

LYMPHOID TISSUE

Objectives

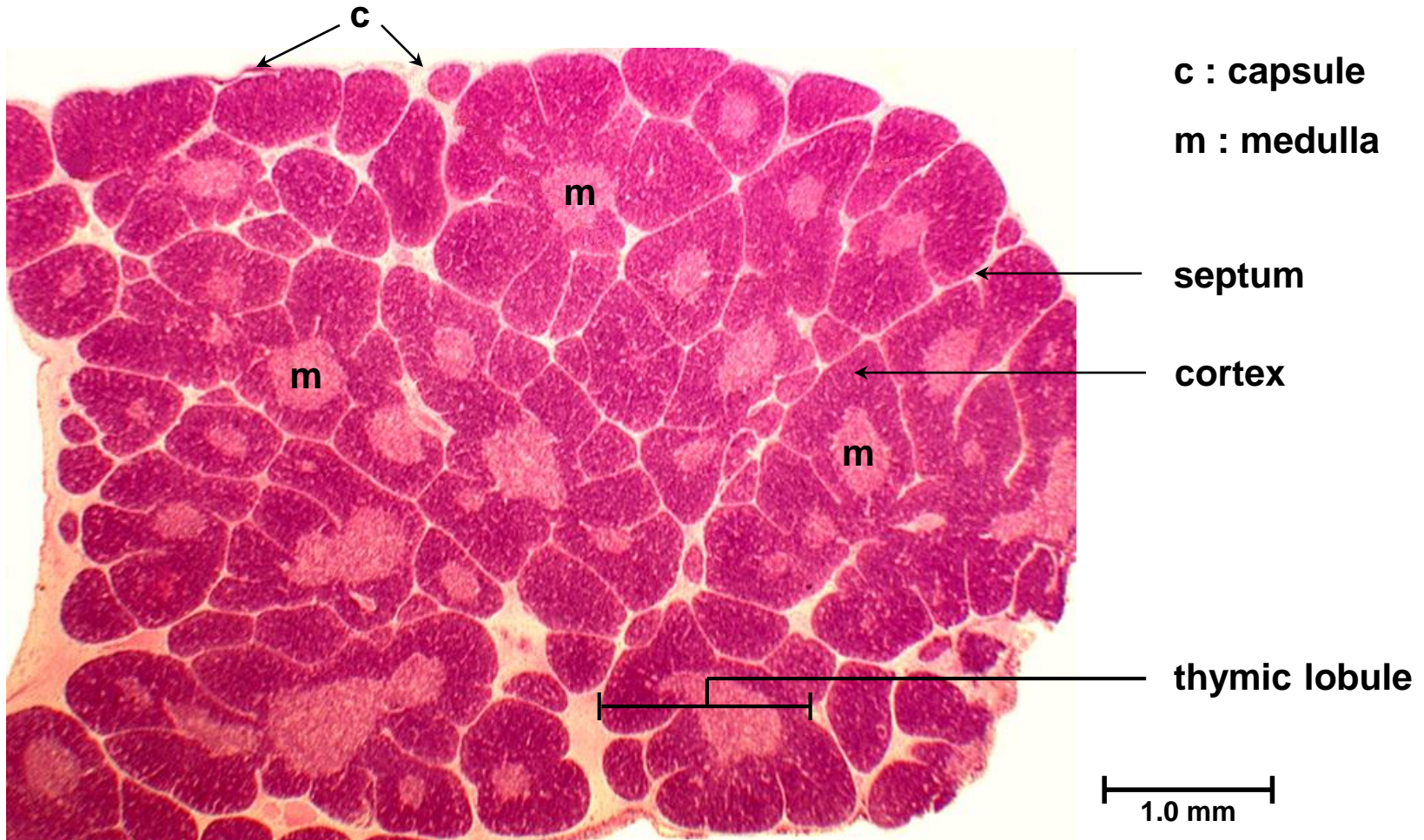
1. Appreciate that the lymphoreticular system is divided into primary and secondary lymphoid organs.
2. Recognise that the structure of the **BONE MARROW** and **THYMUS** provides an ideal environment for **B** cell and **T** cell differentiation.
3. Describe how the structure of the **LYMPH NODE** is well adapted for filtering antigens from the tissue fluid and initiating immune responses.
4. Describe the structure of the **SPLEEN** and appreciate that this is related to its role in initiating immune responses to antigens in the blood.
5. List the important components of the **MUCOSAL ASSOCIATED LYMPHOID TISSUES (MALT)** and describe how their structure relates to their function in protecting mucosal surfaces.

Thymus

Examine the thymus at very low magnification.

Identify; a. Capsule.

b. Thymic lobules with cortical and medullary zones.

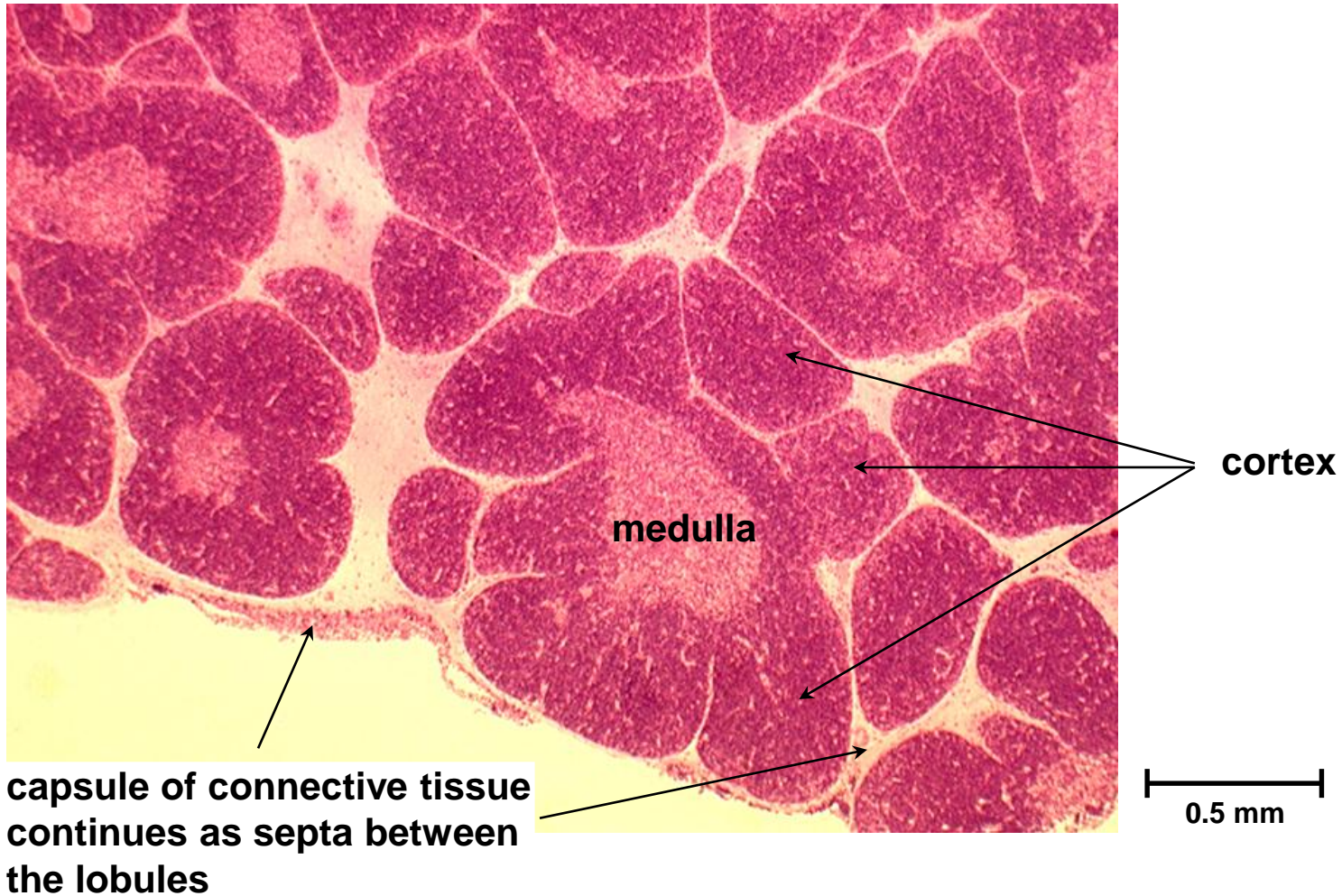


Thymus

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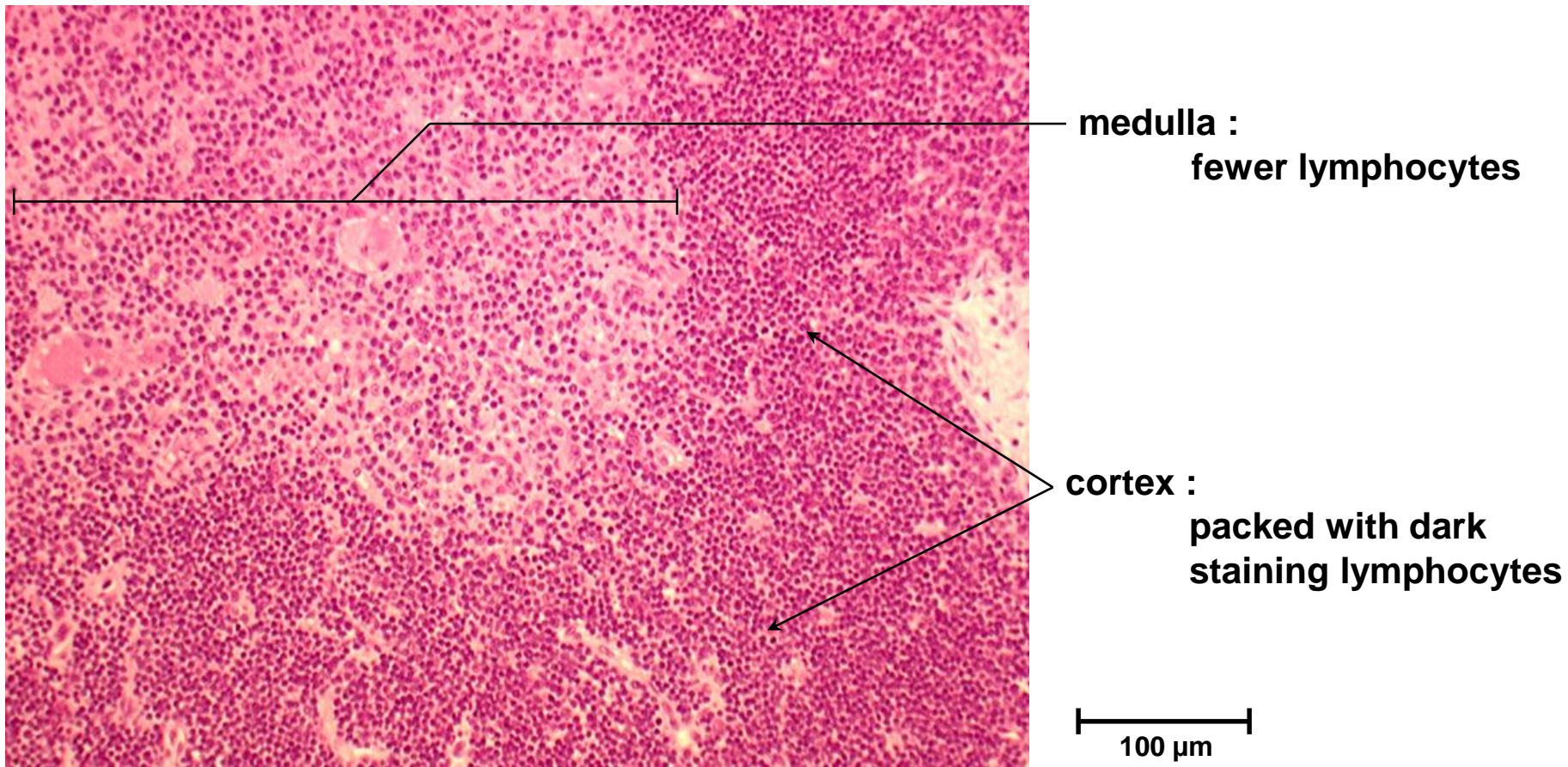


Thymus

What are the major differences in the histological structure of the thymus in the cortical and medullary zones?

Cortex: tightly packed with small lymphocytes, few stromal cells visible.

Medulla: fewer lymphocytes, more non-lymphoid cells visible (e.g. Epithelioreticular cells, macrophages) and more obvious blood vessels.



Thymus

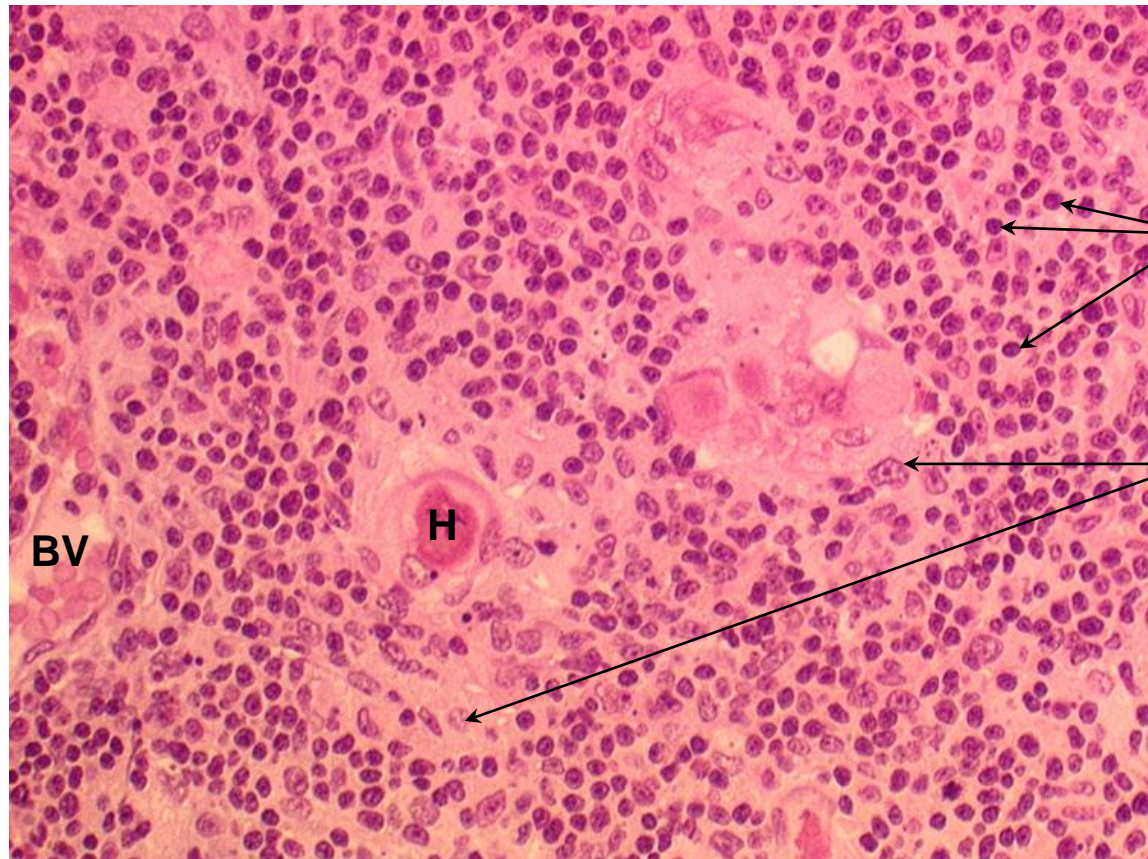
In which part of the thymic lobule would you expect to see mature lymphocytes and can immature and mature lymphocytes be distinguished morphologically?

Immature in cortex.

Mature in medulla.

It is difficult to distinguish between the two types of cell on morphology but you could look for expression of cell surface markers.

e.g. CD4 & CD8 : double negative → double positive → single positive.



medulla of thymus

**lymphocytes
(dark staining)**

**pale staining
non-lymphoid cells
(epithelioreticular cells,
macrophages)**

BV : blood vessel

H : Hassall's corpuscle

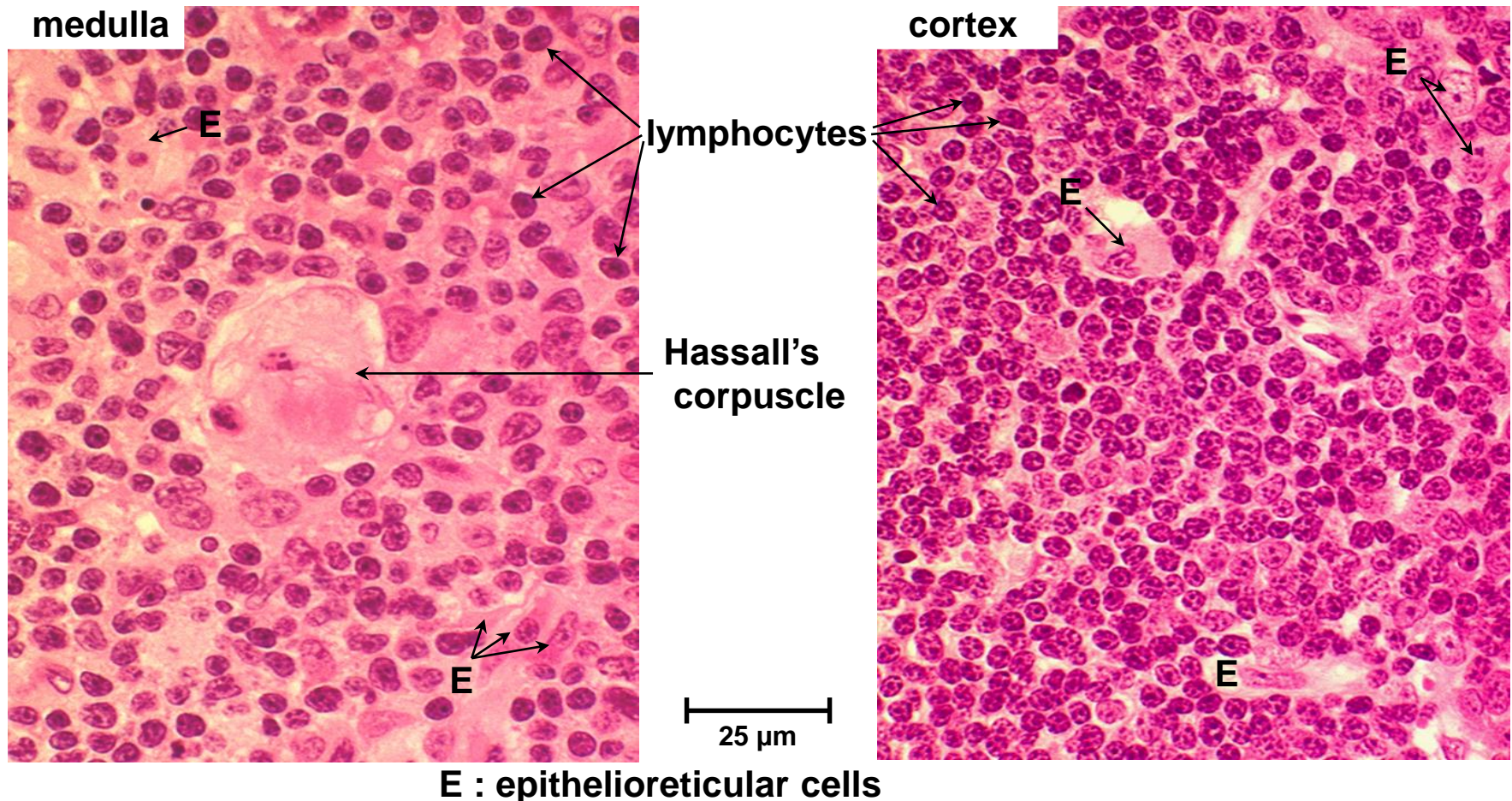
50 μm

Thymus

What is the function of epithelioreticular cells, how can they be identified in this section?

