Lymph nodes
Structure and functions

Lymph nodes

Sites

superficial
deep

Mucosal associated lymphoid structures

G.I.: tract (Waldeyer's ring, Peyer patches, Ileum, Appendix)
Respiratory tract: MALT

Roles:

- ***Humoral/cellular response to antigens to get rid of them***

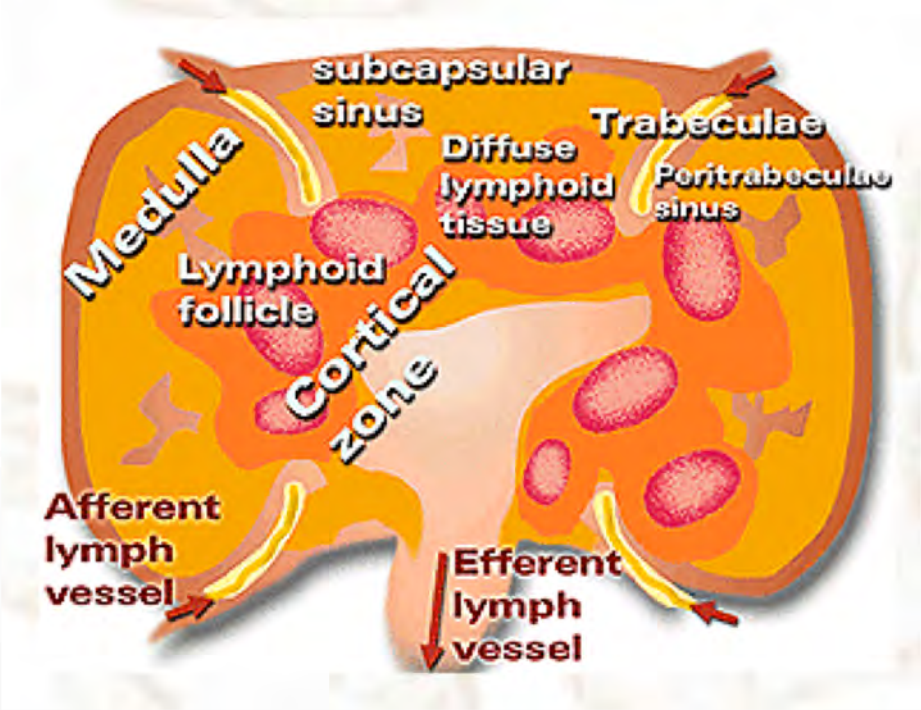
Cell populations:

-***Lymphocytes (B – T)***
-***Macrophages***
-***Dendritic cells, interdigitating cells (APC)***
-***Plump endothelial cells***

HISTOLOGICAL STRUCTURE

Functional compartments:

- **Cortical**
- **Paracortical**
- **Medulla**
- **Sines: subcapsular (marginal), medullary**



LYMPHNODE COMPARTMENTS

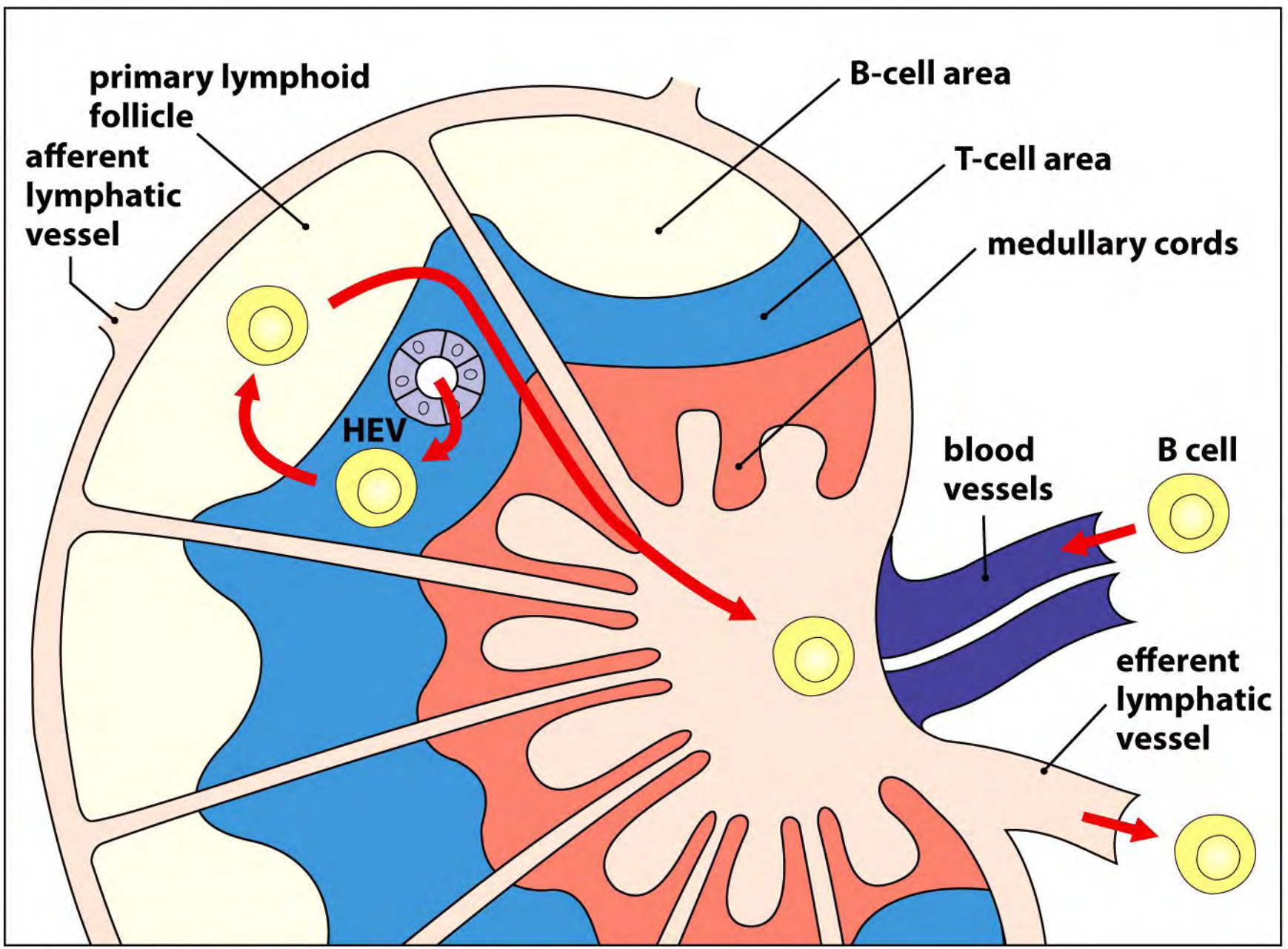
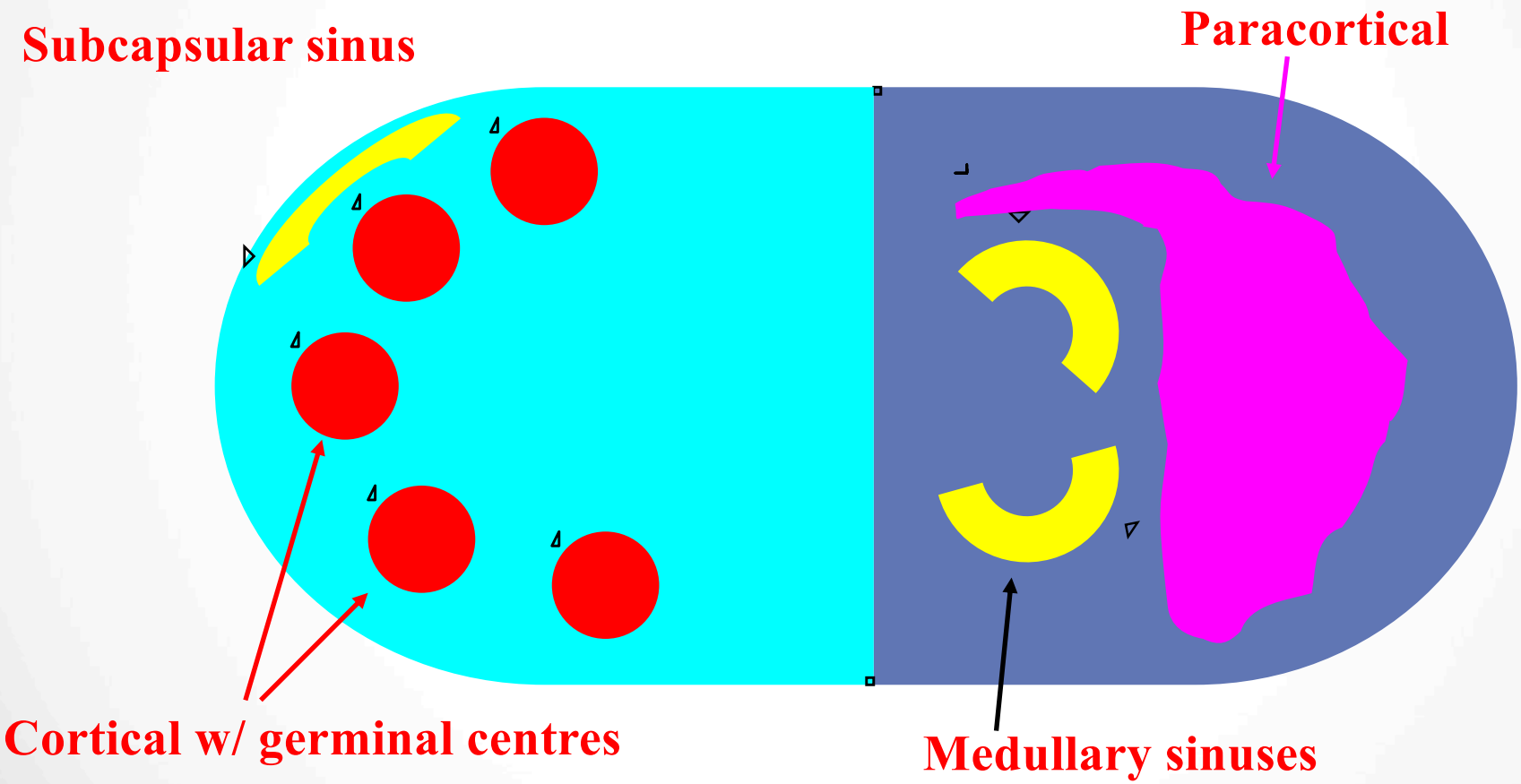


