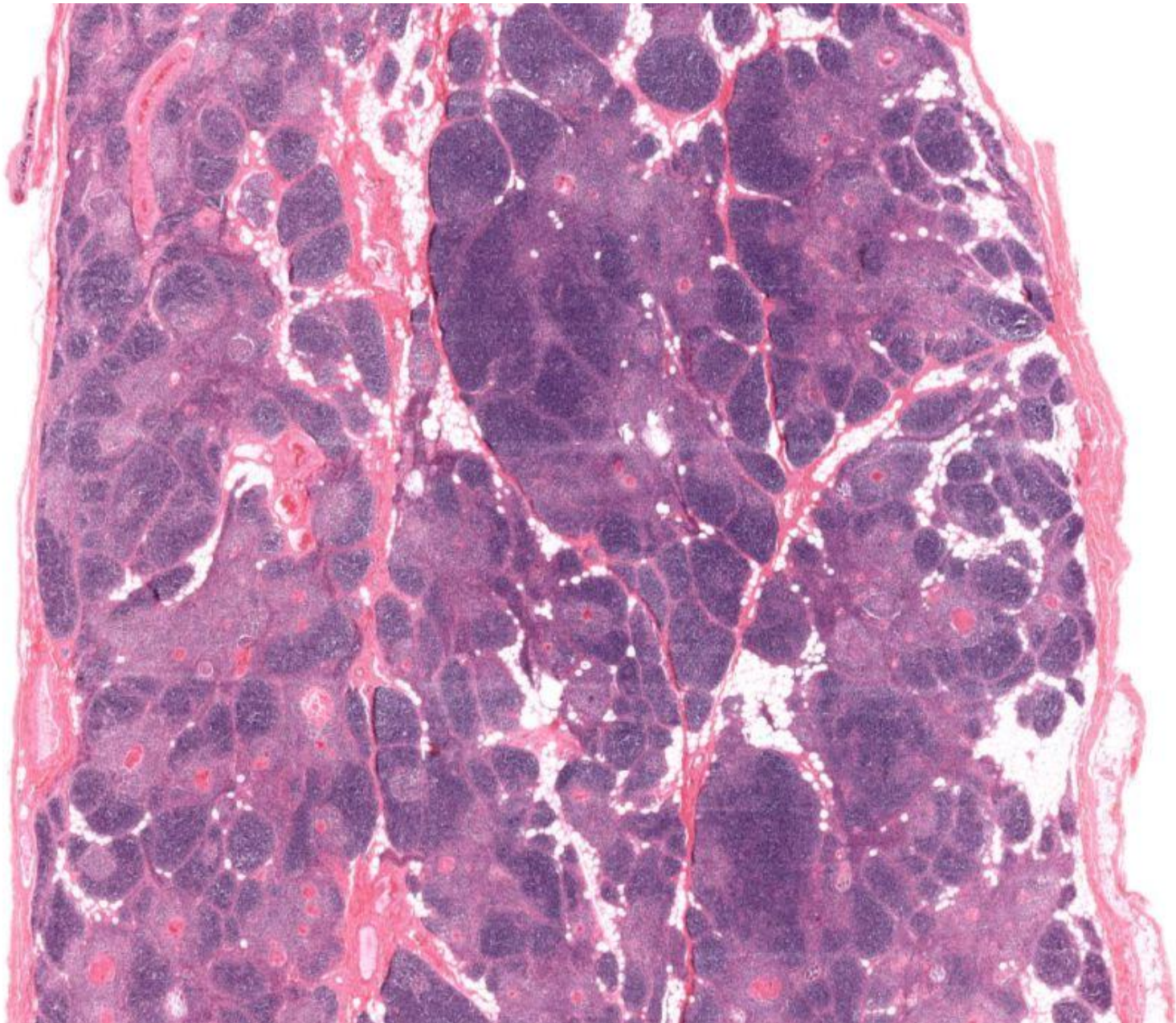
Thymus





Thymus

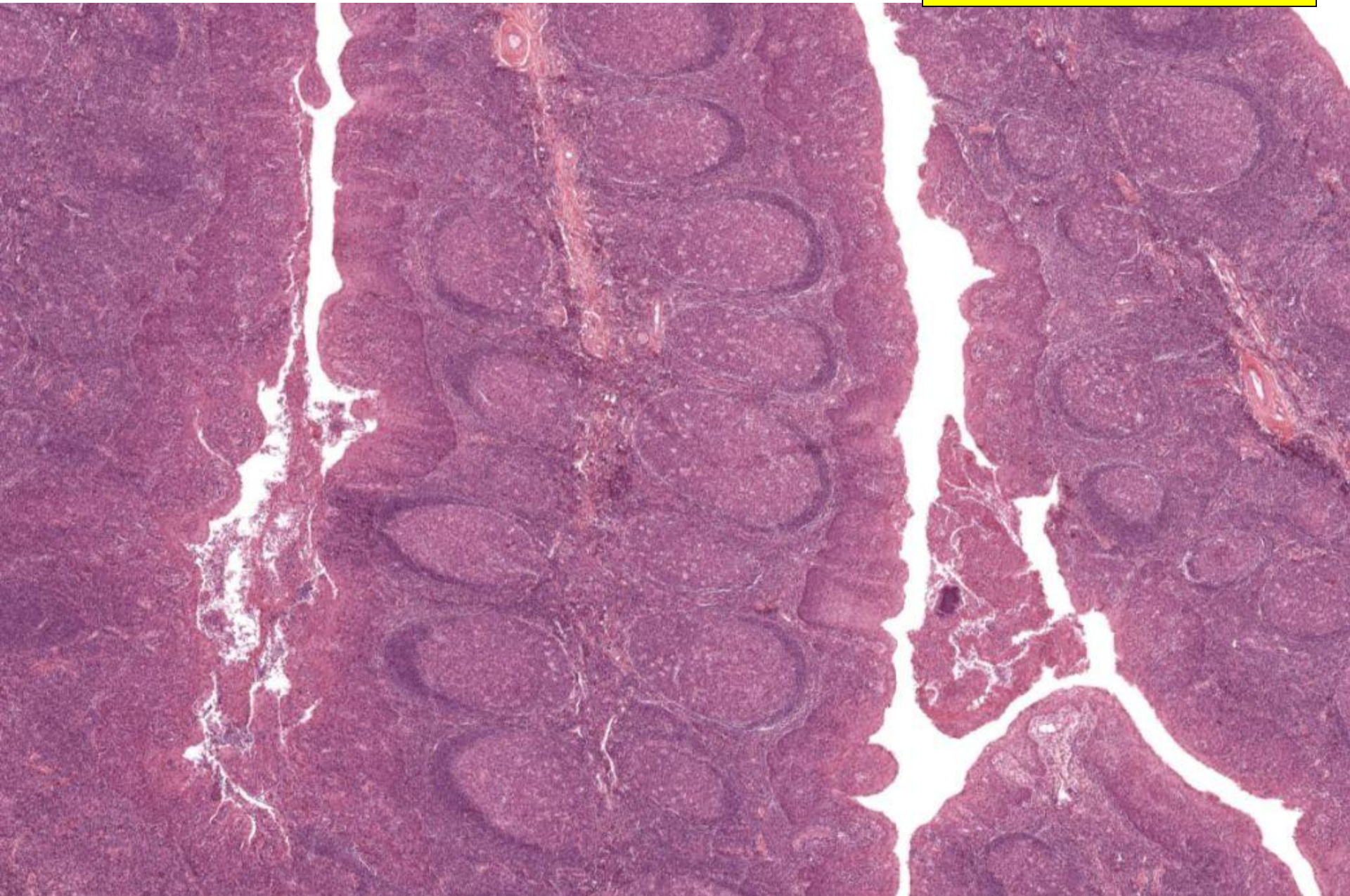
Thymus



Palatine tonsils



Palatine tonsils



	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