They provide the structural framework of the thymus and secrete growth factors as well as essential cell-cell interactions with lymphocytes.

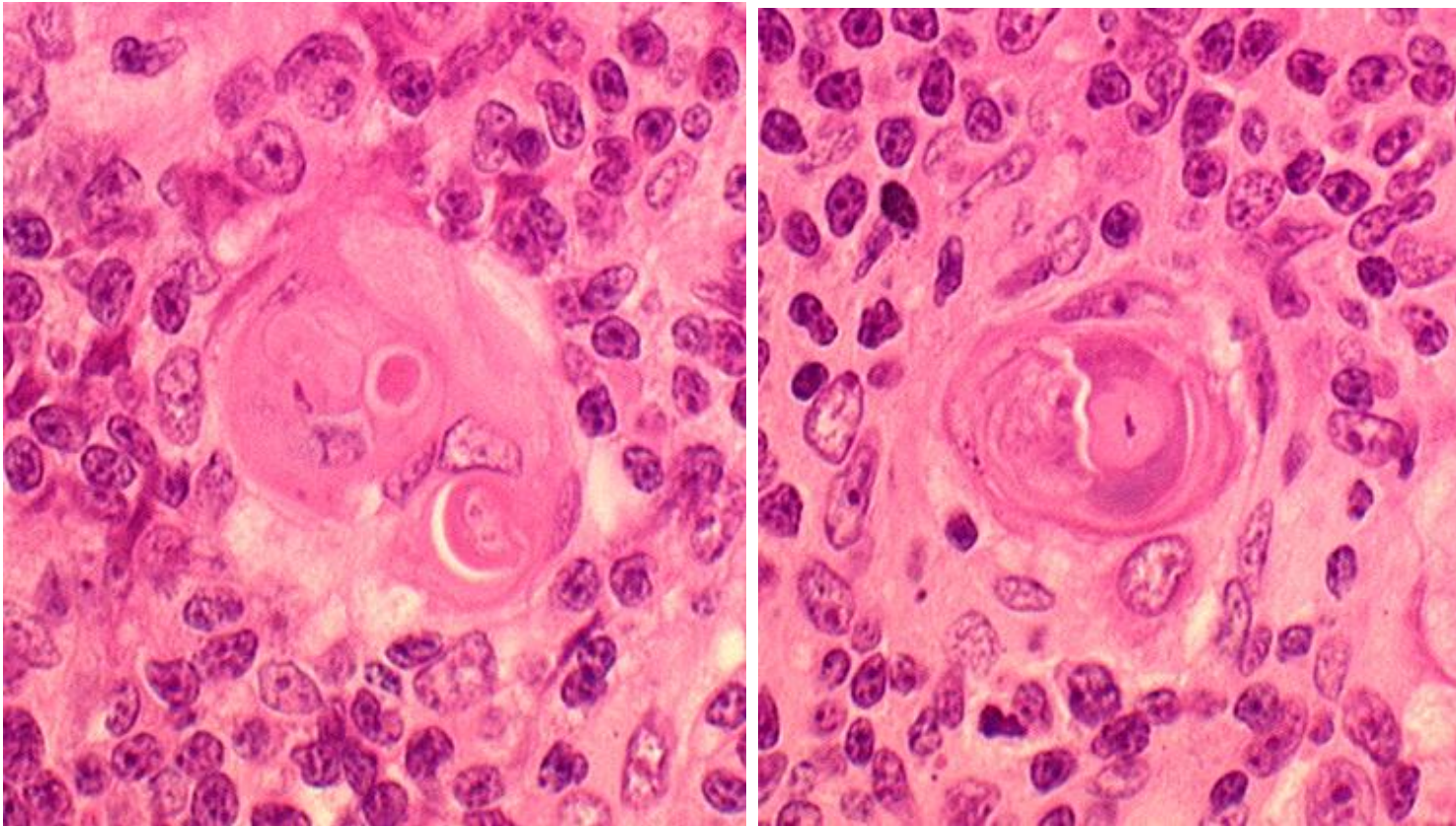
These cells are bigger, lighter staining and more heterogeneous in shape compared to the lymphocytes.



Thymus

What is the distinguishing feature of Hassall's corpuscles and are they found anywhere other than in thymic medulla?

**They look like a section through an onion (degenerate epithelial cells forming squames).
These are only found in the thymus.**

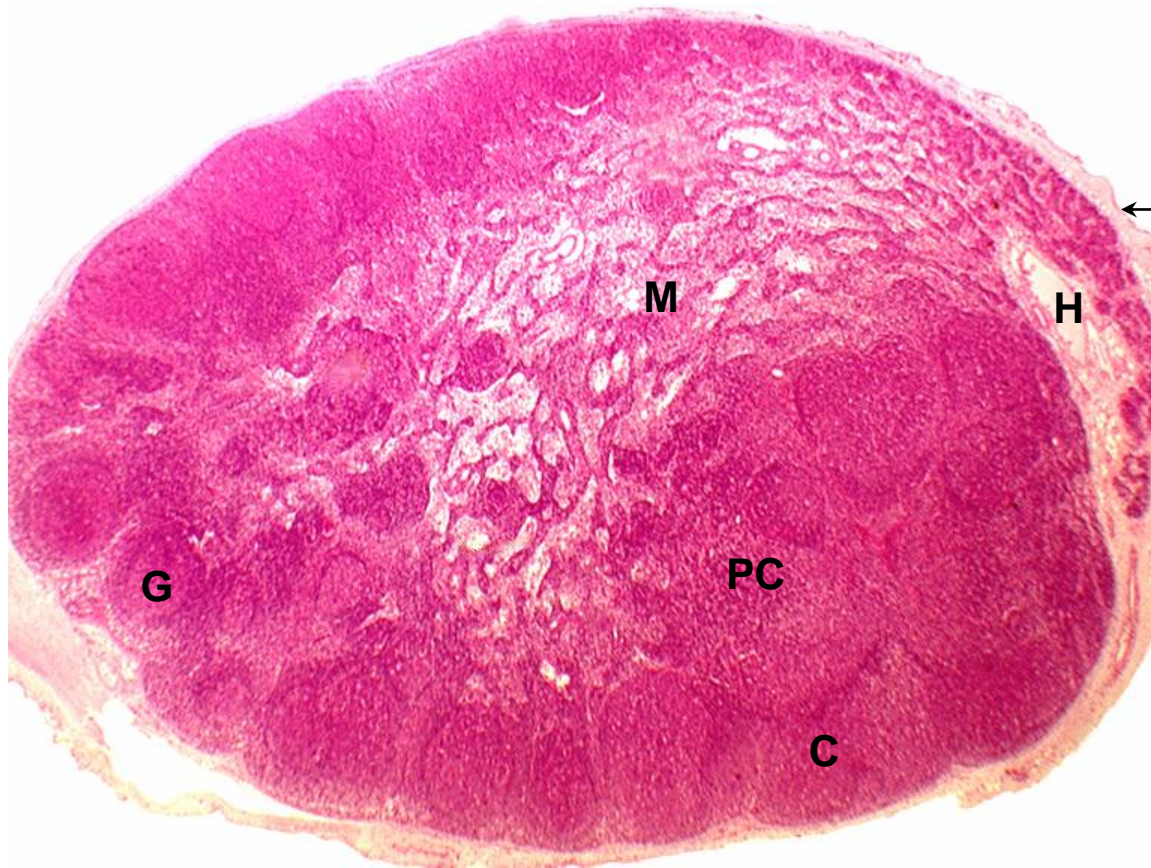


concentric whorls of degenerating epithelioreticular cells forming Hassall's corpuscles (thymic corpuscles).

Lymph node

Identify : a. cortex (outer layer).
b. paracortex.
c. medulla (deeper layer).

d. germinal centre.
e. fibrous capsule.



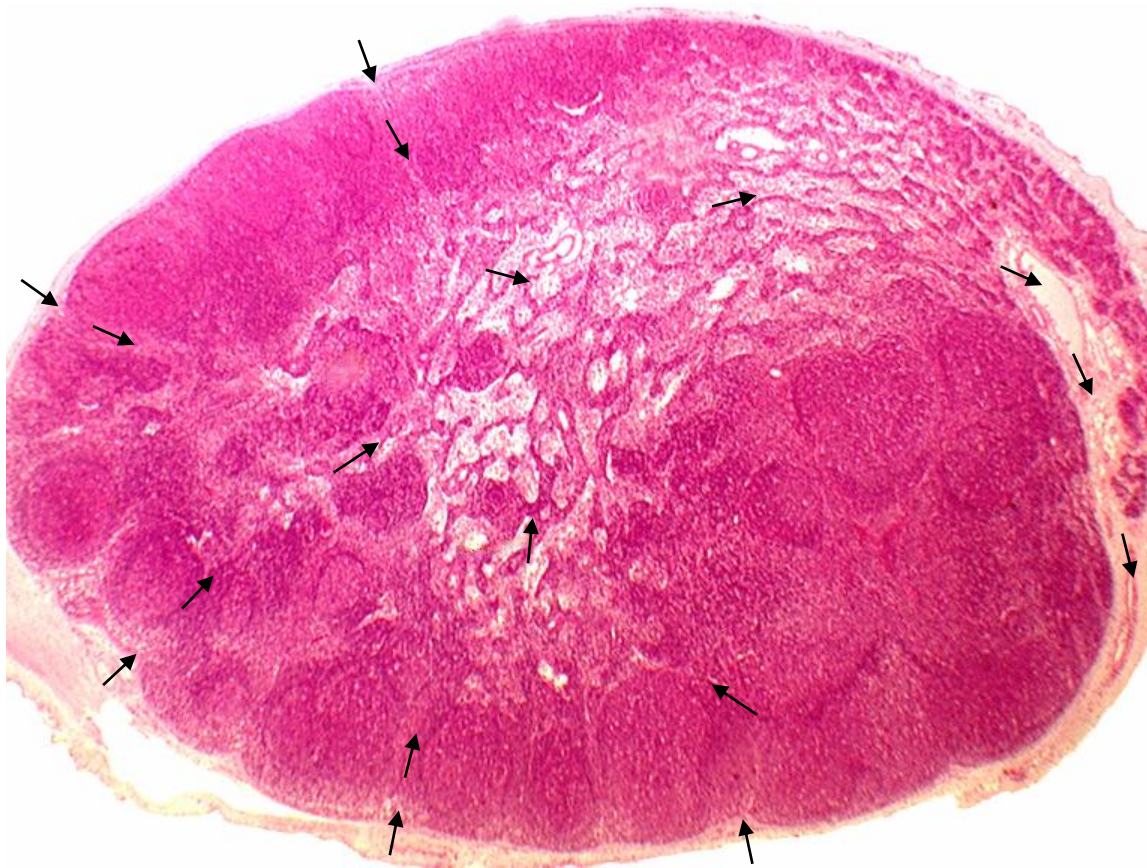
C : cortex
PC : paracortex
M : medulla
G : germinal centre
H : hilum
fibrous capsule

1.0 mm

Lymph node

The sinuses characterise the structure of the lymph node.

Try to visualise how the lymph carrying the antigen enters the subcapsular sinus and flows through the lymph node via cortical and medullary sinuses.



lymph reaches subcapsular sinus from afferent lymphatics.

flows through cortical sinuses in trabeculae.

flows through medullary lymph sinuses.

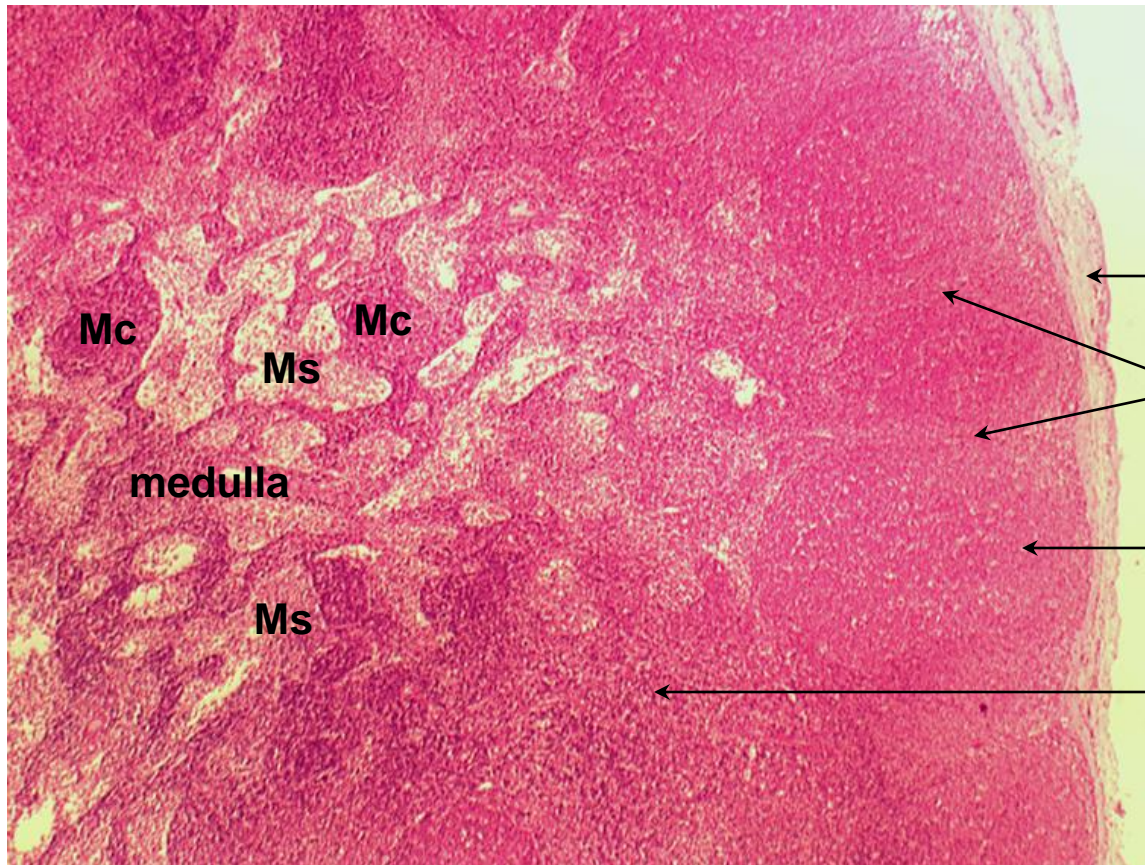
exits from hilus of lymph node via efferent lymphatics.

1.0 mm

Lymph node

- Identify :
- a. cortex (outer layer).
 - b. paracortex.
 - c. medulla (deeper layer).
 - d. medullary cords.

- e. medullary sinuses.
- f. fibrous capsule.
- g. connective tissue trabeculae.



Ms : medullary sinuses

Mc : medullary cords

capsule

trabeculae

cortex

paracortex

0.5 mm

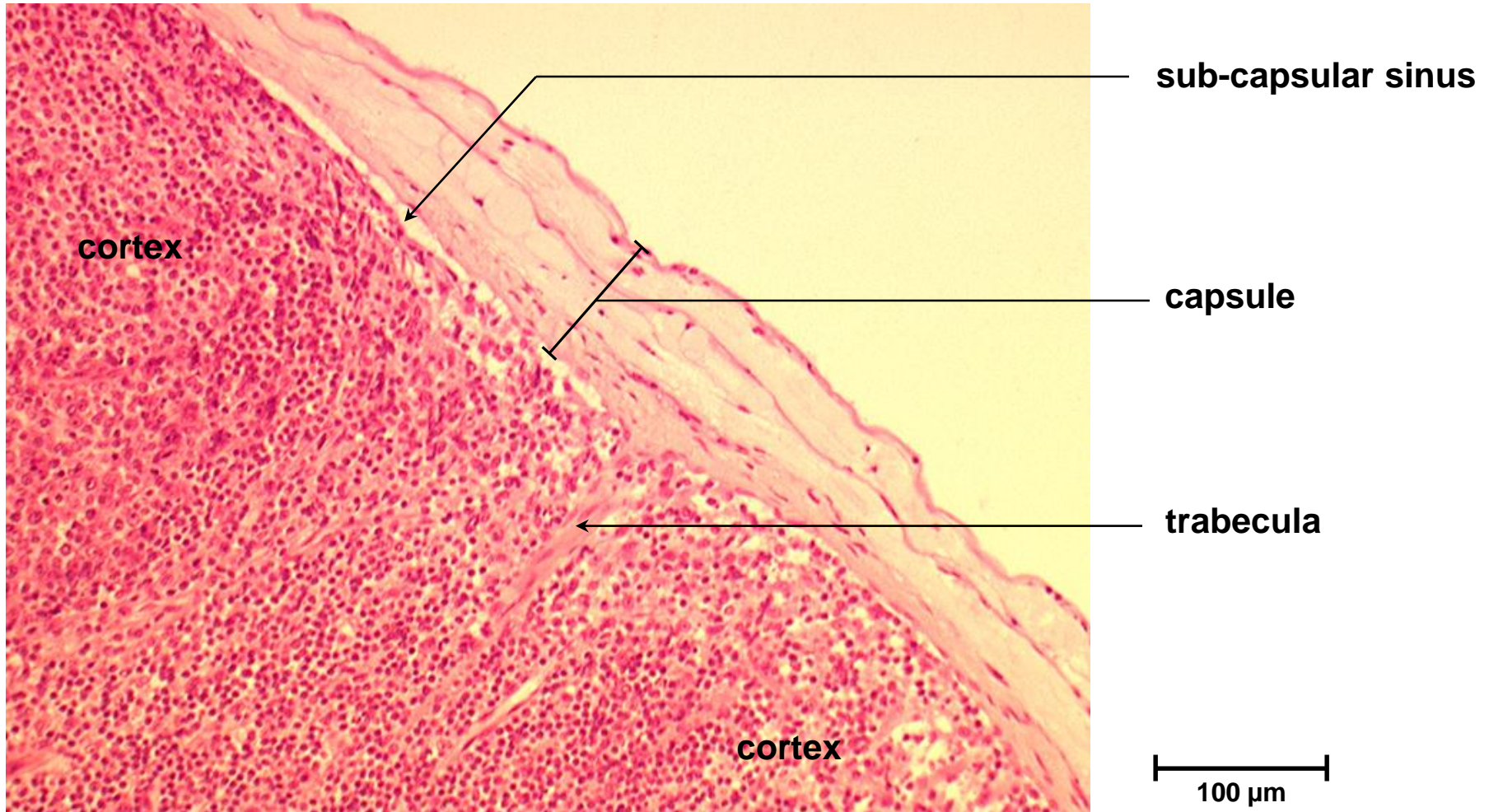
Lymph node

Identify : a. cortex.

b. fibrous capsule.

c. connective tissue trabeculae.

d. sub-capsular sinus.