Figure 6.20 The Immune System, 3ed. (© Garland Science 2009)

LYMPHNODE COMPARTMENTS



CORTICAL

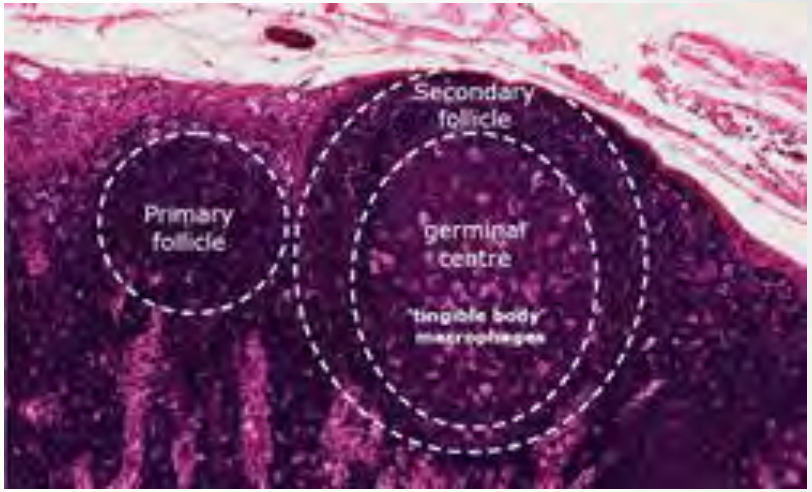
Lymphoid follicles

-Primary

Monotonous

No central clear zone

Mature, small B-lymphocytes

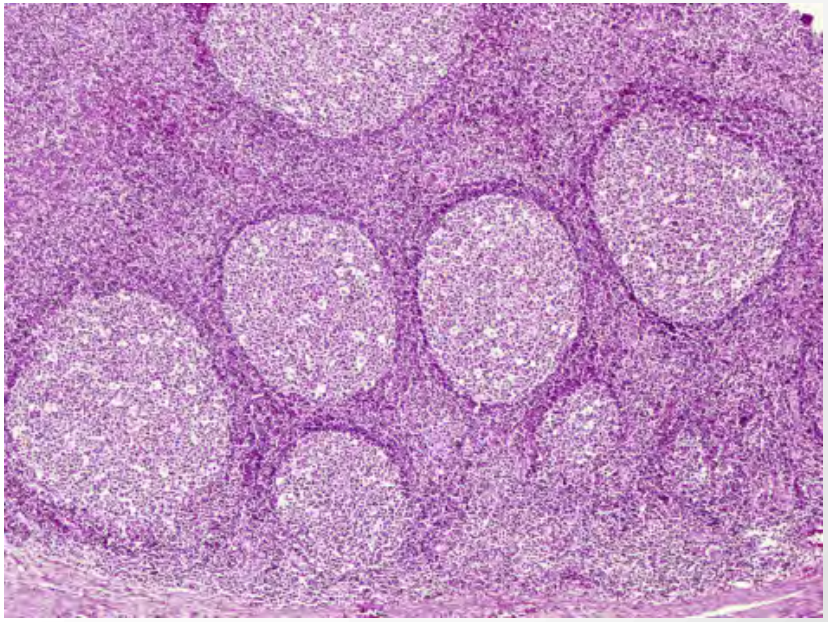


-Secondary

Germinal centre

Mantle zone

Marginal zone



Germinal centres

- ***Centroblastis***
- ***Centrocytes***
- ***Immunoblasts***
- ***Dendritic follicular cells***
- ***Macrophages w/ tingible bodies***