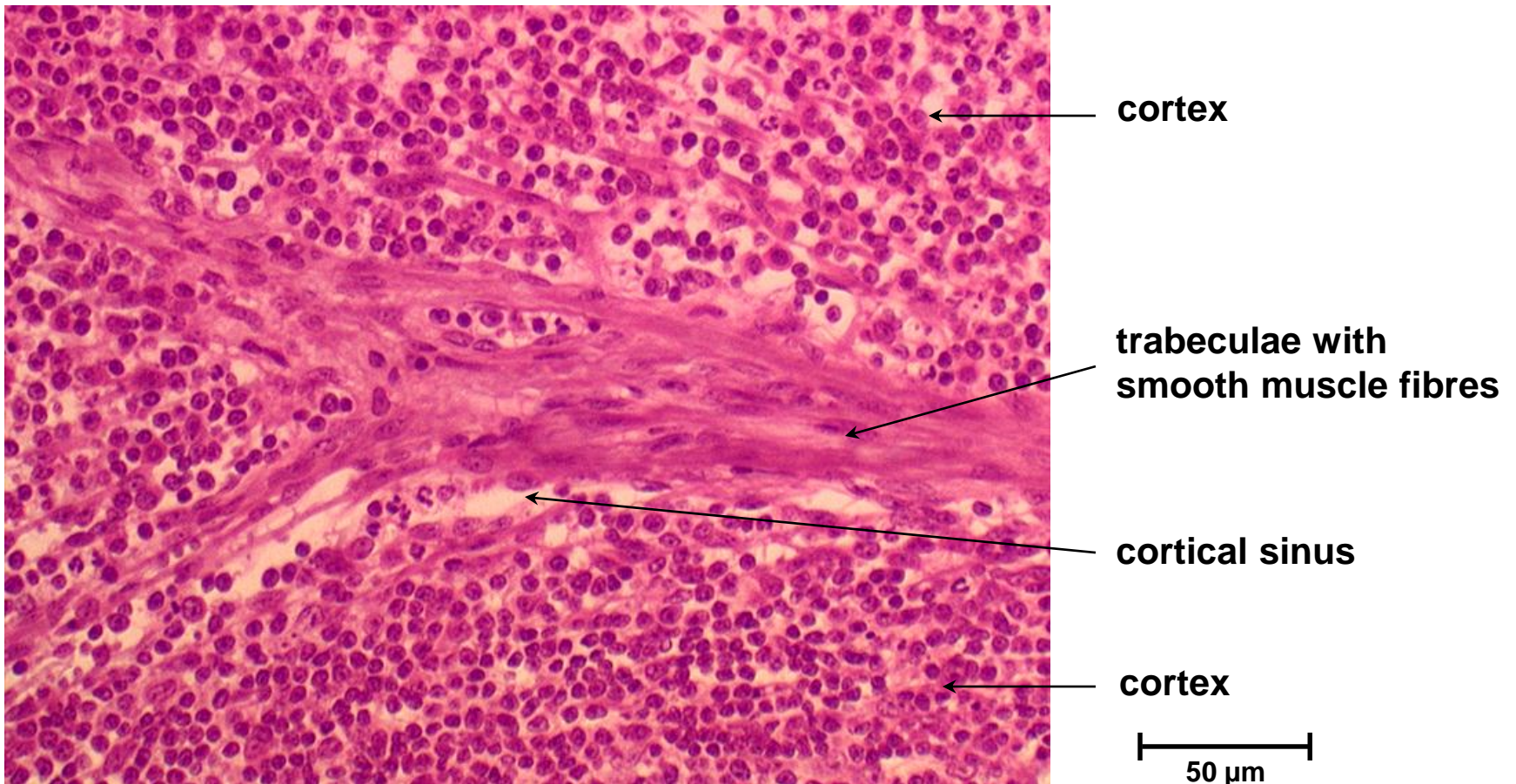


Lymph node

Part of the trabecula of a lymph node.

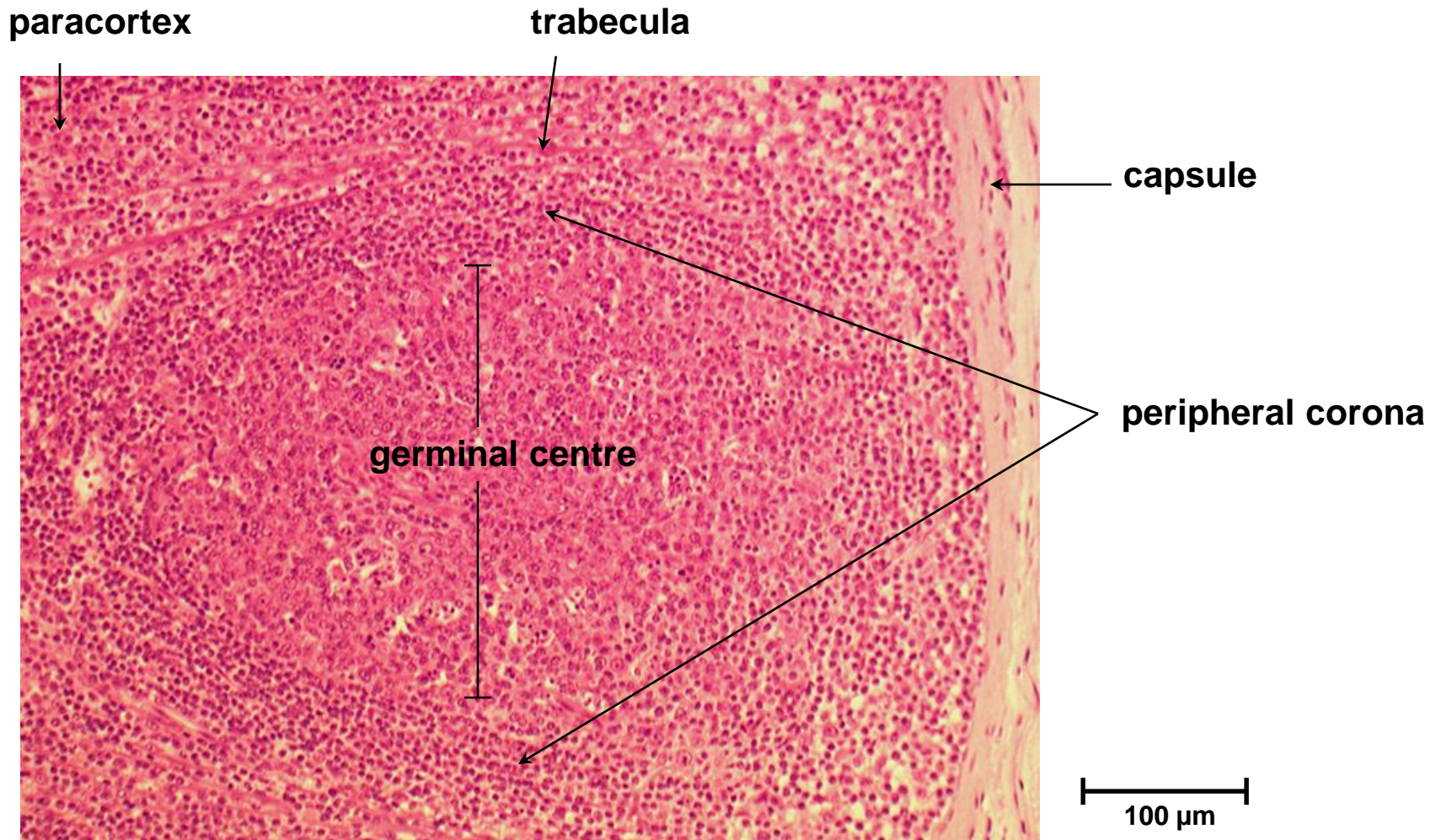
The sub-capsular sinus continues as cortical sinuses in the trabeculae.

Smooth muscle fibres can be seen in the trabeculae.



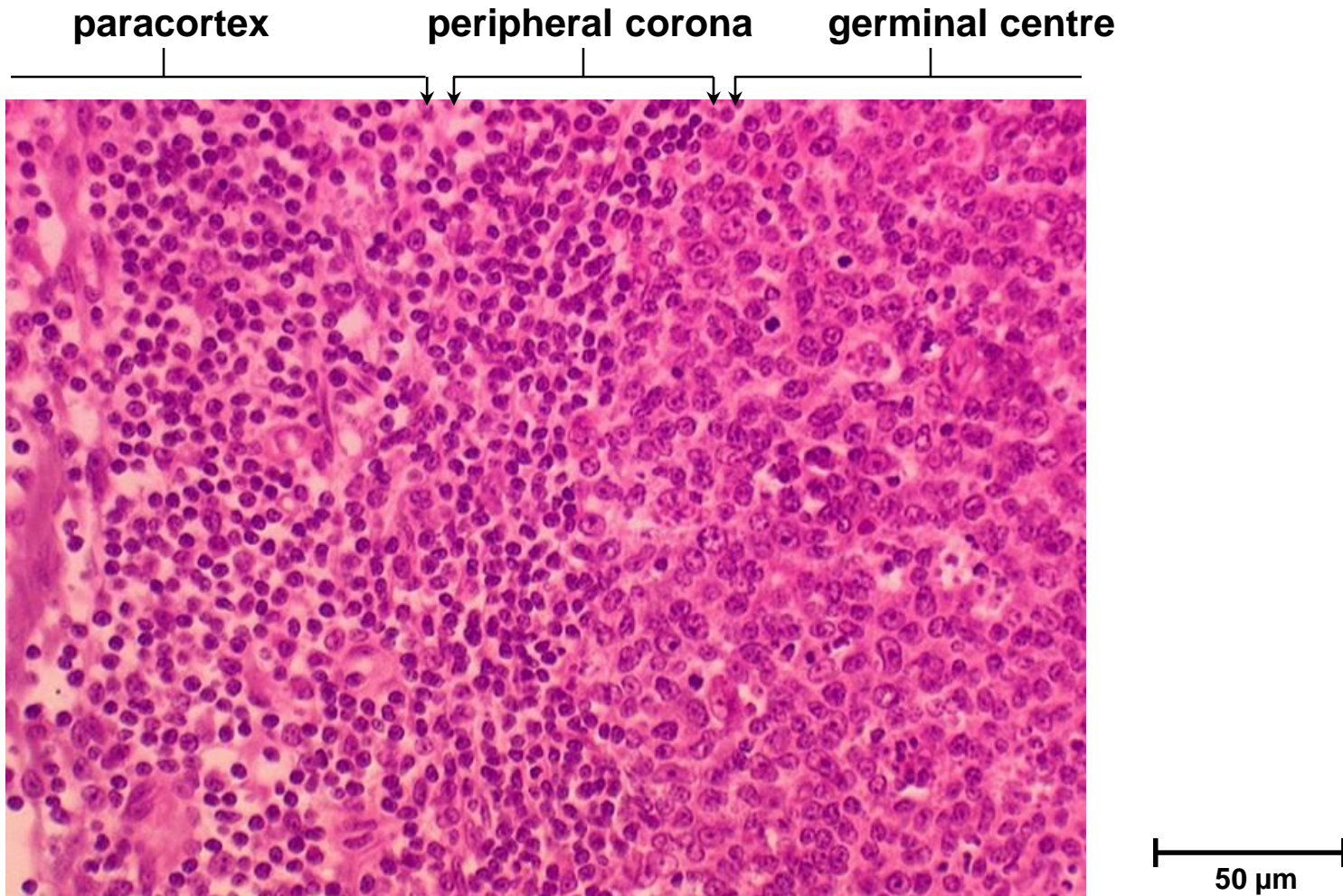
Lymph node

Under higher magnification distinguish different cell types in the germinal centre and peripheral corona of follicles and diffuse paracortex.



Lymph node

Under higher magnification distinguish different cell types in the germinal centre and peripheral corona of follicles and diffuse paracortex.



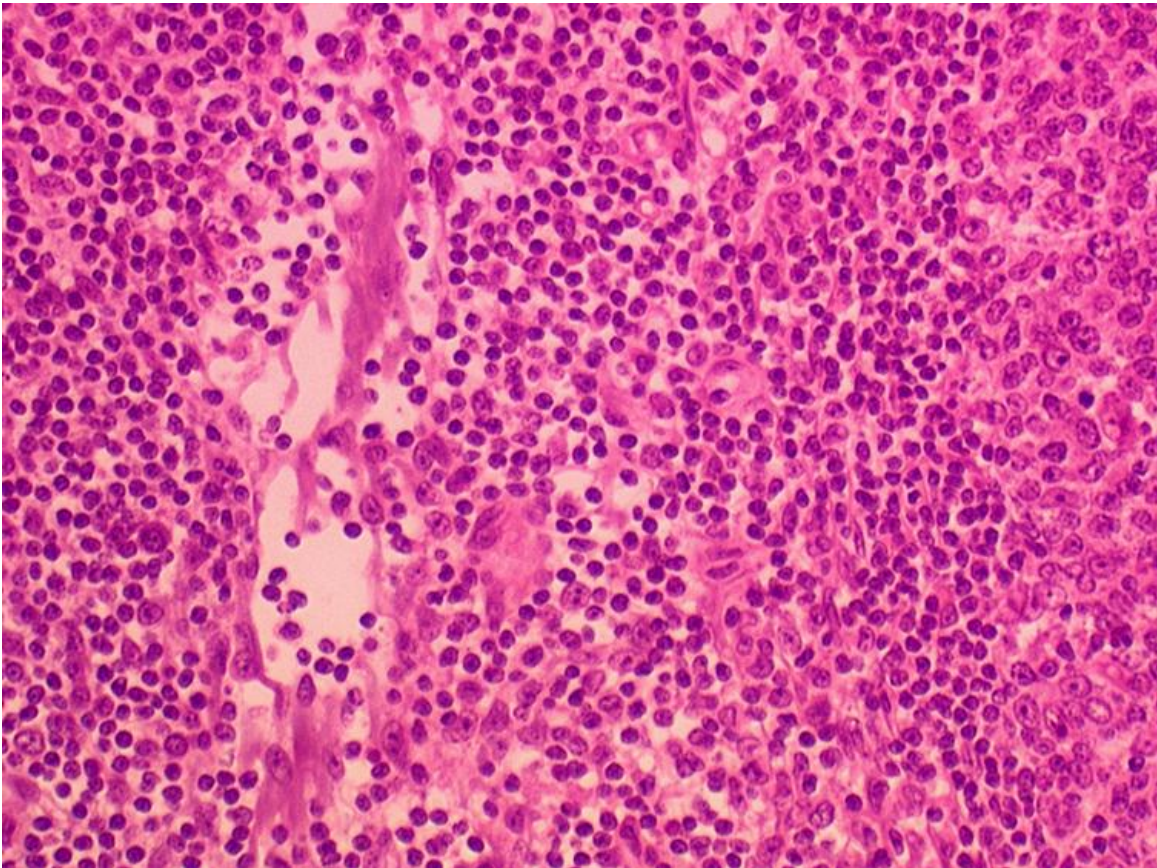
Lymph node

What are the major cell types found in the paracortex and how does this differ from the cells present in the follicles or medulla?

T cells, interdigitating DCs and macrophages in paracortex.

B cells and follicular DCs in follicles.

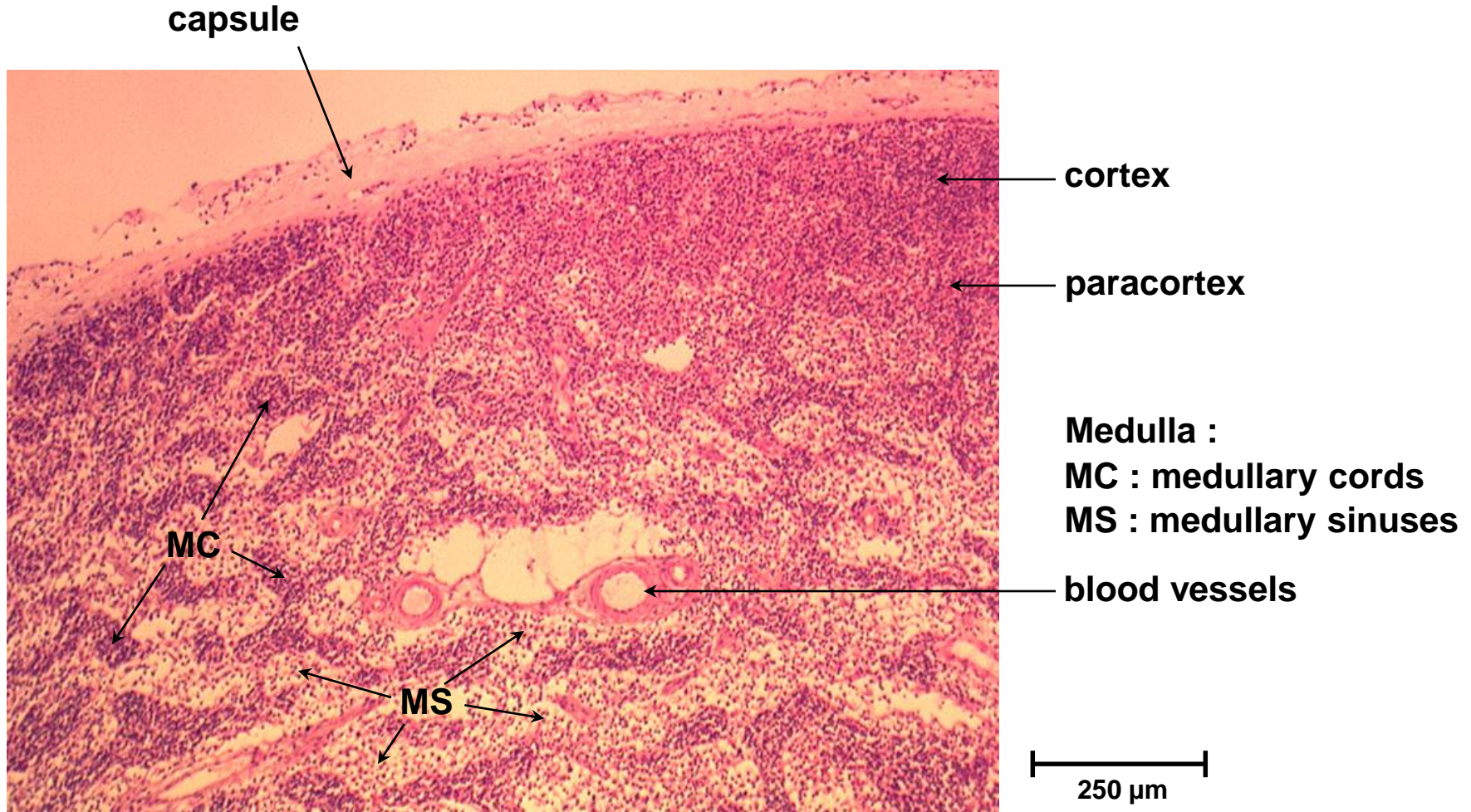
Macrophages and plasma cells in medulla.



50 μ m

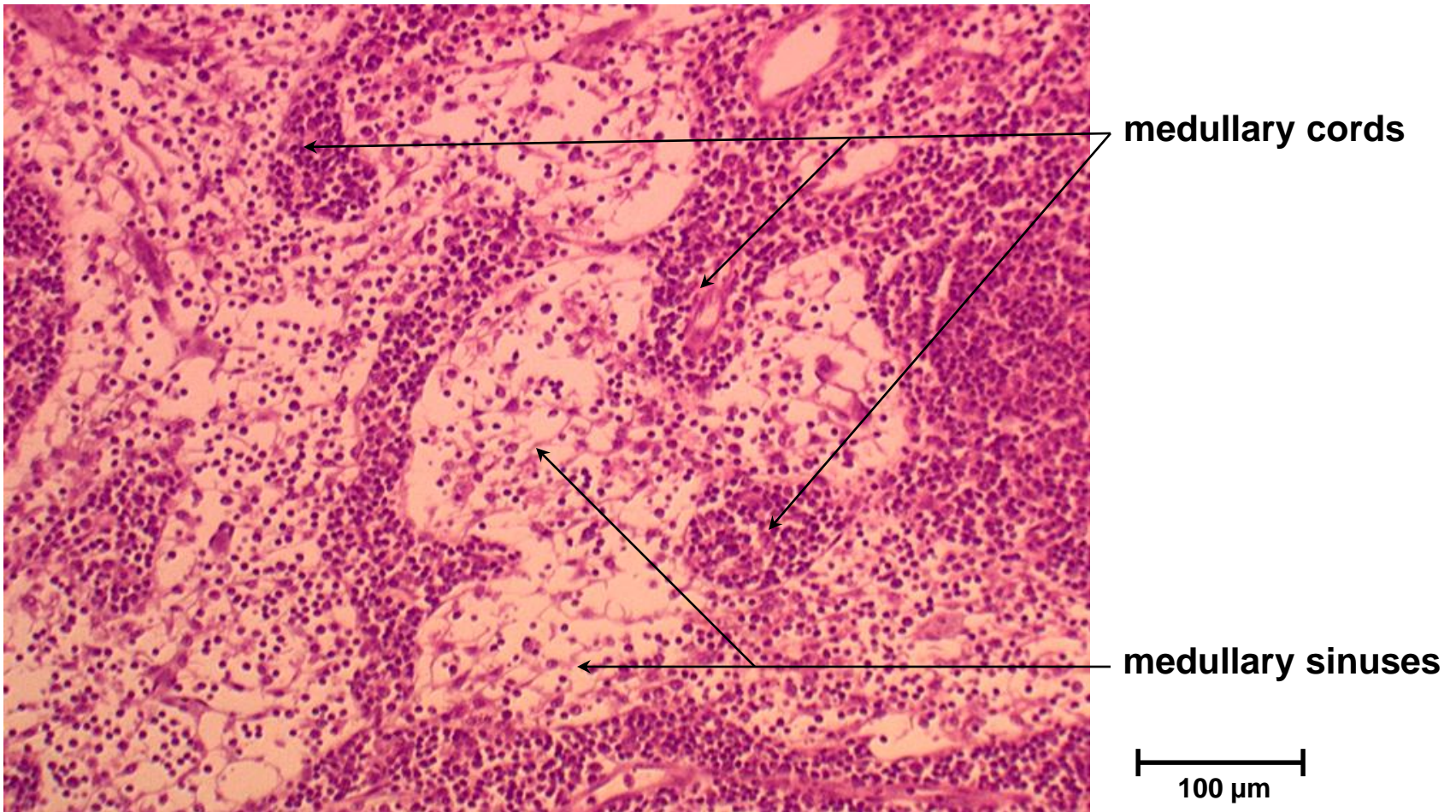
Lymph node

Examine the medulla with medullary cords and sinuses.



Lymph node

The medulla with medullary cords and sinuses lined with an endothelium containing lymphocytes, plasma cells and macrophages.



Lymph node

Identify the main regions of this lymph node stained for reticular fibres.

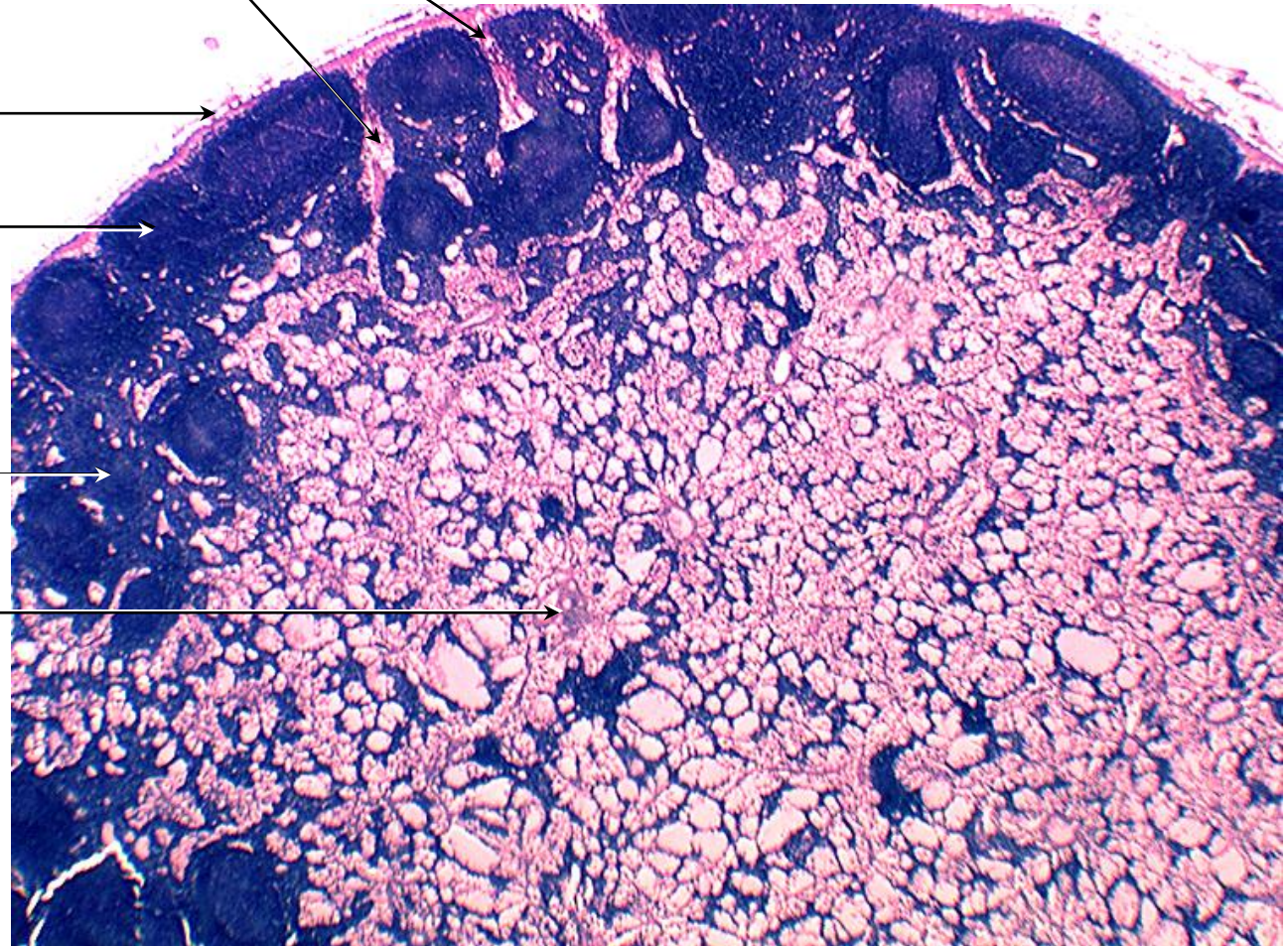
trabeculae

capsule

cortex

paracortex

medulla

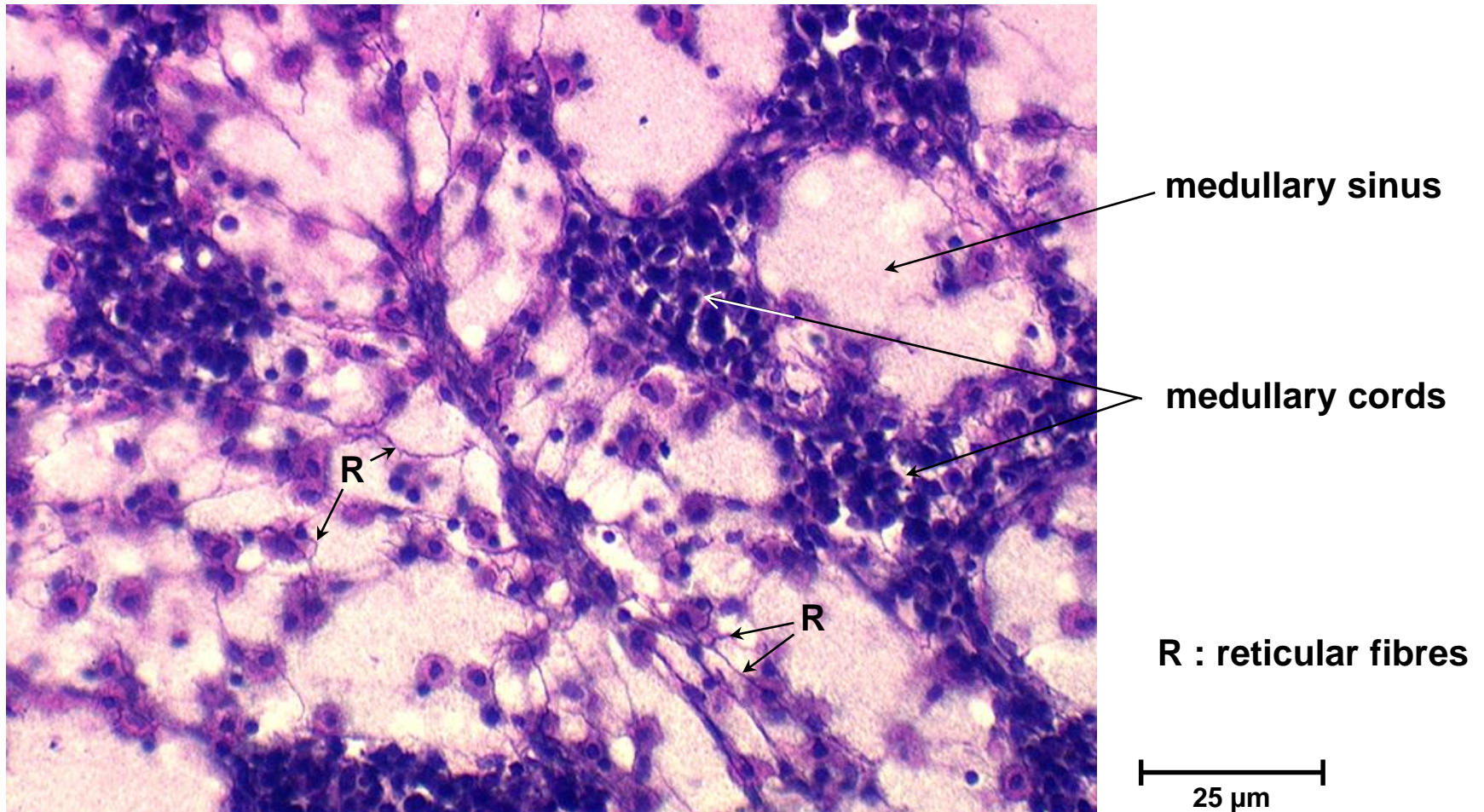


1.0 mm

Lymph node

At high magnification the network of reticular fibres can be seen in this area of medulla.
What is this protein fibre composed of?

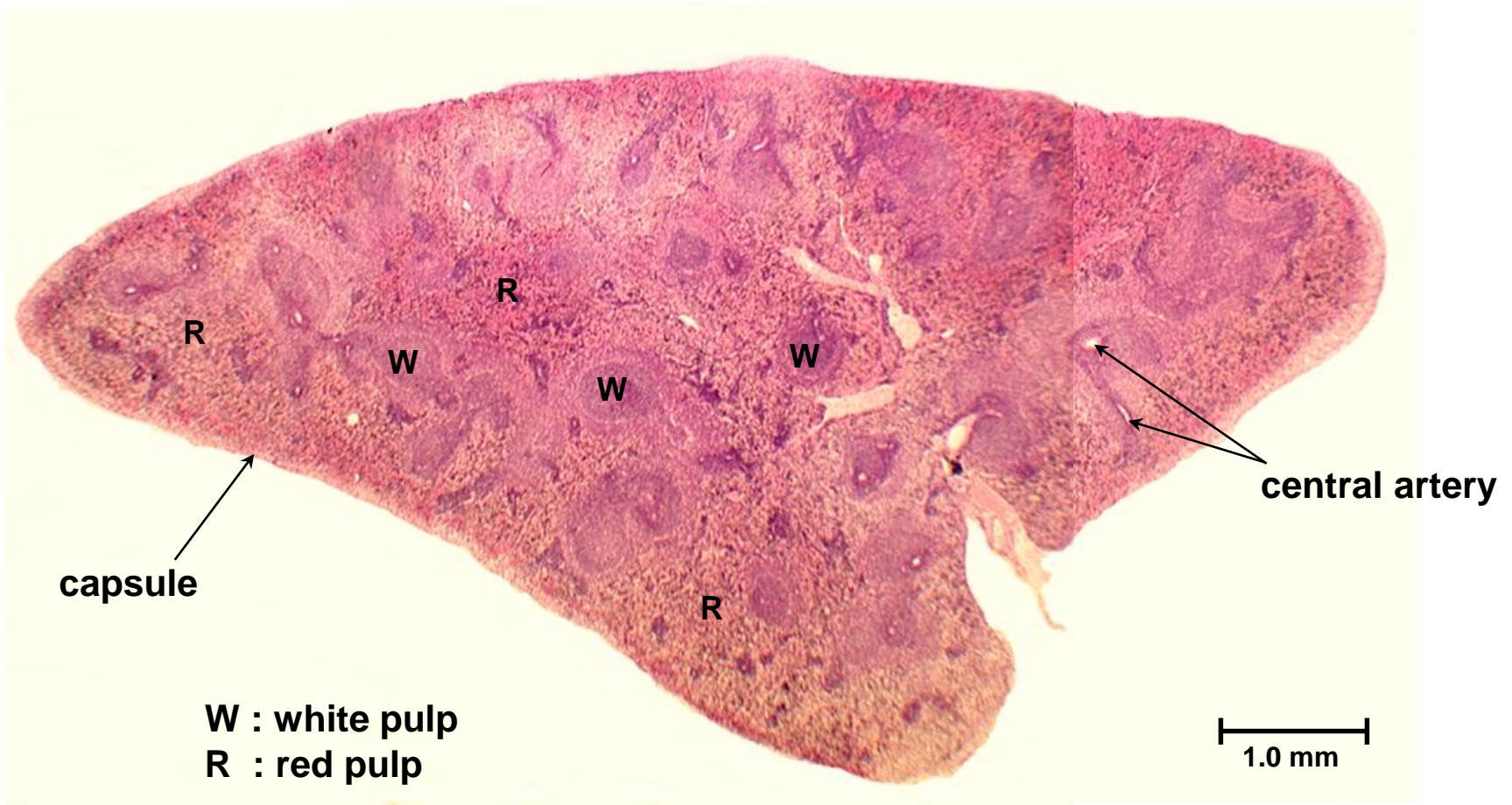
Collagen type III.



Spleen

Whole section seen under low magnification.

Identify : a). capsule. d). central artery.
 b). white pulp.
 c). red pulp.