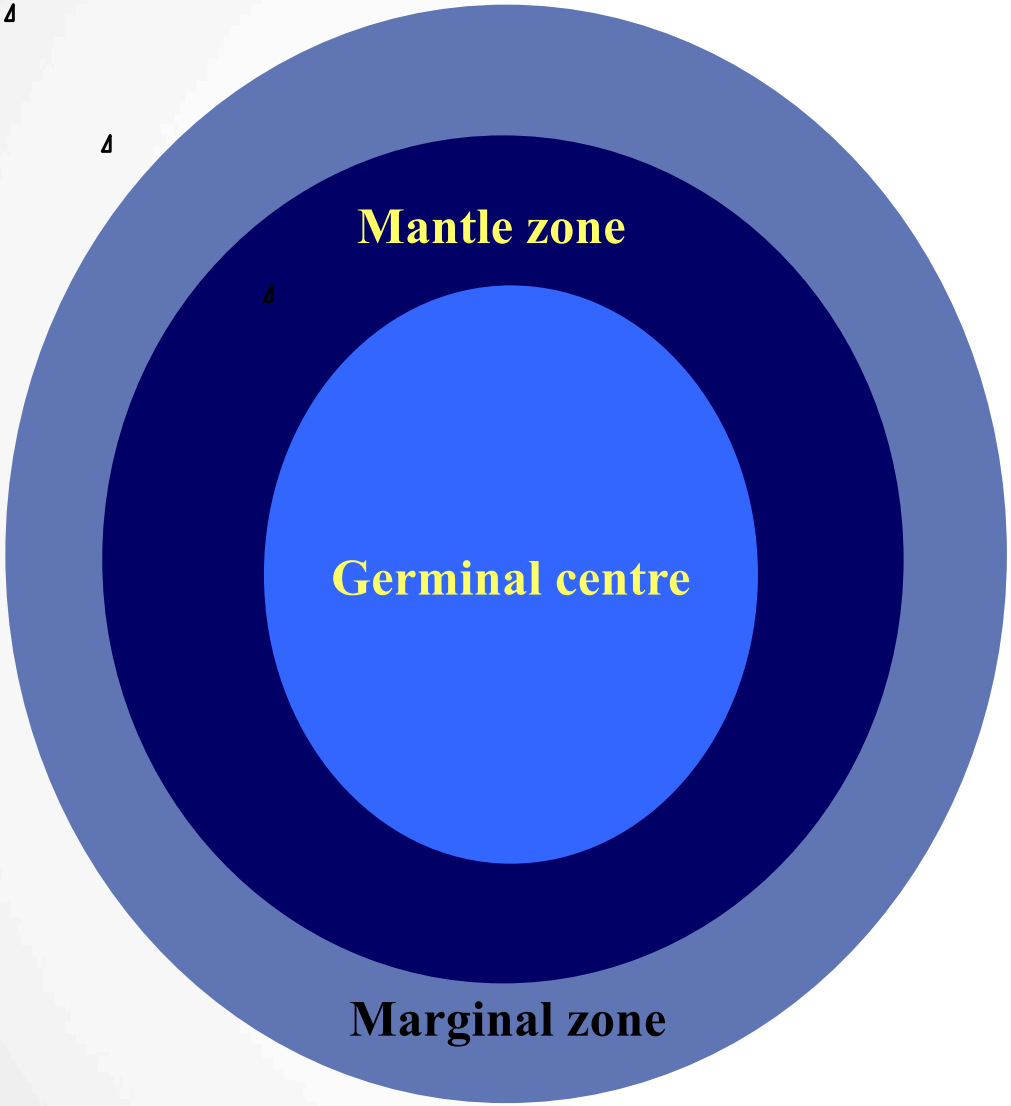
Mantle zone

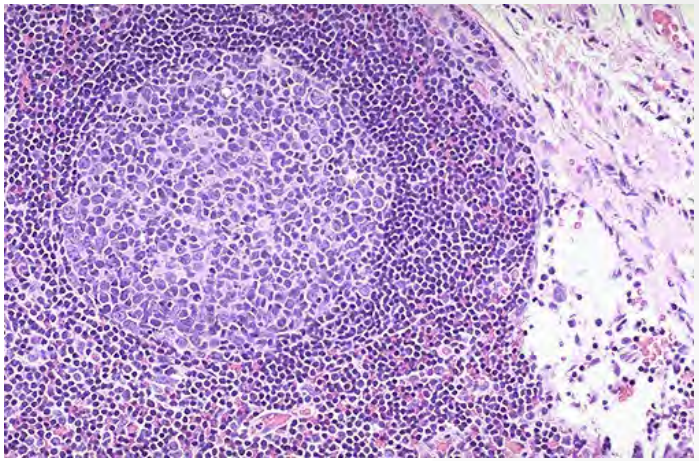
- ***Small lymphocytes with dense nuclei and scarce cytoplasm***

Marginal zone

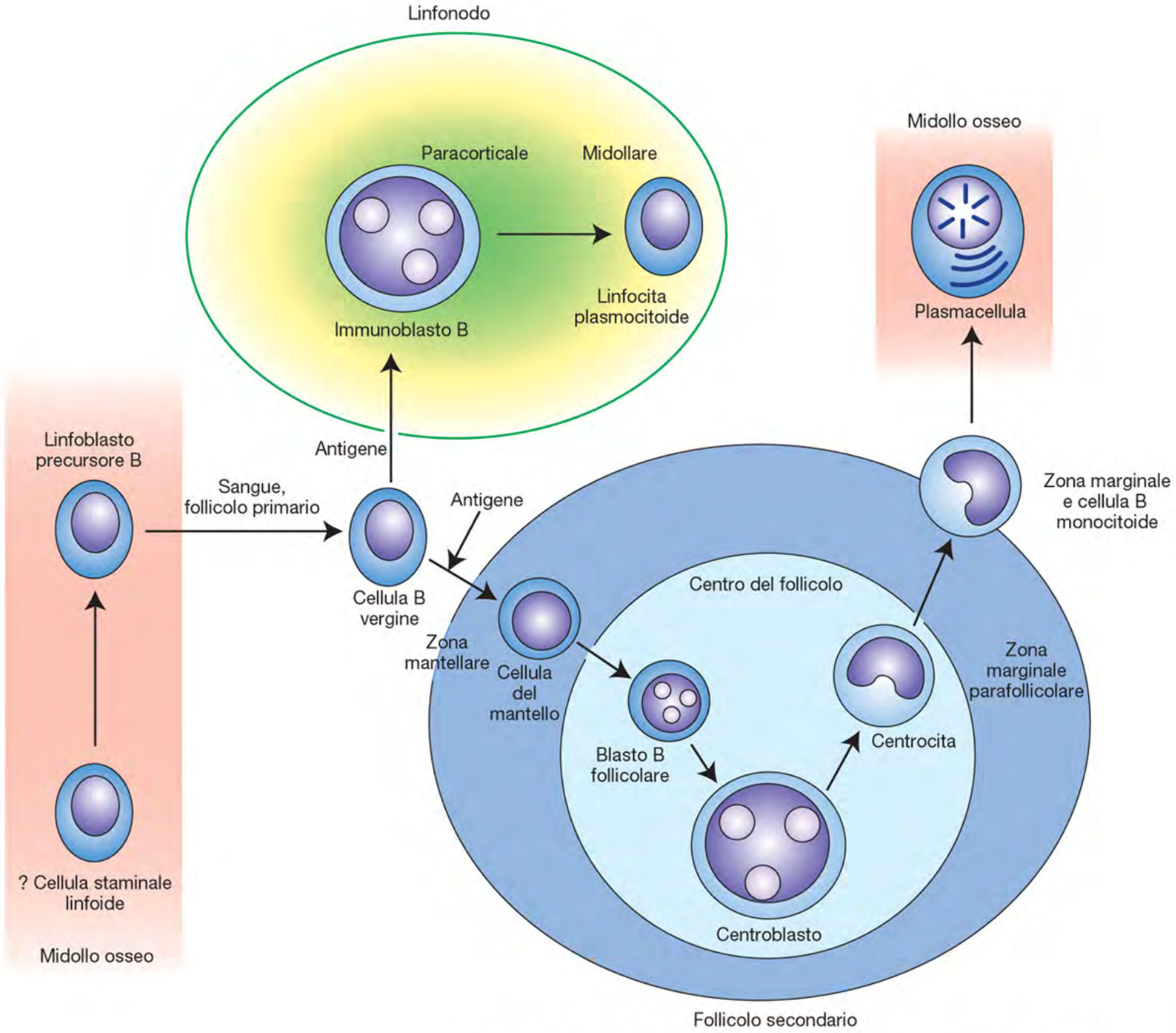
- ***Thin, circumscribing the mantle zone***

CORTICAL


Mantle zone
Germinal centre
Marginal zone




Germinal center
Marginal zone



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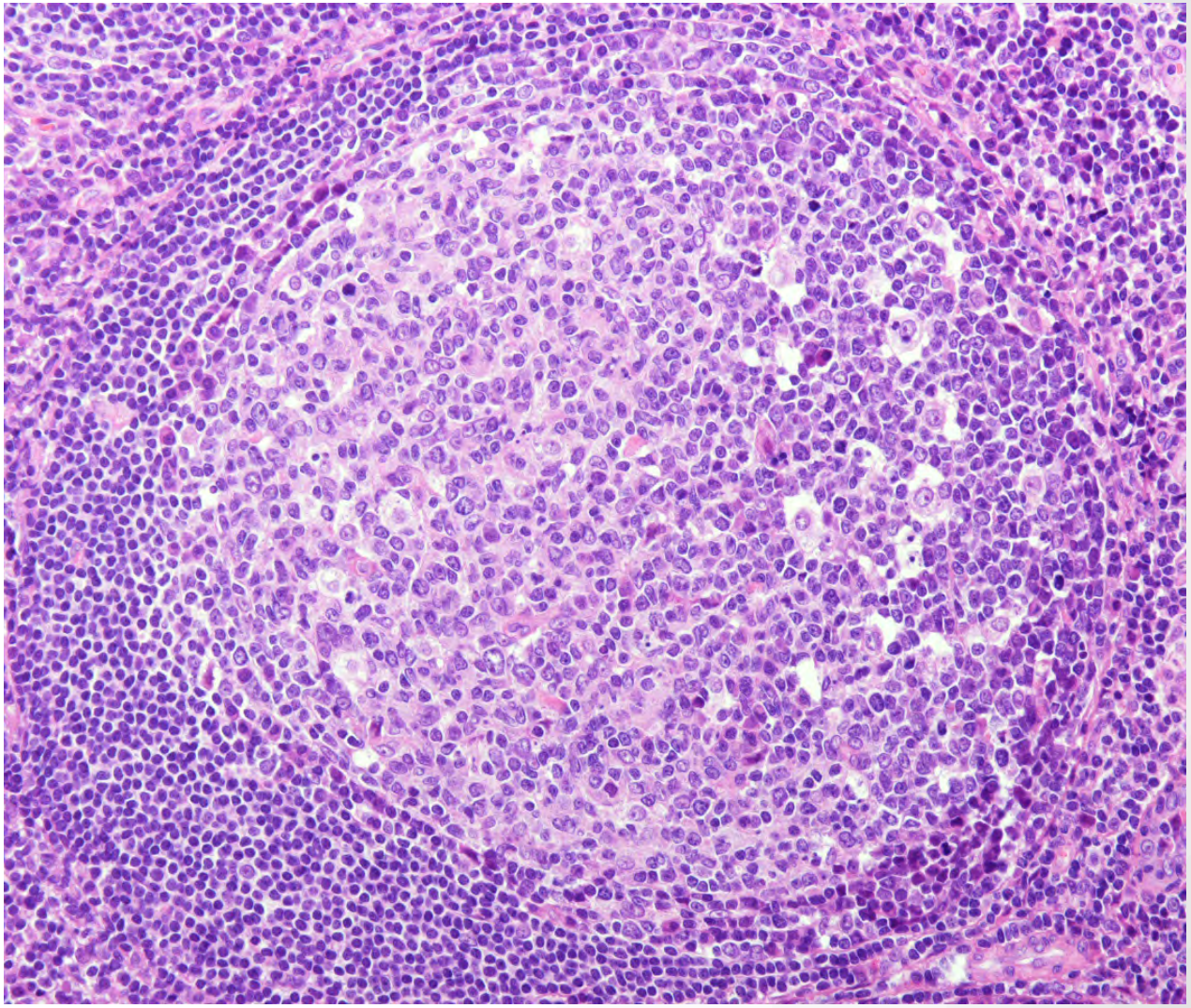
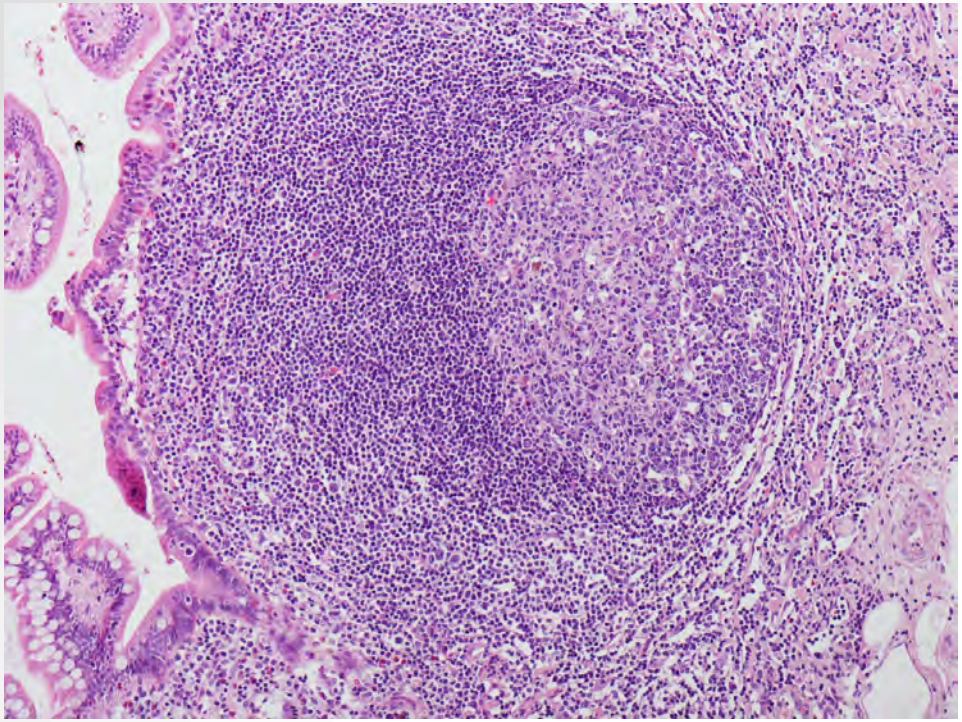
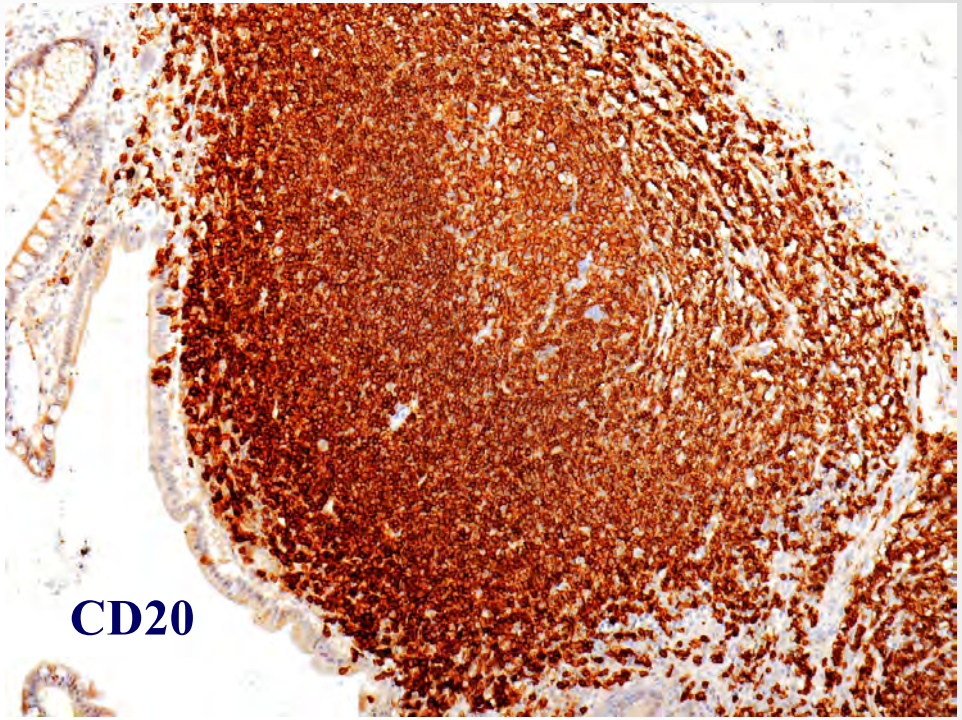
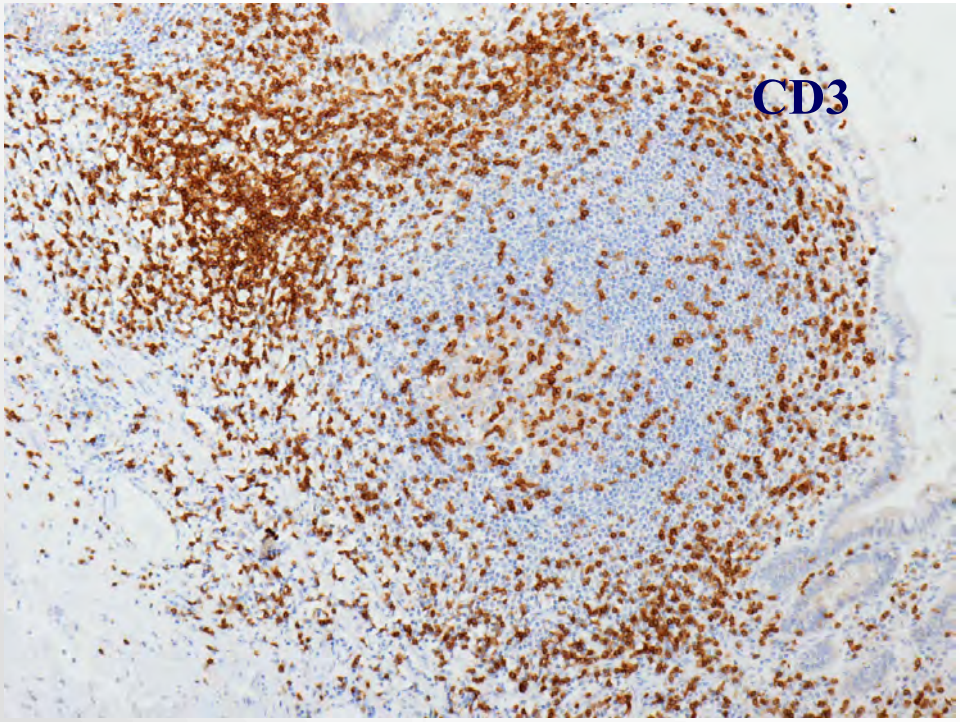
Germinal centre