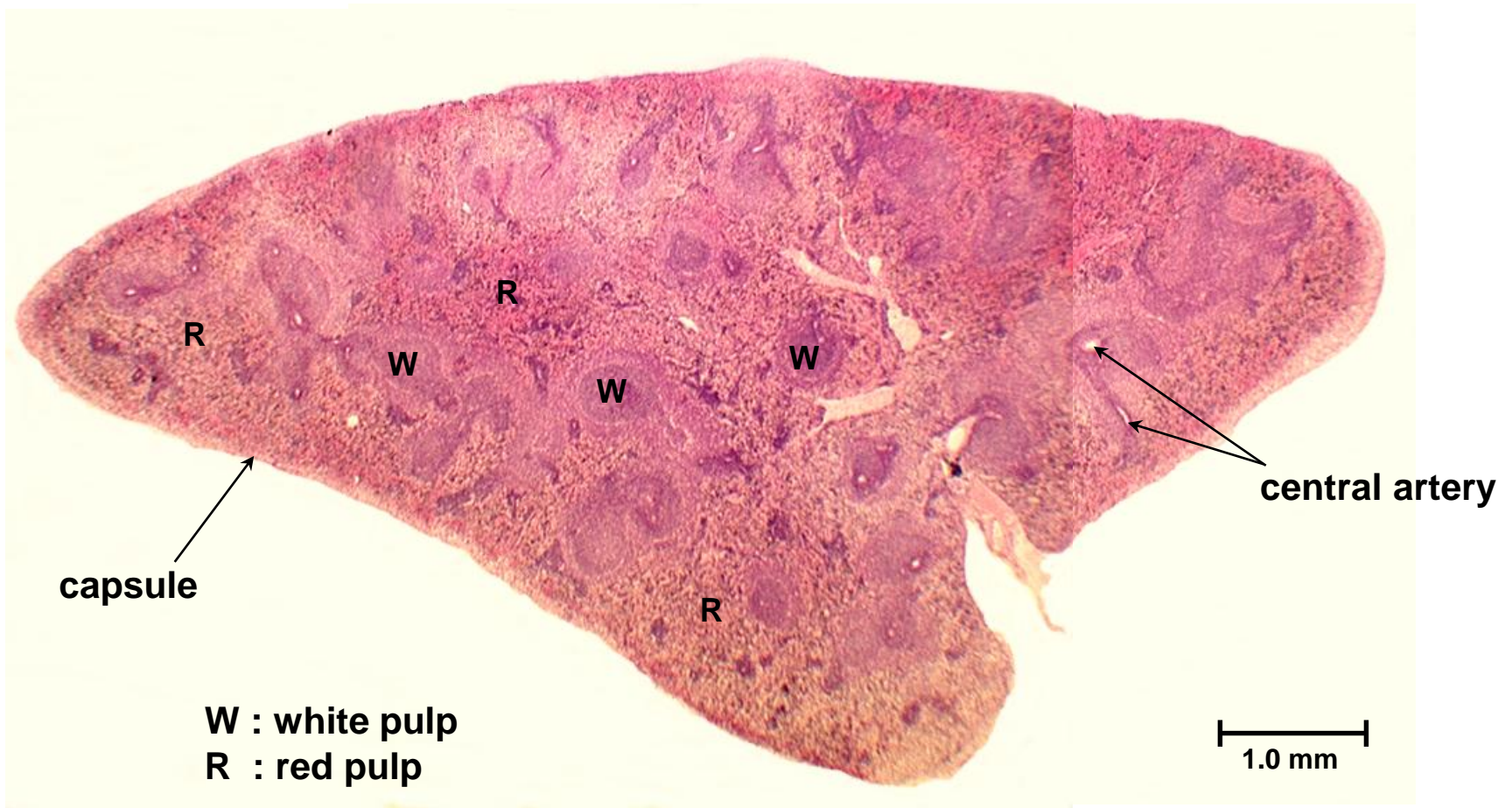


Spleen

What features distinguish the spleen from lymph nodes and other lymphoid tissues?

Central arteries in the white pulp.

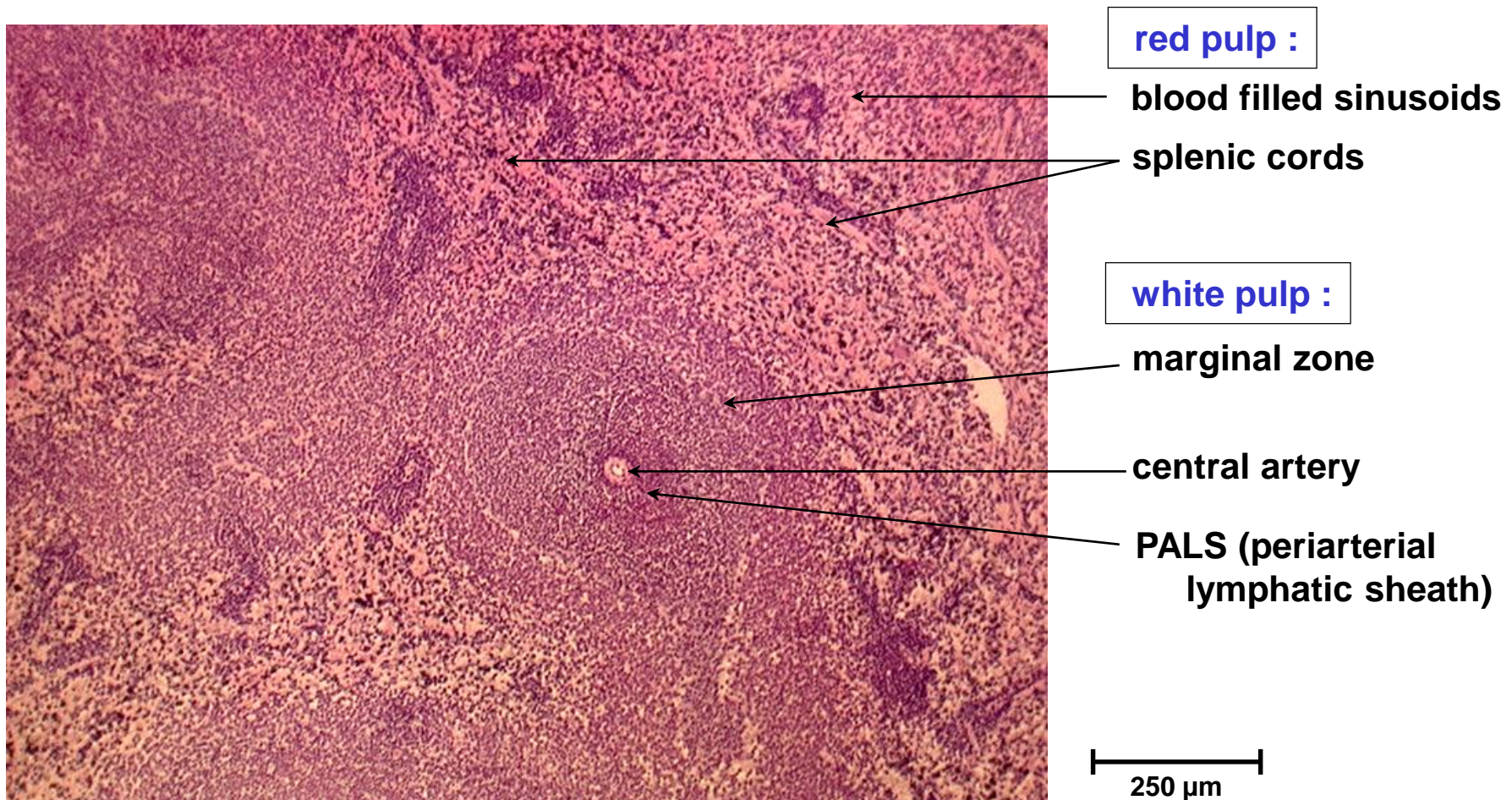
No cortex and medulla.



Spleen

Note the random scattering of lymphatic tissue, **white pulp**, centred around the branches of the central artery in the blood filled parenchyma called **red pulp**.

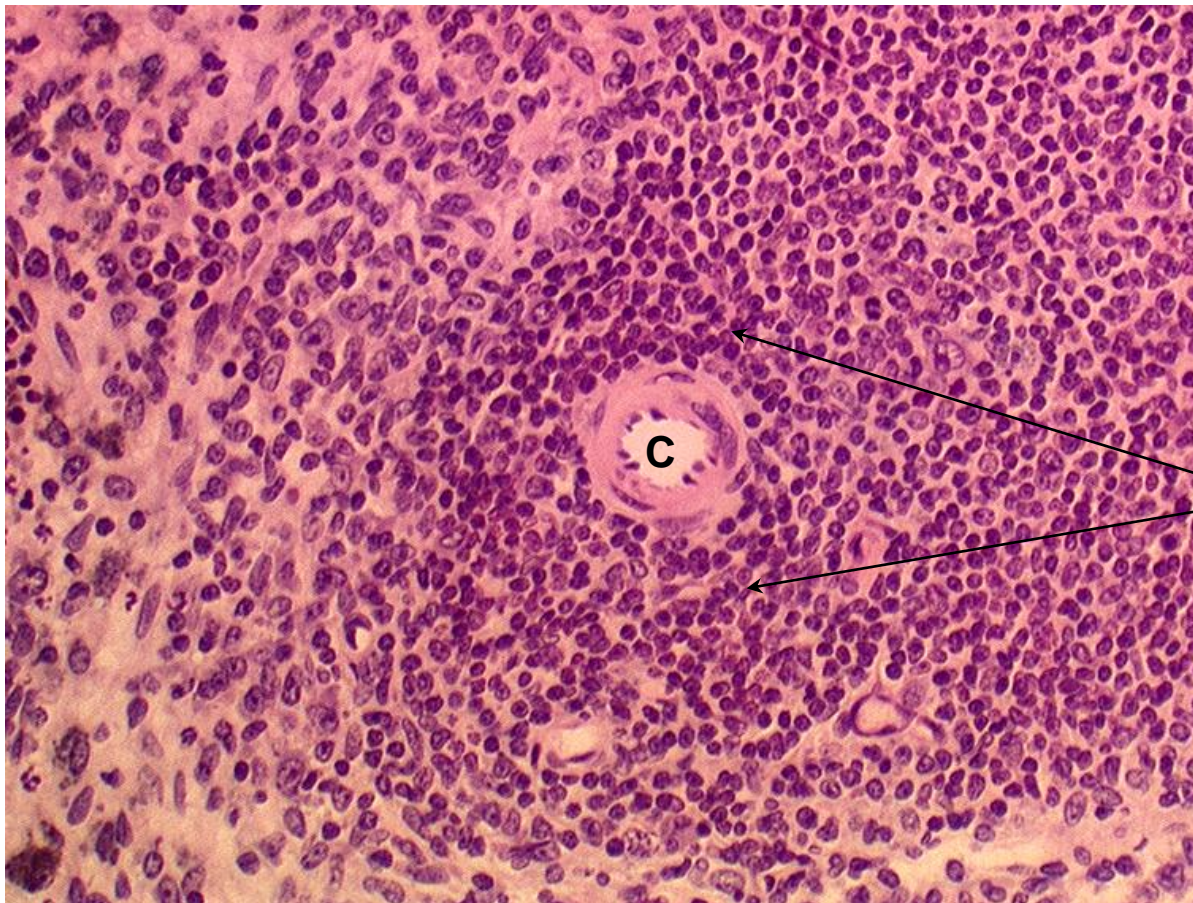
Note the red pulp is composed of elongated structures called splenic cords that lie between the sinusoids.



Spleen

The lymphocytes around a central arteriole are called a periarterial lymphatic sheath or **PALS**.

The lymphatic follicles are also present at the edges of the PALS.



C : central artery

PALS
periarterial lymphatic
sheath

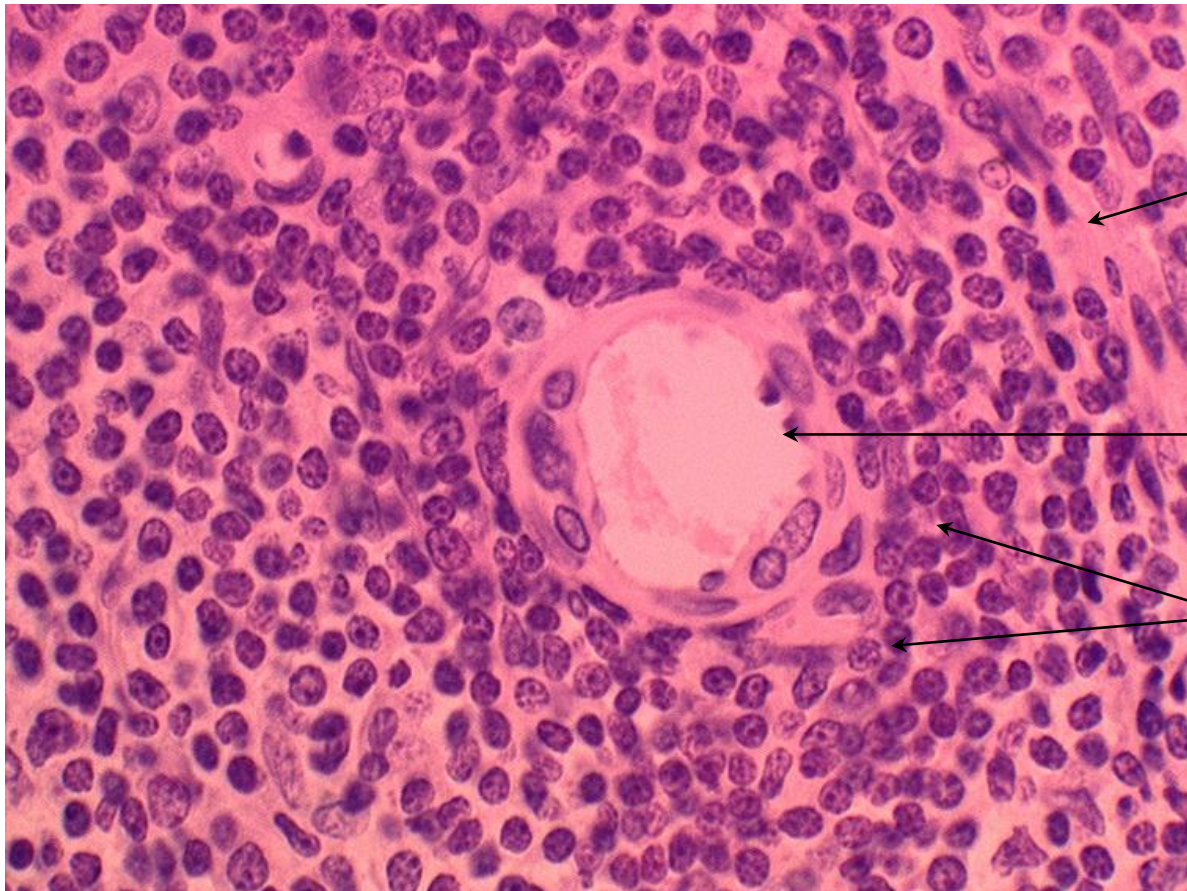
50 μ m

Spleen

How does the antigen arrive in the spleen and how does this differ from a lymph node?

Antigen arrives via blood to the spleen, compared to afferent lymphatic vessels for the lymph node.

Splenic artery → trabecular arteries → central arteries (surrounded by white pulp).



marginal zone

central artery

surrounding lymphocytes
of the periarteriolar
lymphatic sheath (PALS).

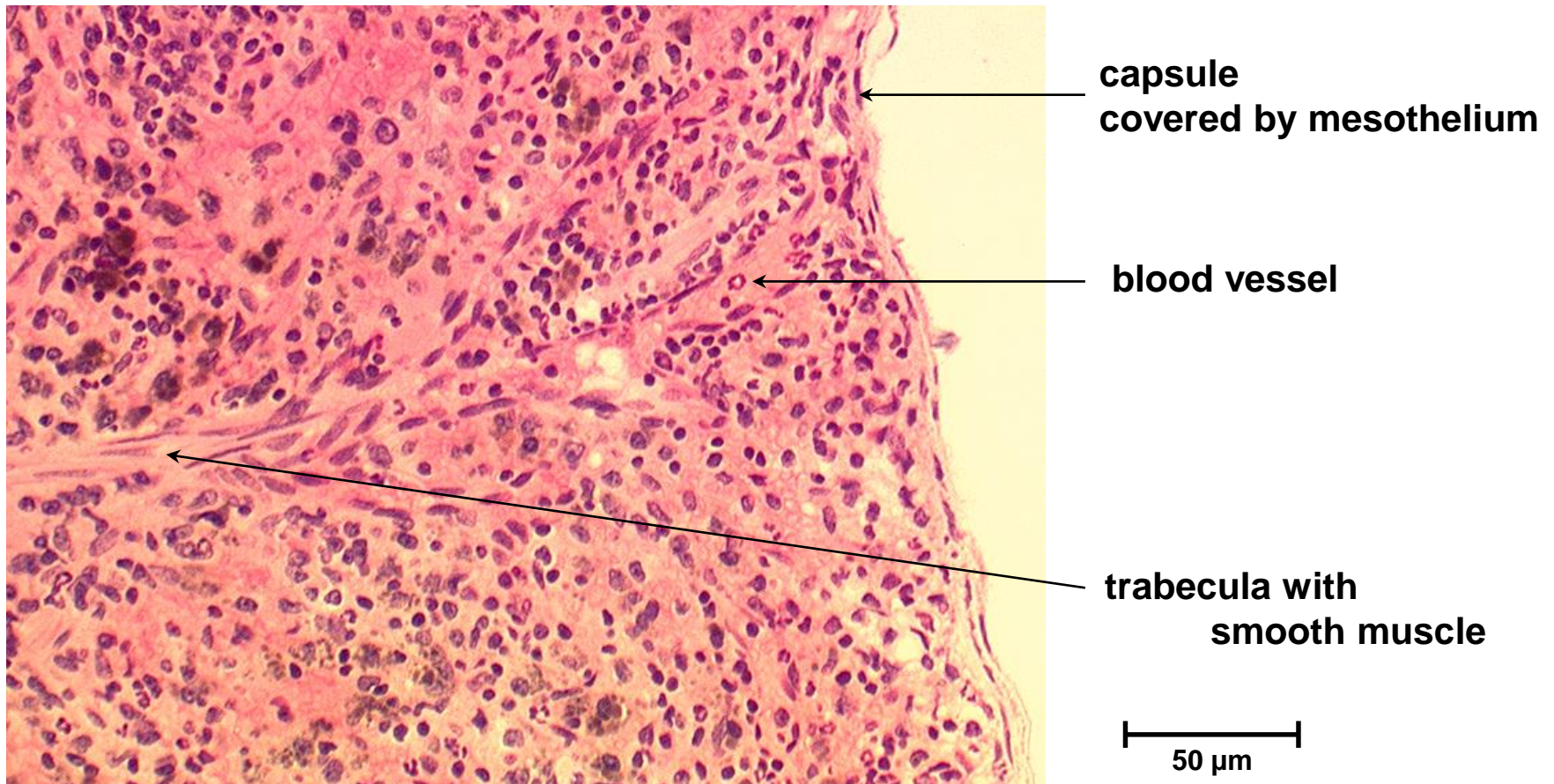
25 μ m

Spleen

Identify : connective tissue support represented by a). capsule.

b). trabeculae.