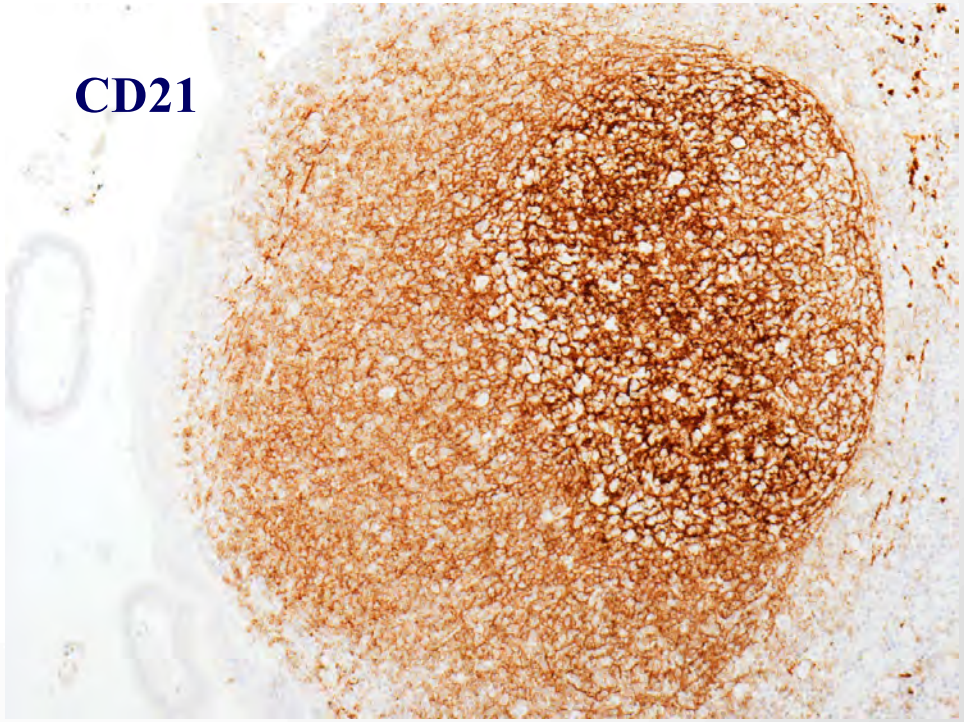
- Centroblasts
- Centrocytes
- Dendritic follicular cells
- Macrophages
- Follicular T-helper cells