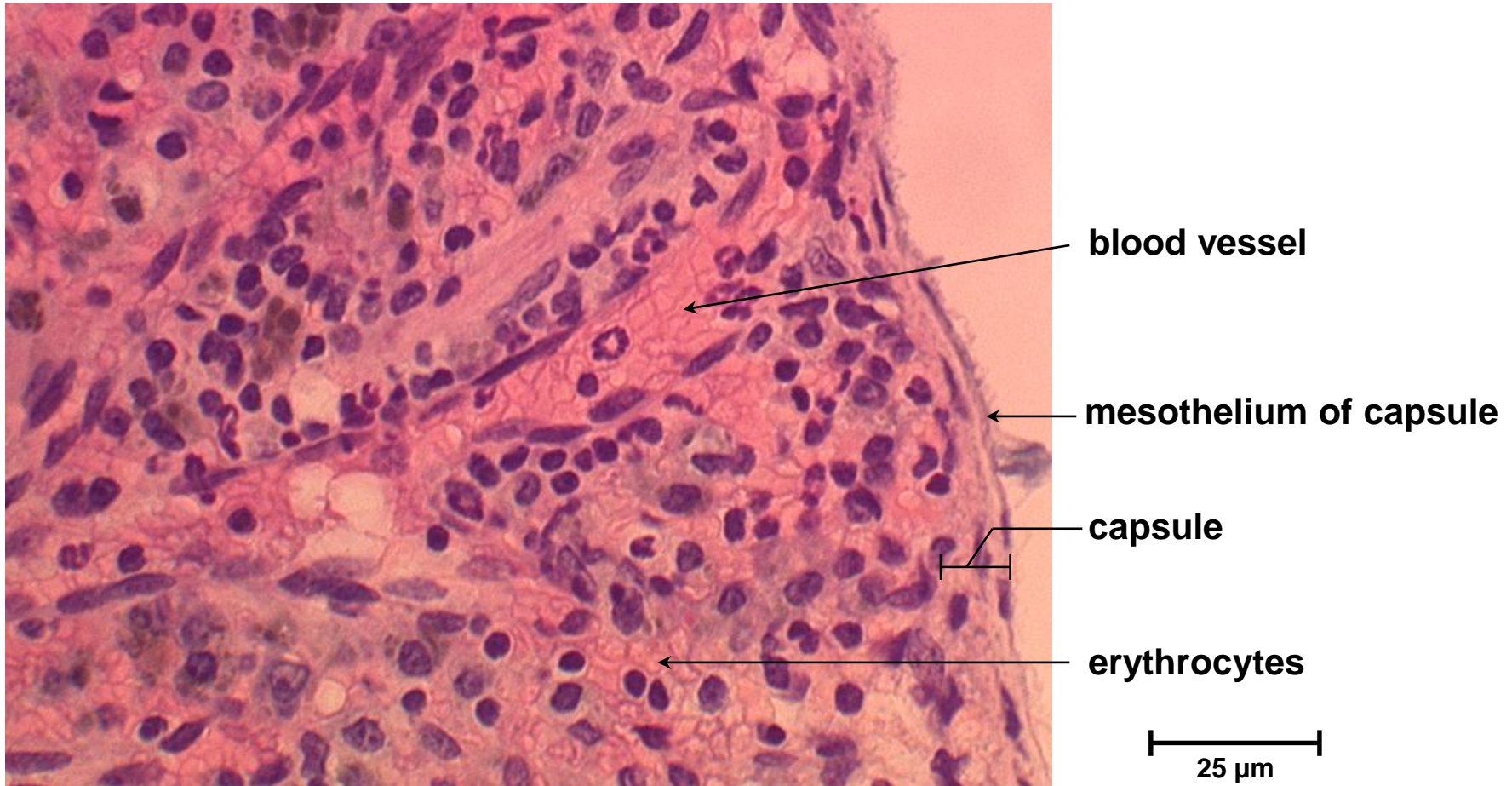
Reticular connective tissue is extensive in the spleen; it supports the PALS and lymphatic follicles of the white pulp and supports the pulp spaces in the blood filled red pulp.



Spleen

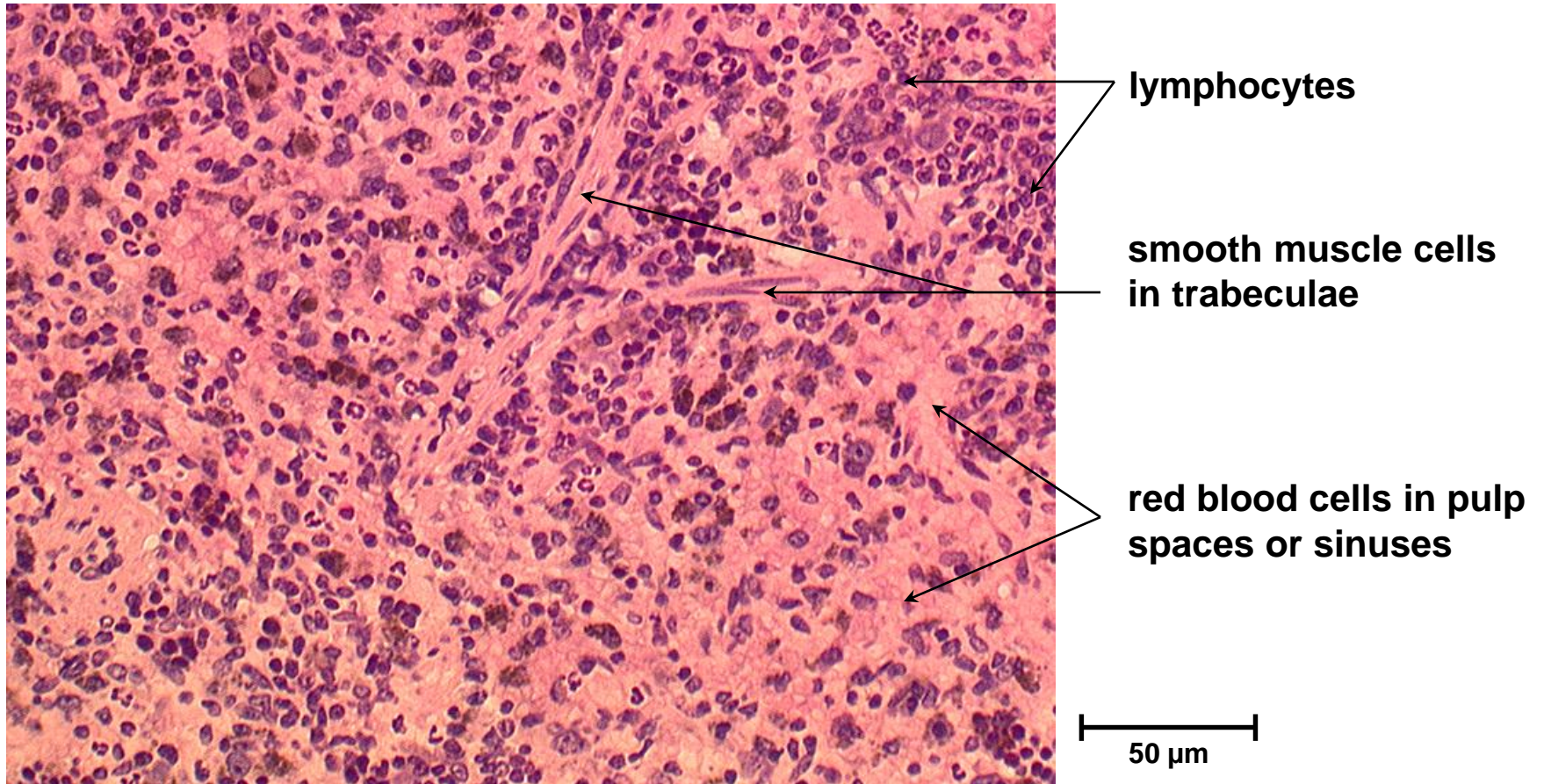
The capsule is covered by a layer of mesothelium and contains bundles of smooth muscle fibres.

In this higher magnification of red pulp close to the capsule, the tissue can be seen to be packed with erythrocytes in sinuses and blood vessels.



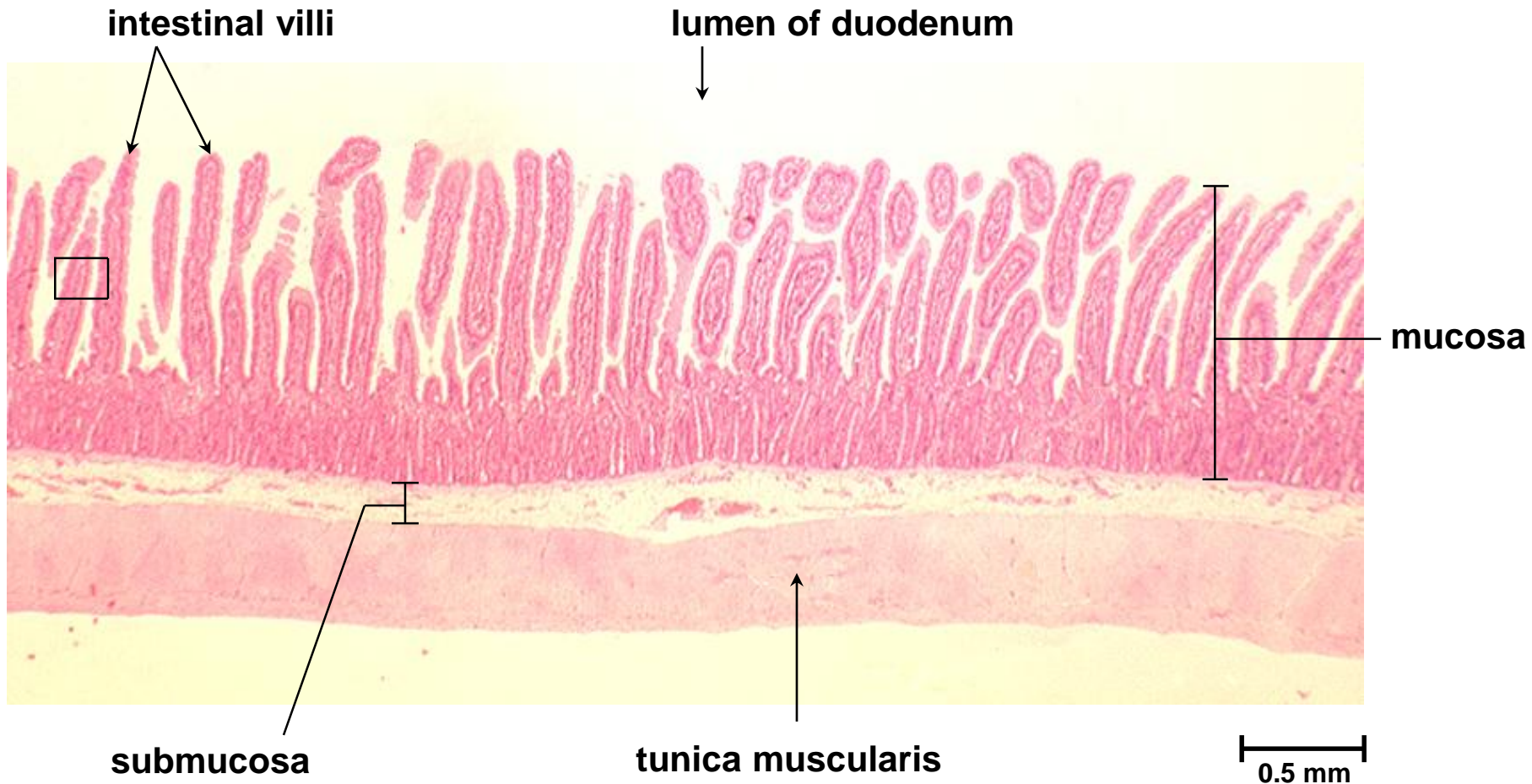
Spleen

Red pulp : consists mainly of blood filled pulp spaces within a reticular network giving the tissue its red appearance.



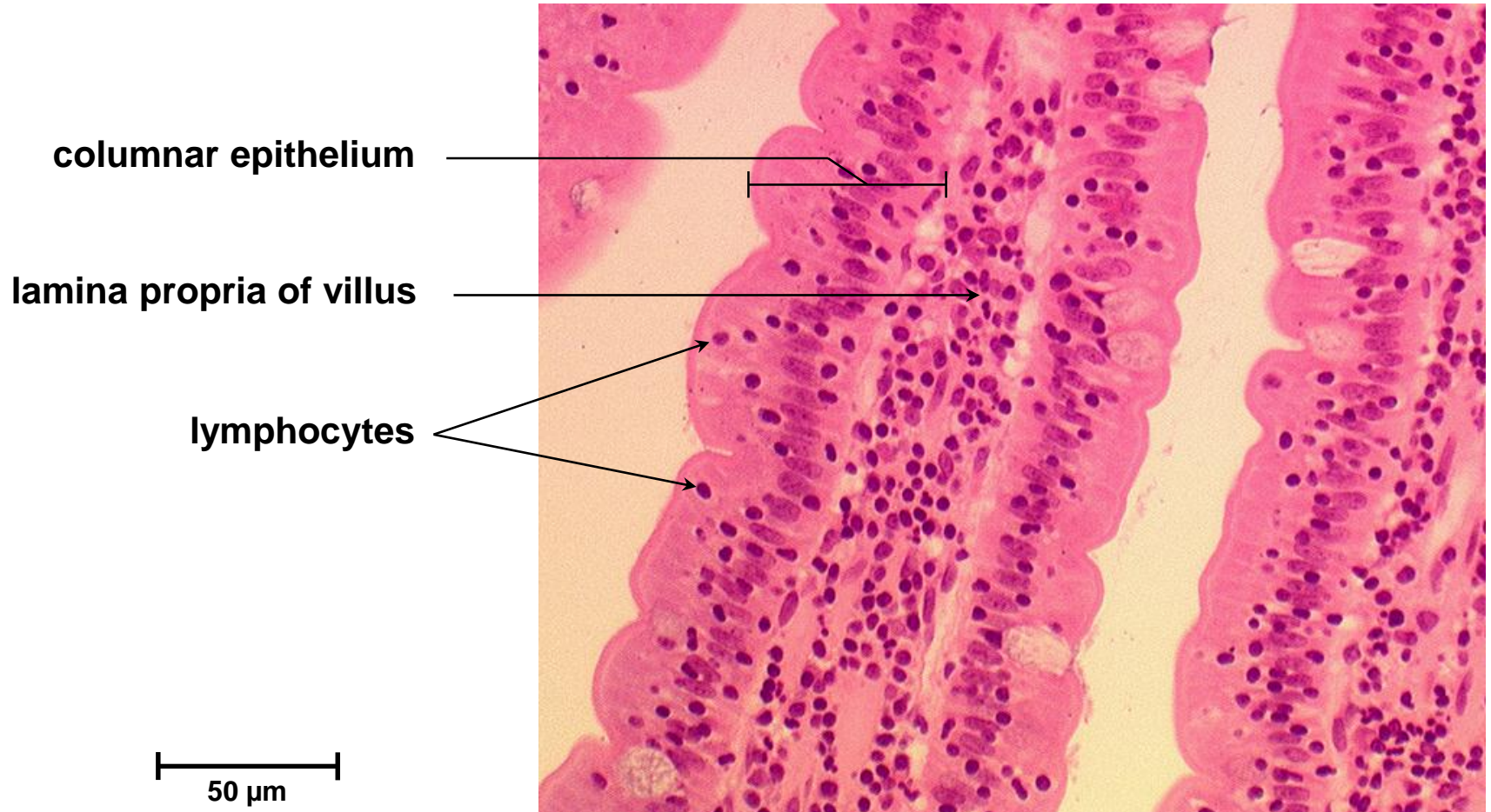
Duodenum

The lymphatic tissue here shows an unorganised accumulation of scattered lymphocytes in the mucosal layer of the intestinal wall.



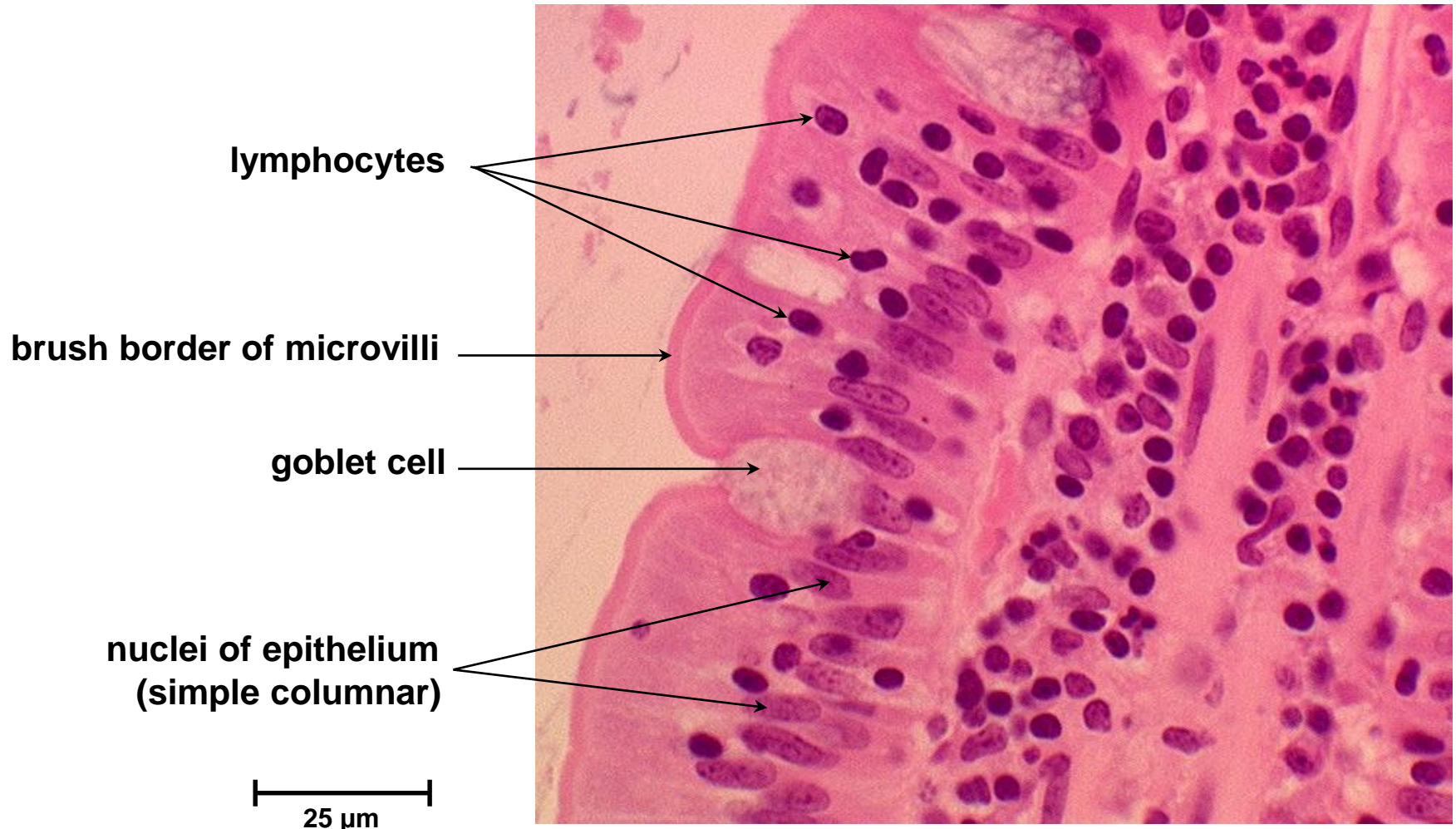
Duodenum

The lymphocytes here appear as dark staining small cells against the paler staining columnar epithelial cells lining the villi.



Duodenum

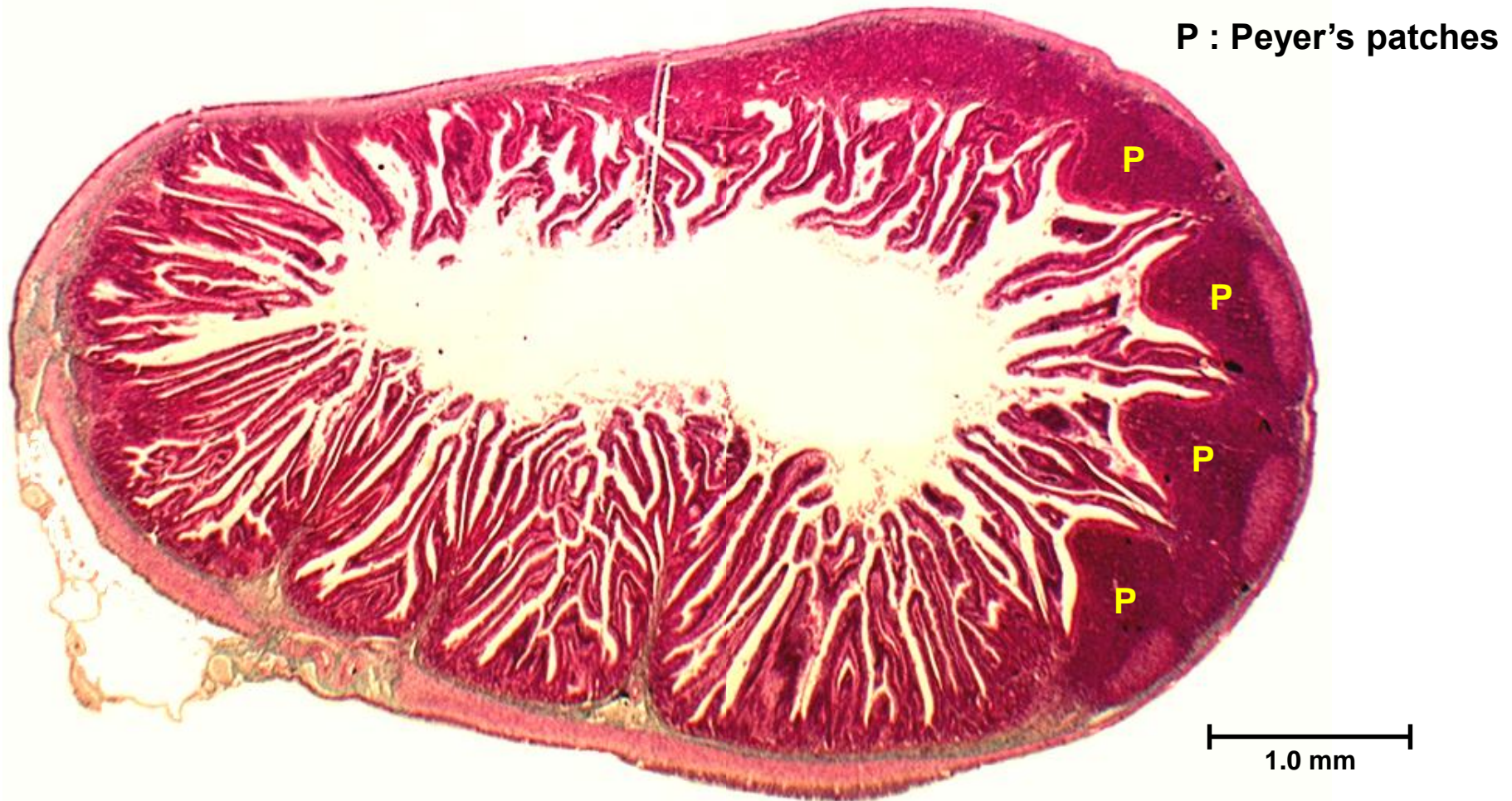
Note that the lymphocytes are smaller and darker than the elongated nuclei of columnar epithelial cells.



Peyer's patch

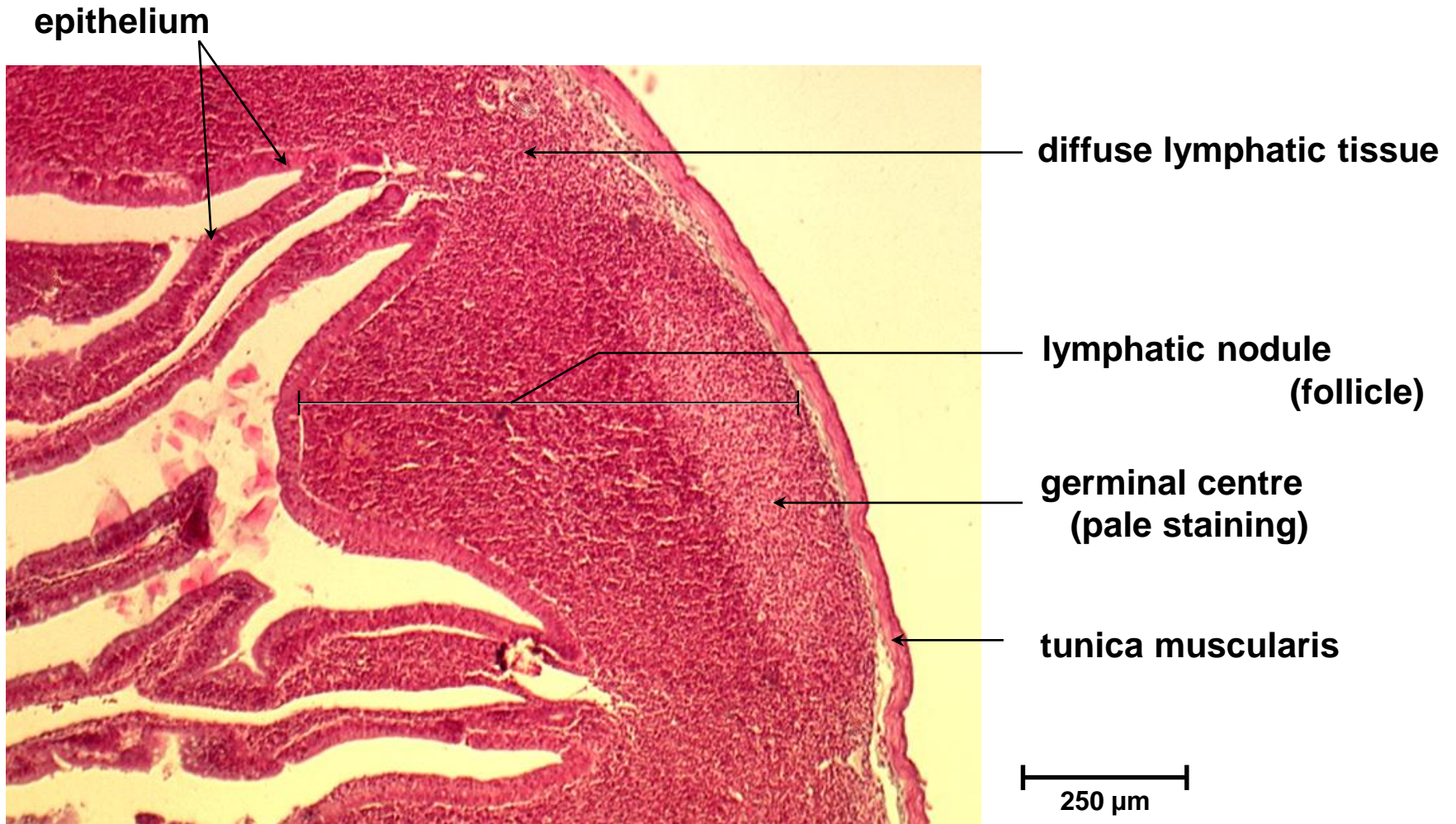
At very low magnification identify Peyer's patches represented by collections of lymphatic nodules present in **ONLY** a part of the wall of the intestine. If you view this slide in the laboratory you can see these without the microscope.

The remainder of the intestinal wall lacks these swellings.



Peyer's patch

View this area at higher magnification to confirm the presence of lymphatic nodules. Identify the structures of the Peyer's patch.

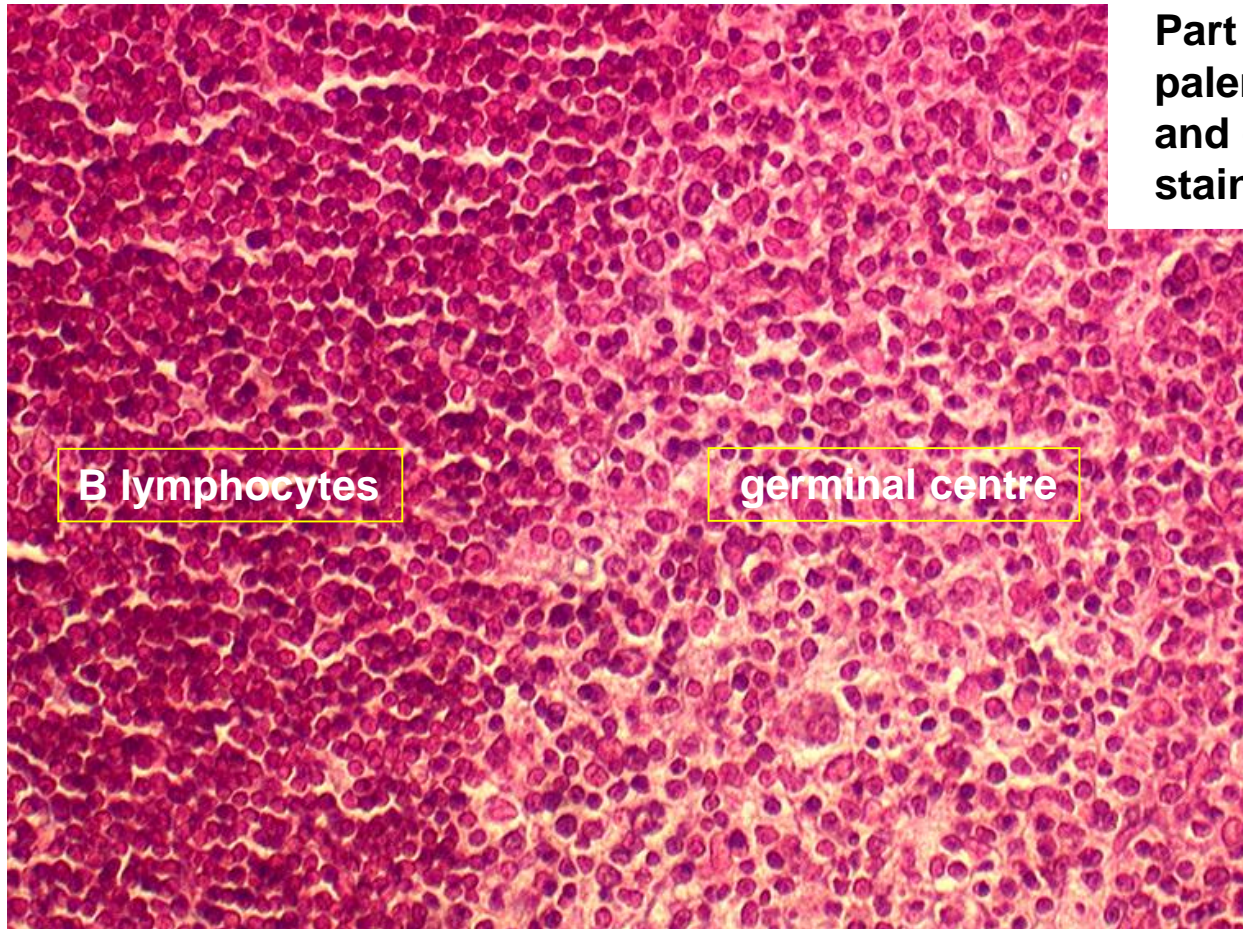


Peyer's patch

Where would you find the B and the T lymphocytes in Peyer's patches?

B cells are in the follicles.

T cells are scattered throughout the rest of the lymphoid tissue.

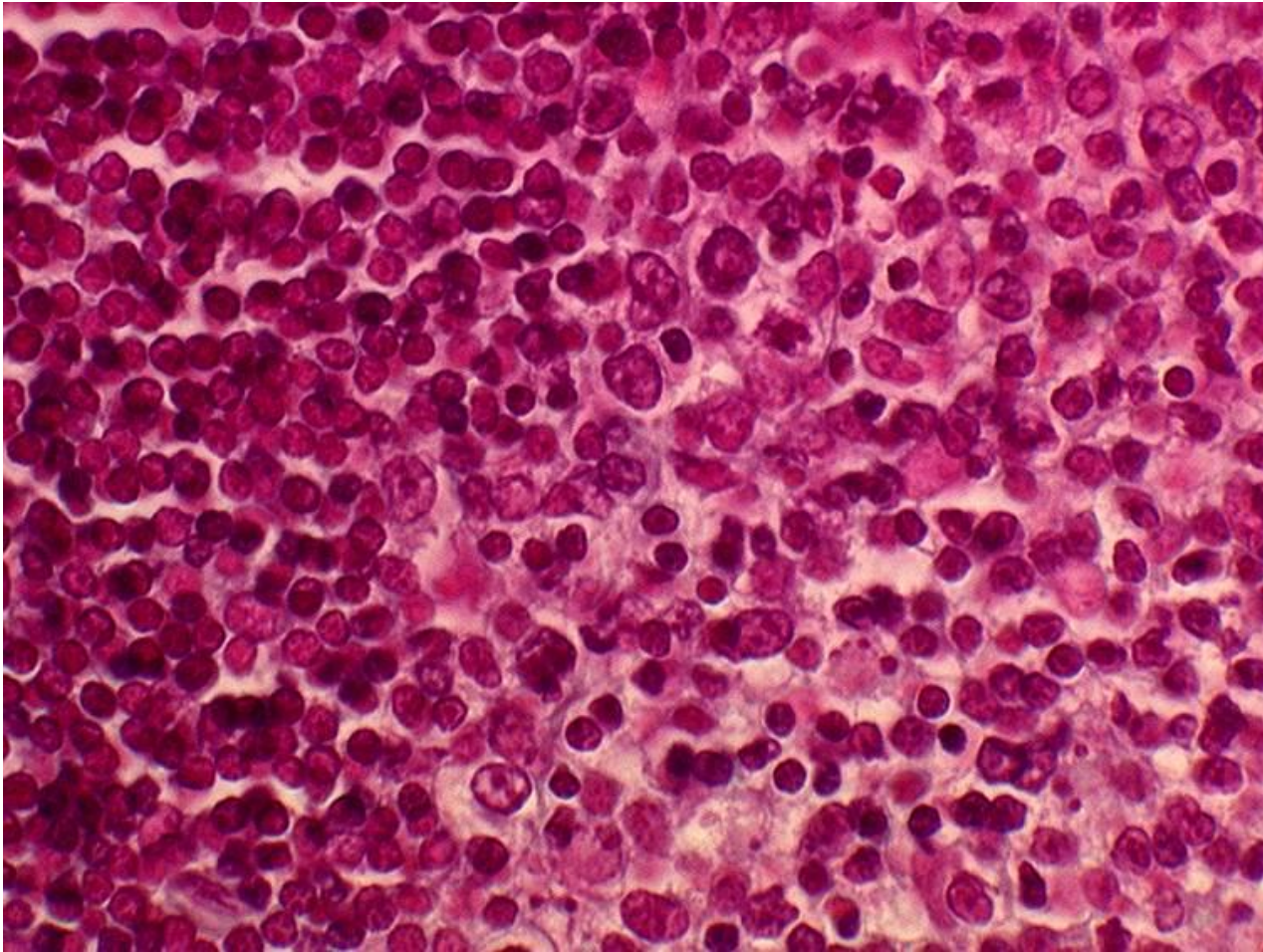


Part of lymphatic nodule with paler staining germinal centre and corona mostly of dark staining B lymphocytes.

50 μm

Peyer's patch

High magnification of part of lymphatic nodule of Peyer's patch.
Many small dark staining B lymphocytes can be seen.