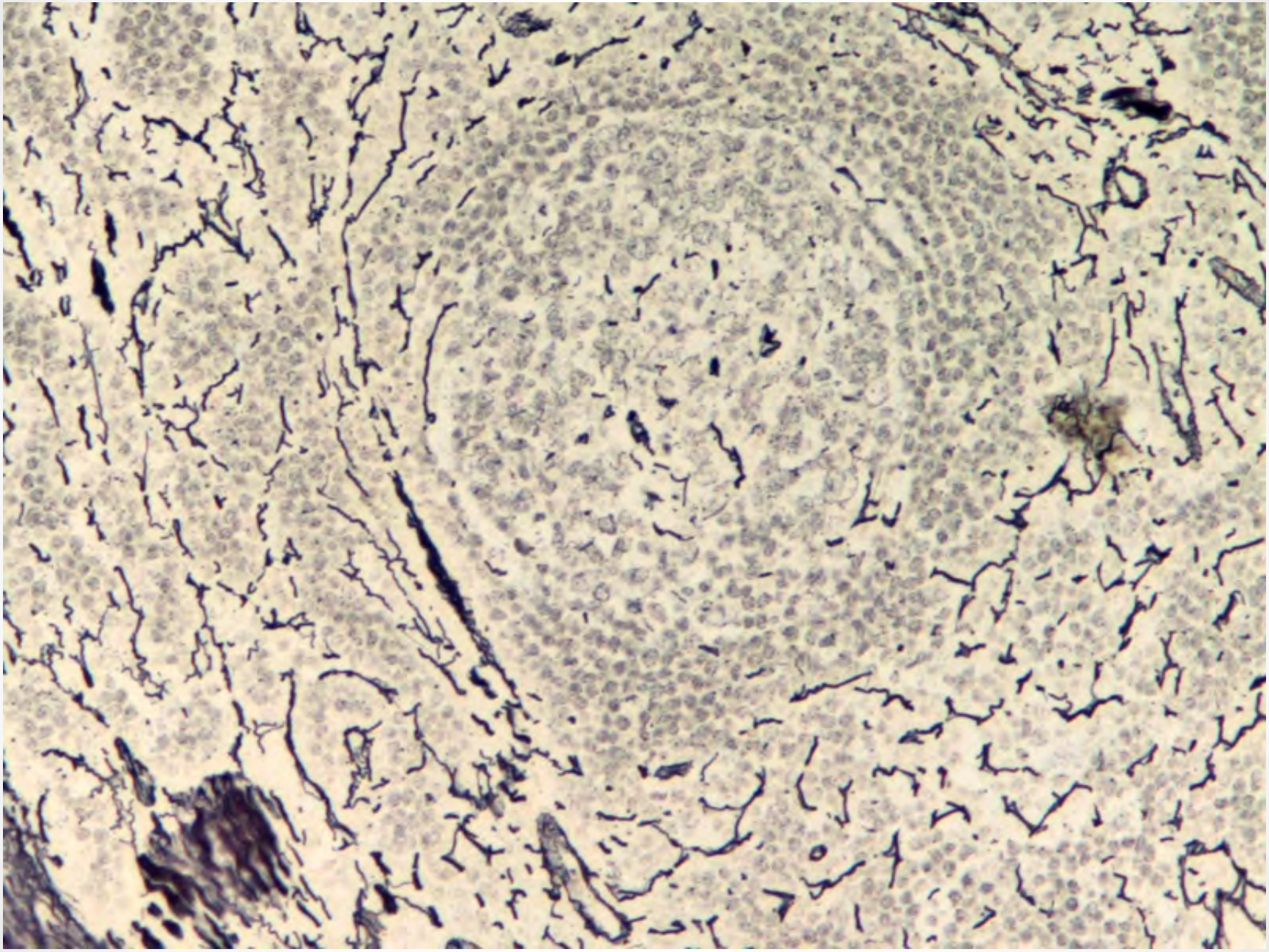


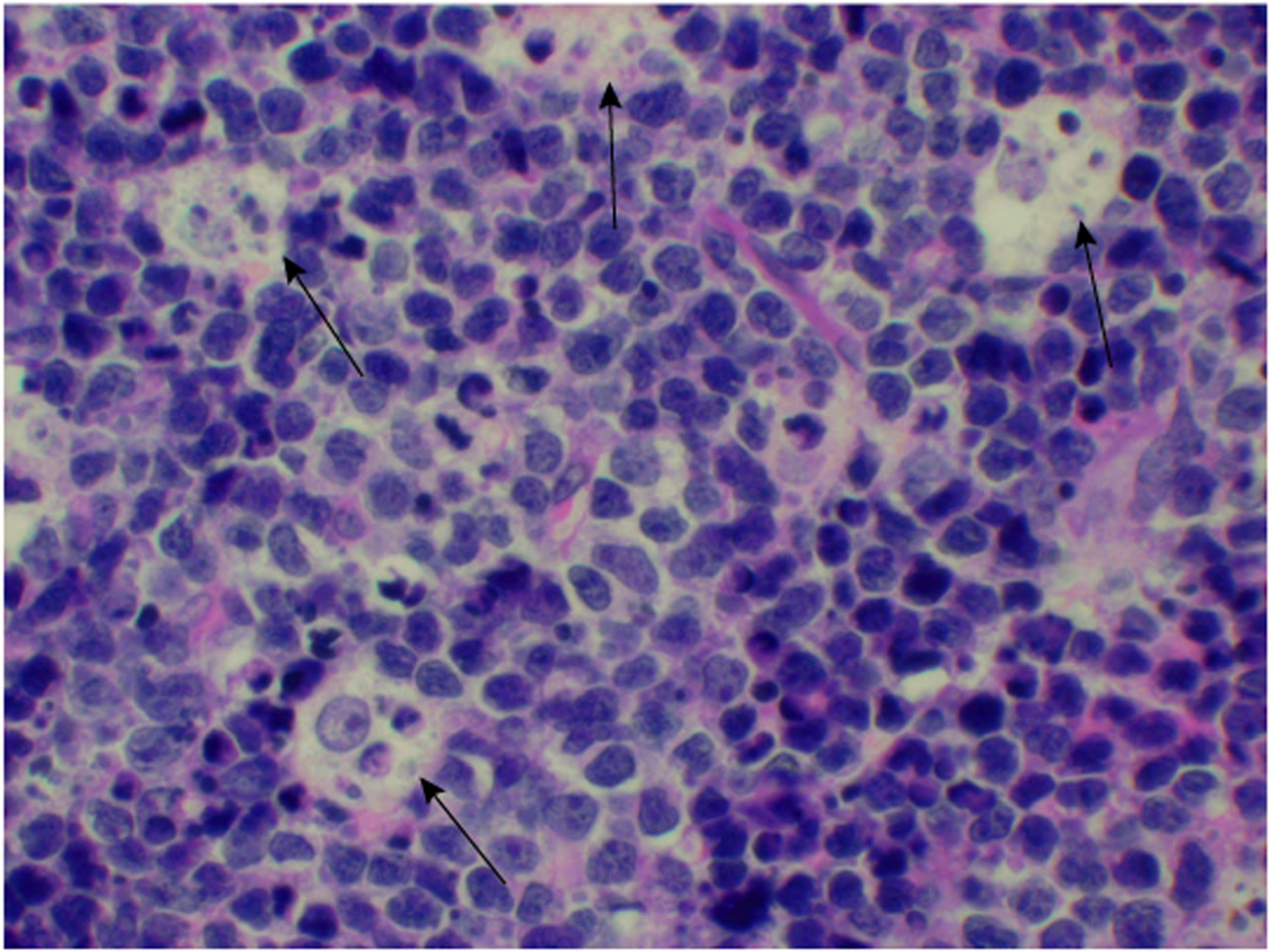


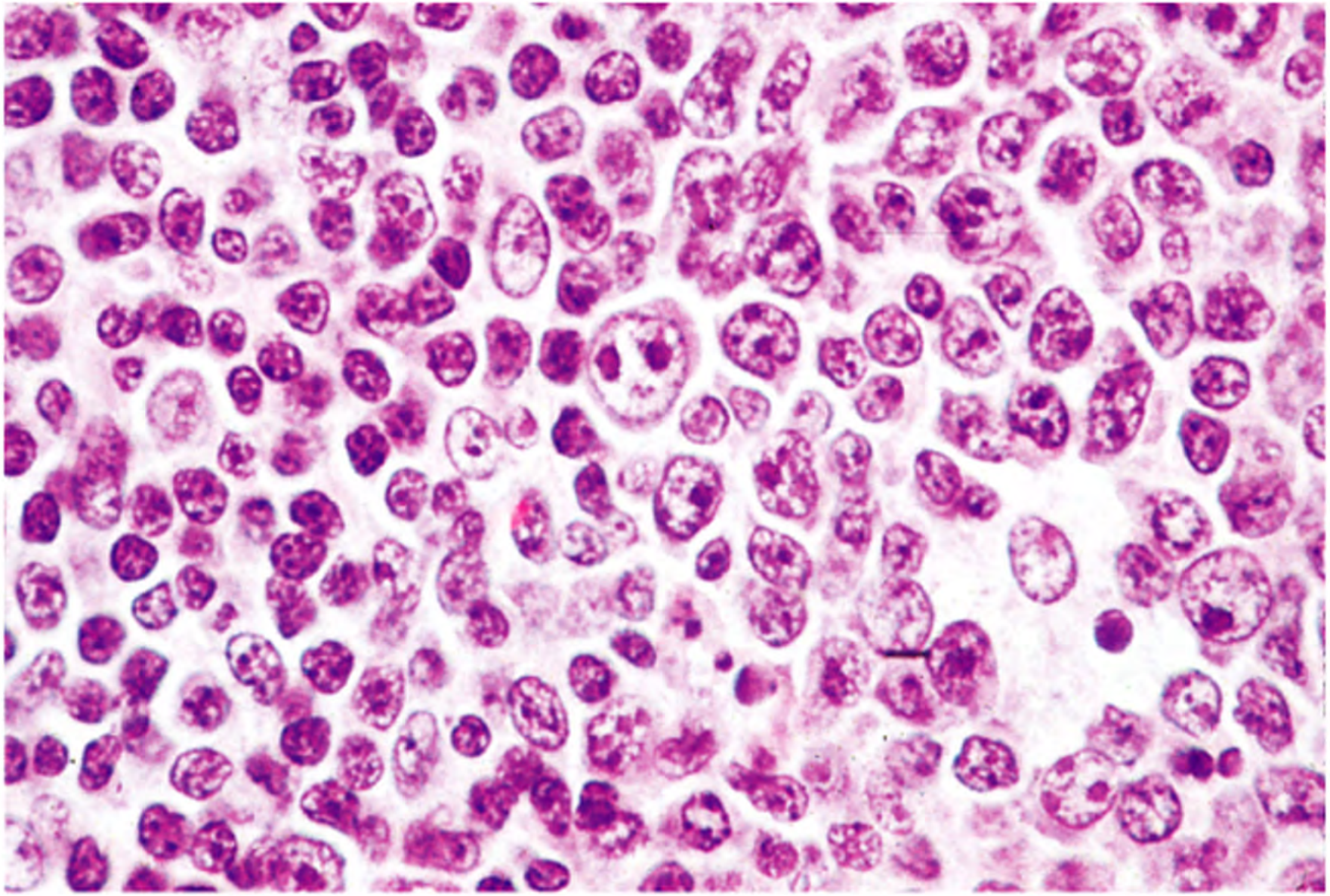

CD20


CD3


CD21







PARACORTEX

Mature T-lymphocytes (CD3 / CD4 +)

Dendritic follicular cells

Wide cells with clear cytoplasm, large nuclei with delicate chromatin and intedigitating cytoplasmic processes. Act as "Antigen-presenting cells"

Venules with plump endothelial cells

- **Crossing ways of lymphocytes from and to peripheral blood**
- **Regulate re-circulation, distribution and *homing* of lymphocytes in lymphoid organs**
- **Regulate *migration* through adhesion molecules**
- **Become hyperplastic during chronic stimulation**

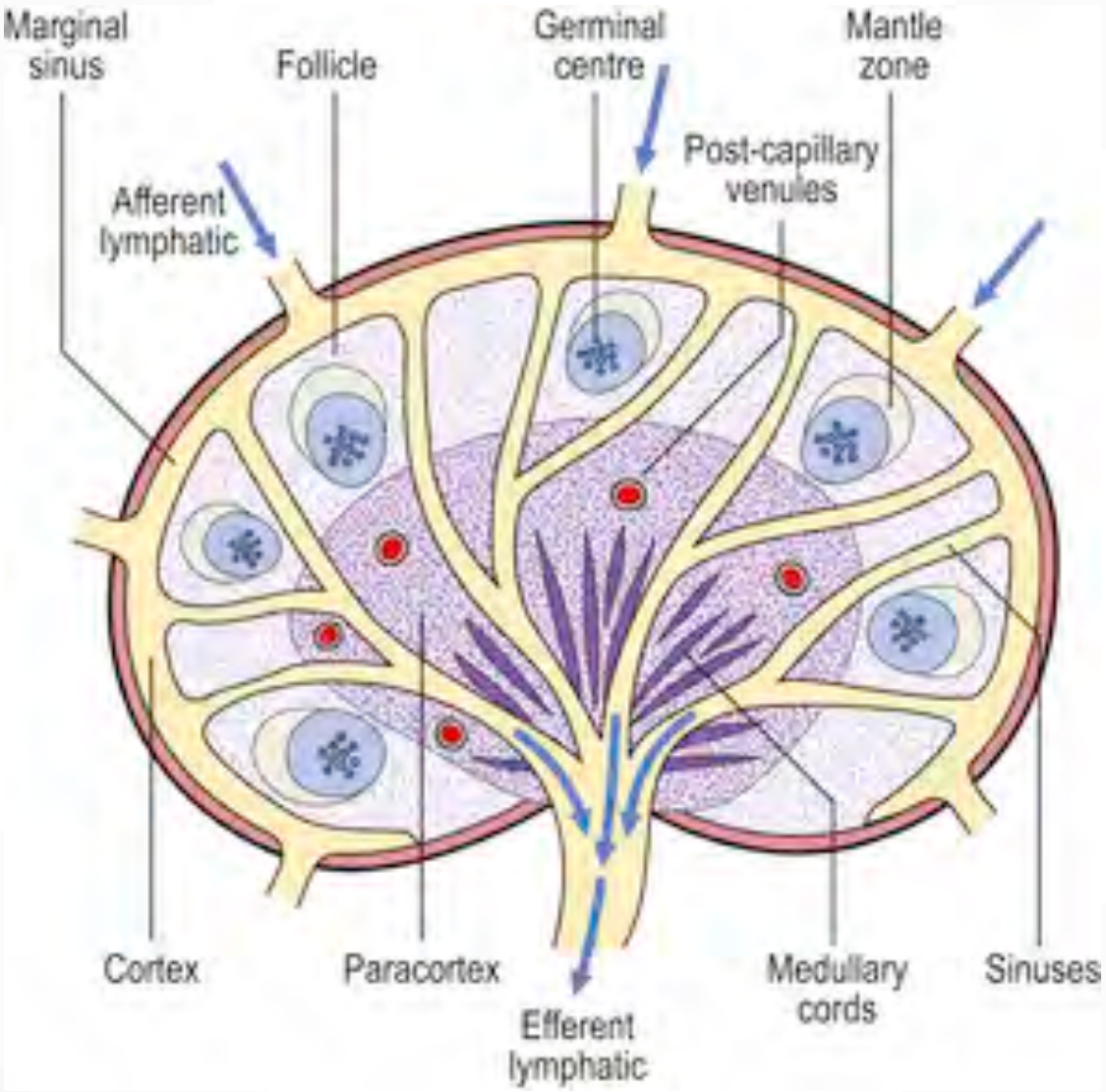
MEDULLA

- *Small B & T Lymphocytes*
- *Rare immunoblasts*
- *Plasmablasts*
- *Plasmacytoid lymphocytes with cartwheel chromatin*
- *Mature plasma cells (Russel bodies)*
- *Macrophages*

Antibodies produced by plasma cells are conveyed into efferent vessels

Intra-nodal lymph circulation

- Afferent lymph vessels
- Marginal sinus
- Intermediate sinuses
- Medullary sinuses
- Efferent lymph vessels


Marginal sinus
Follicle
Germinal centre
Mantle zone
Post-capillary venules
Afferent lymphatic
Cortex
Paracortex
Efferent lymphatic
Medullary cords
Sinuses

Sinus circulation

Lymph from draining basins

↓

Marginal sinus (w/ endothelial cells)

Antigens
- free
- antigen/antibody complexes
- exposed on immature dendritic cells