25 μ m

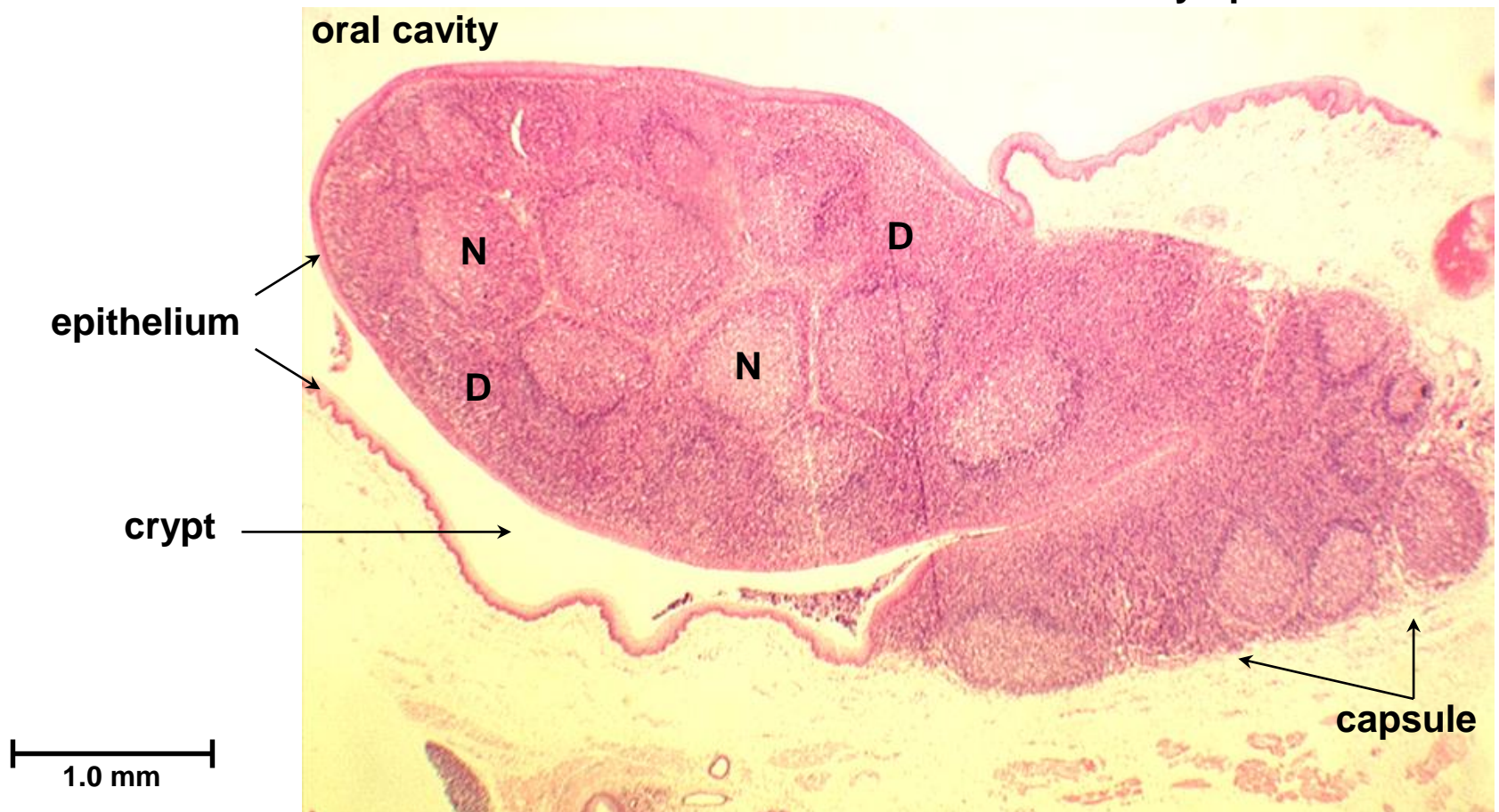
Pharyngeal tonsil

The tonsil is a partly encapsulated lymphoid tissue characterised by the presence of crypts.

Identify the main features of its structure.

N : nodular lymphatic tissue

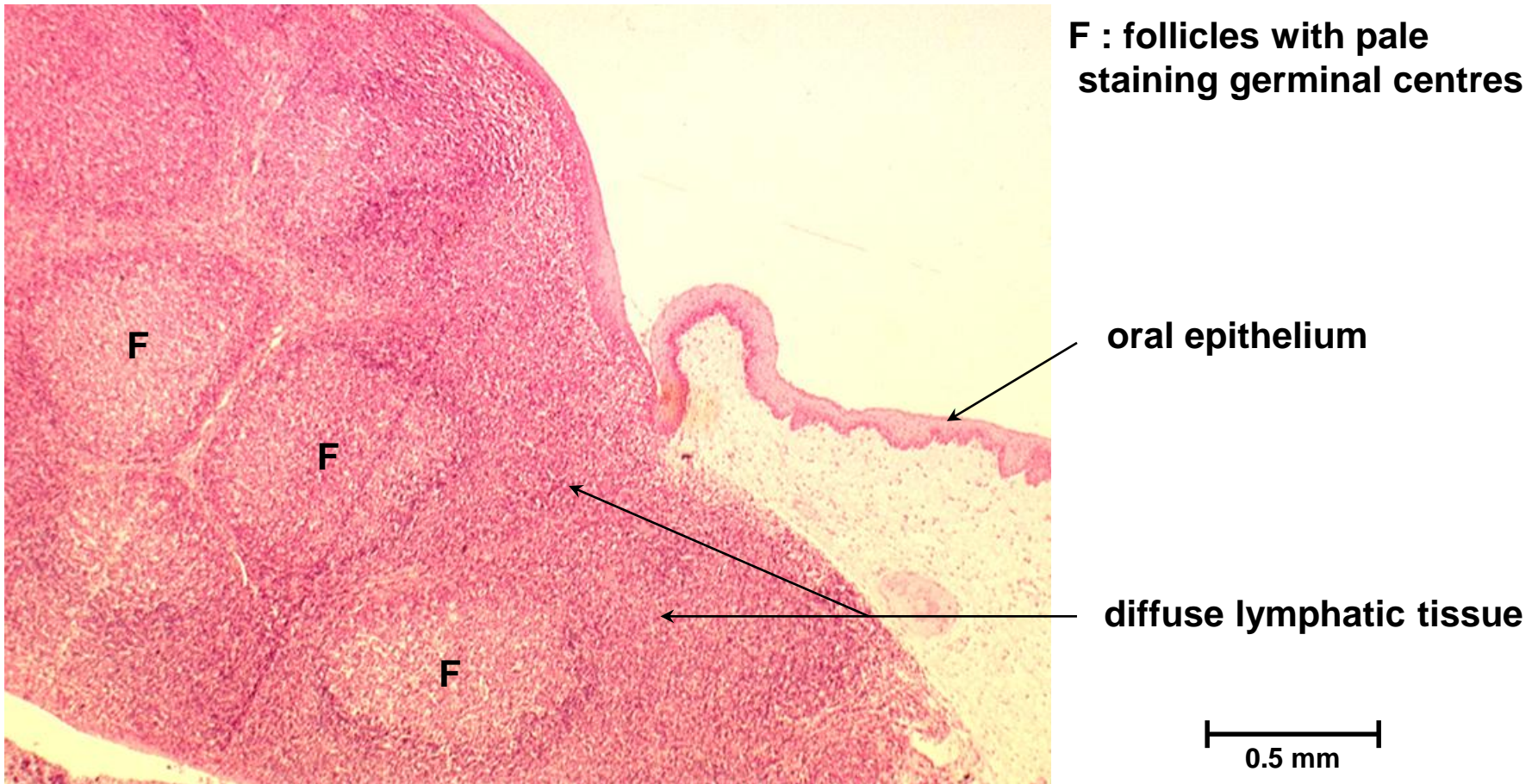
D : diffuse lymphatic tissue



Pharyngeal tonsil

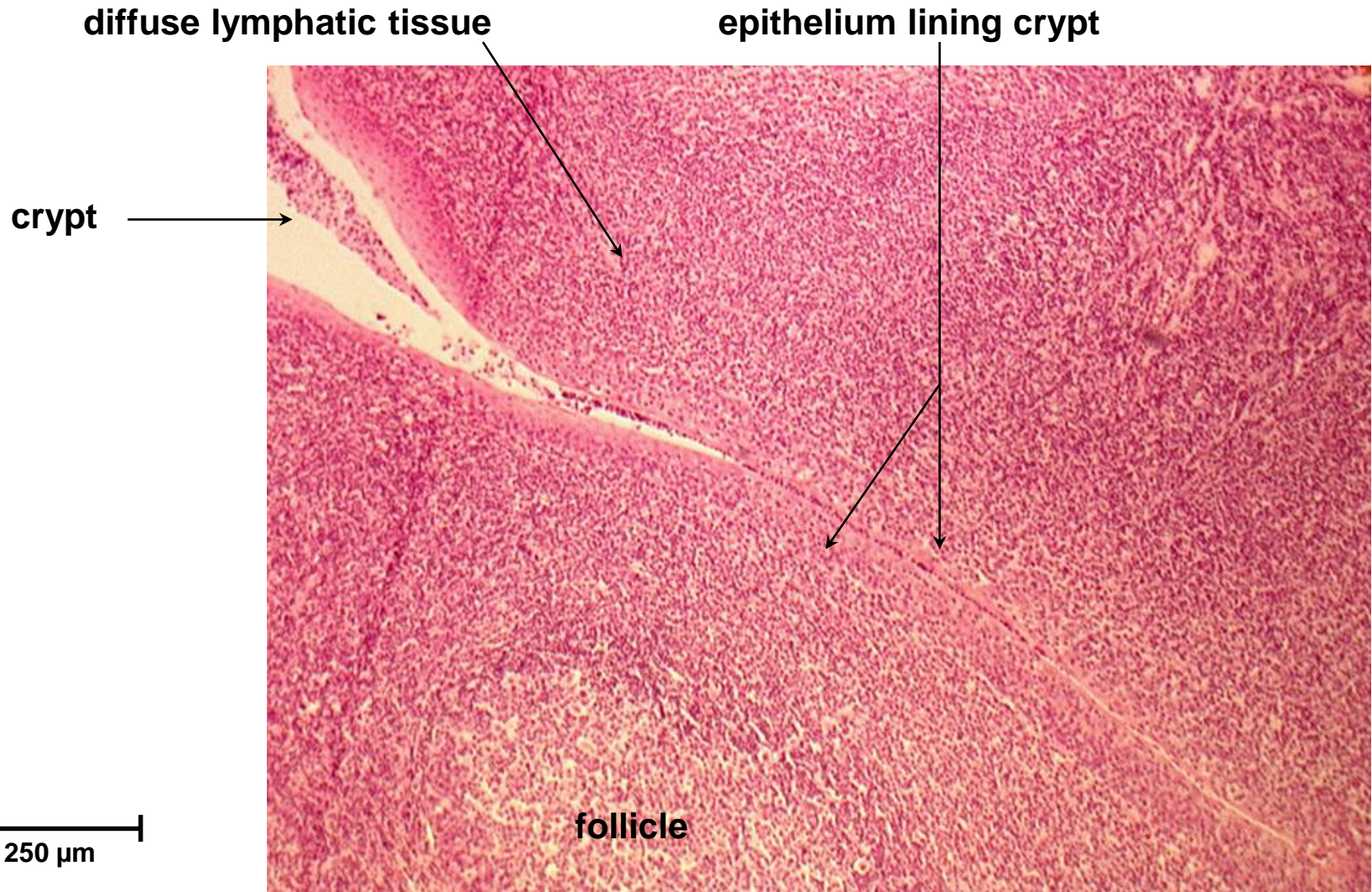
What does the presence of a large number of follicles with active germinal centres tell you?

This is commonly a site of immune reactivity stimulated by foreign organisms in the oropharynx.



Pharyngeal tonsil

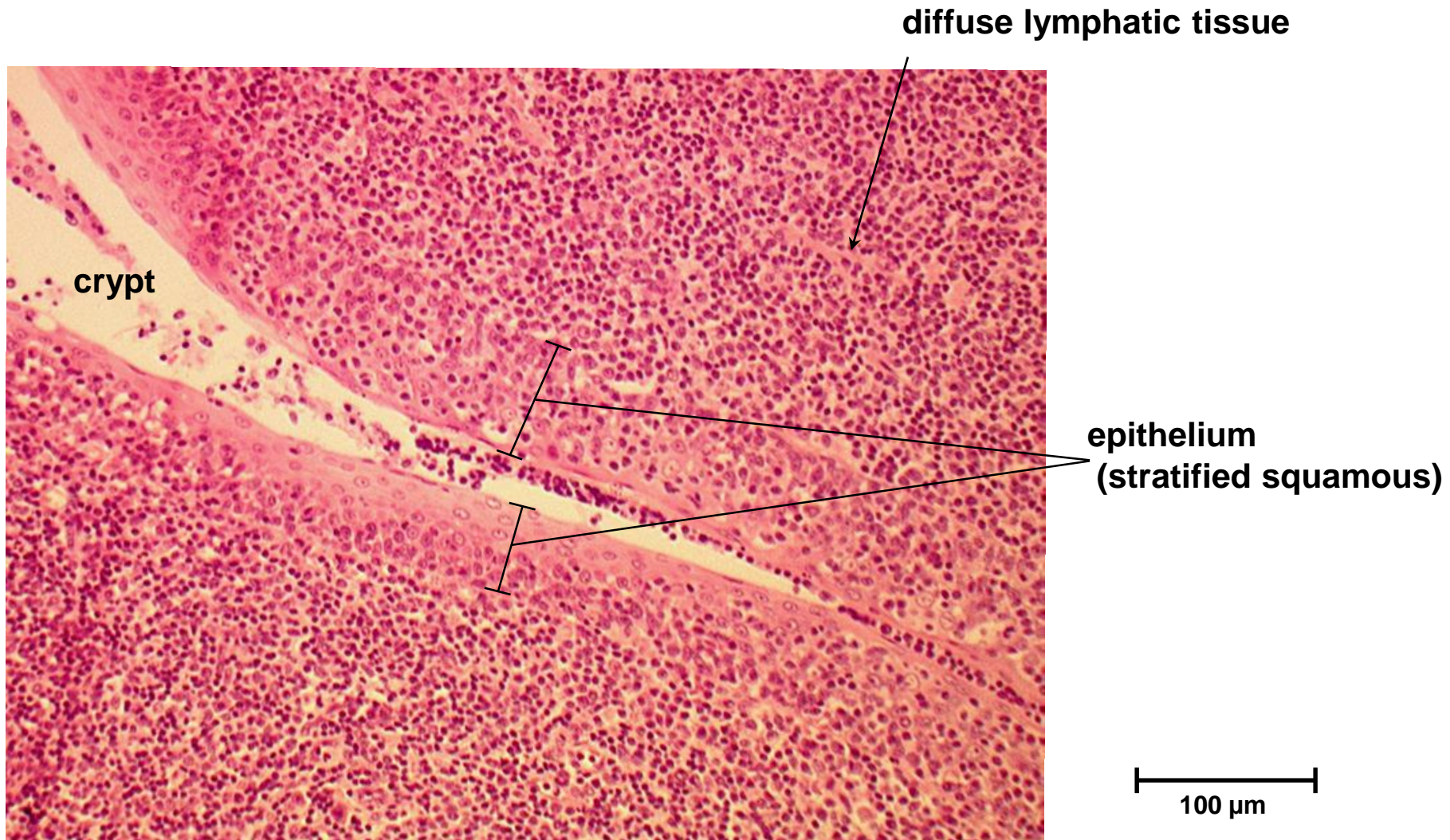
Characteristic crypt of tonsil.



Pharyngeal tonsil

What type of epithelium lines the pharyngeal tonsil?

Stratified squamous epithelium.

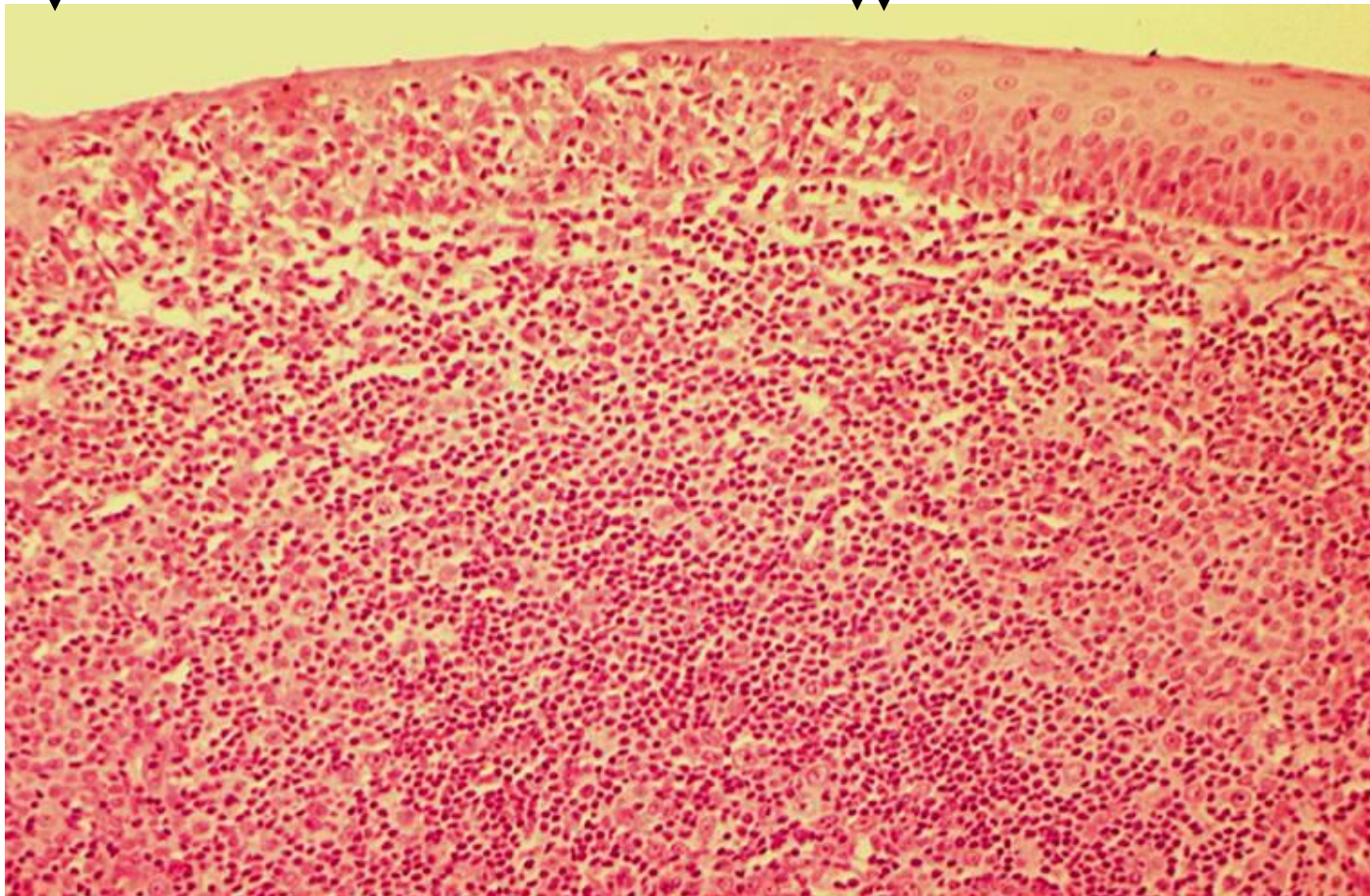


Pharyngeal tonsil

Why is the nature of the epithelium unclear in some places?

stratified squamous epithelium
layers unclear

stratified squamous epithelium
layers clear



100 μ m

Pharyngeal tonsil

Why is the nature of the epithelium unclear in some places?

Due to infiltration of the epithelium by lymphocytes.