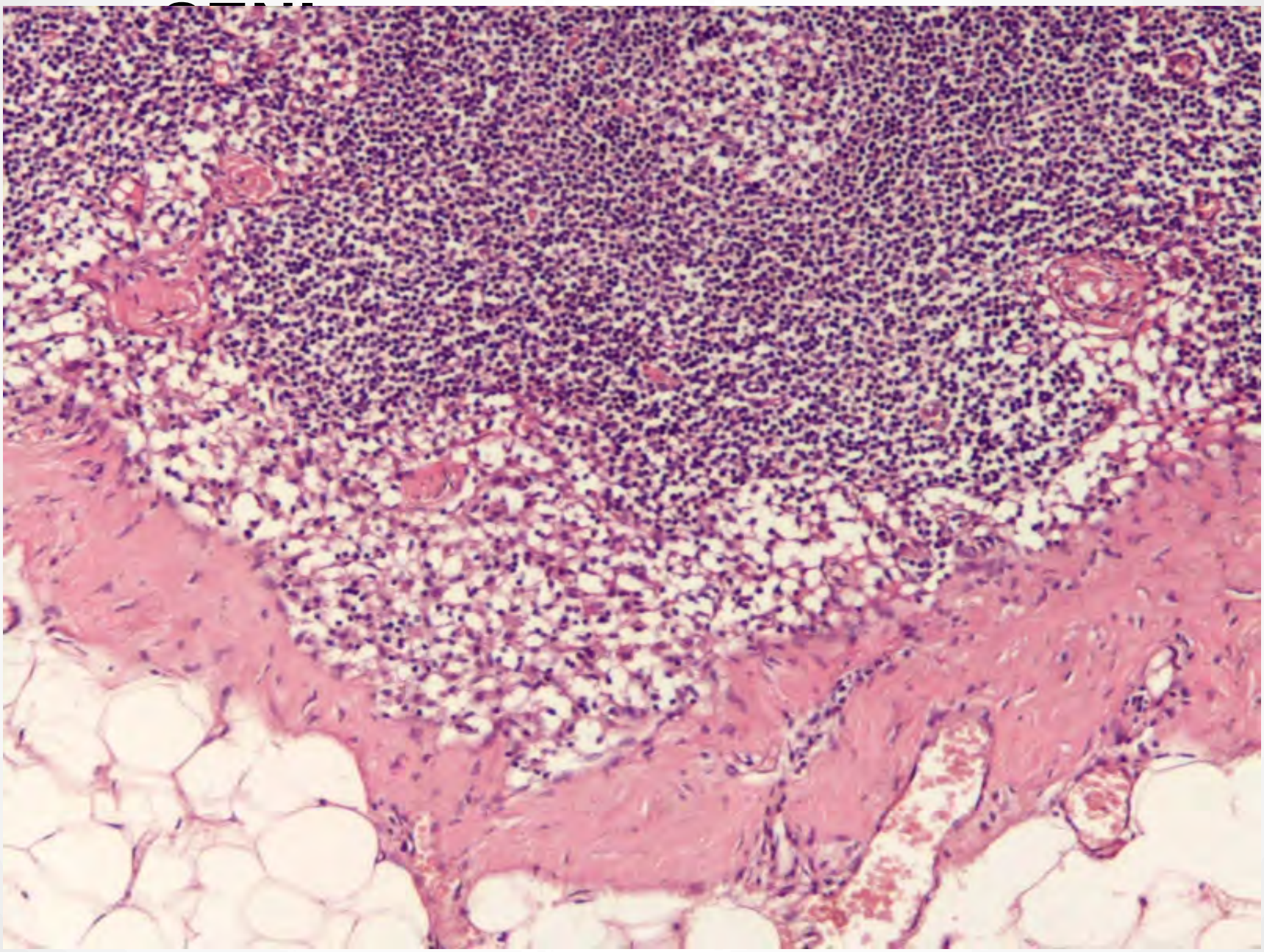
↓

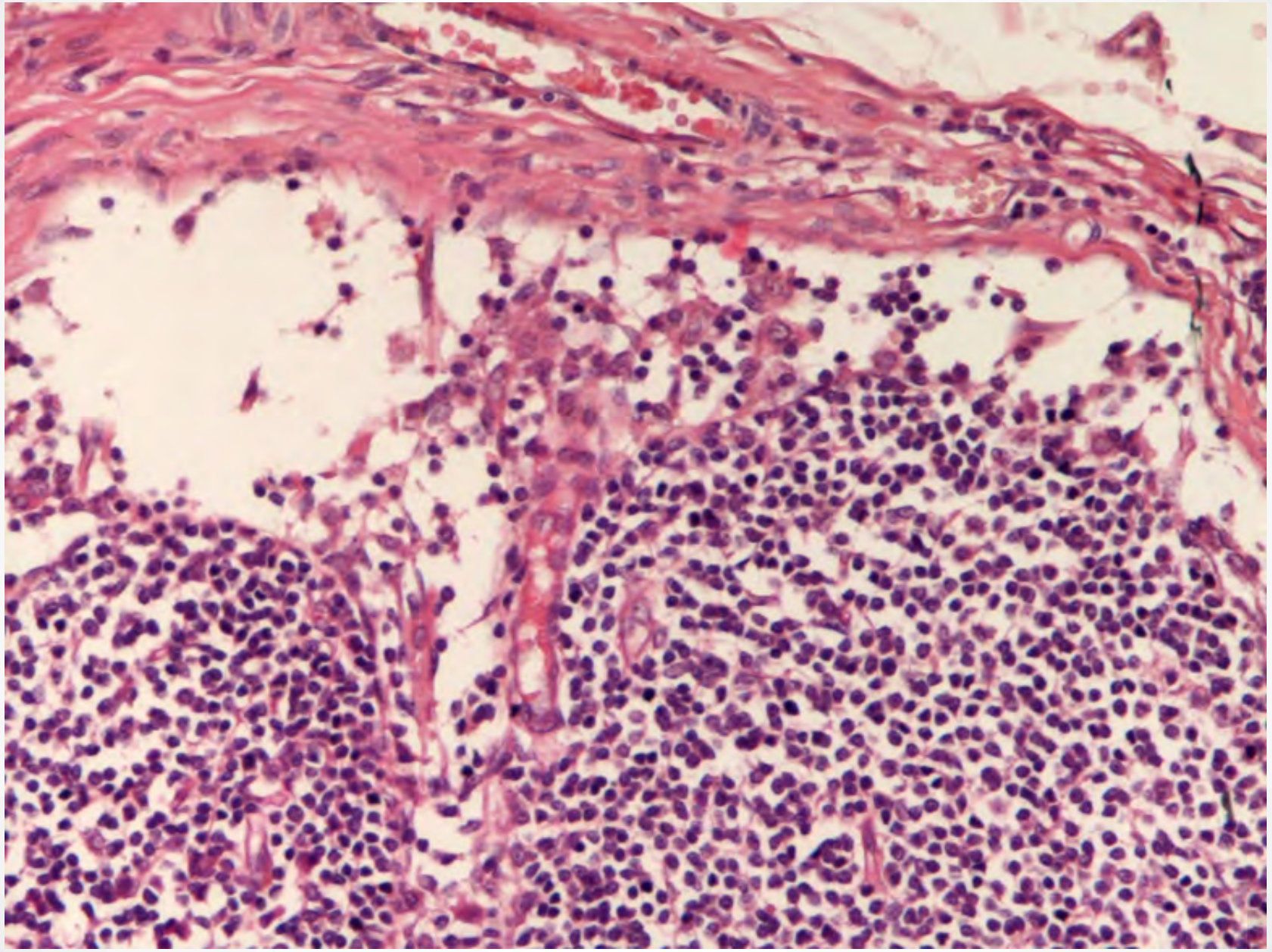
Medullary sinuses (w/out endothelial cells)

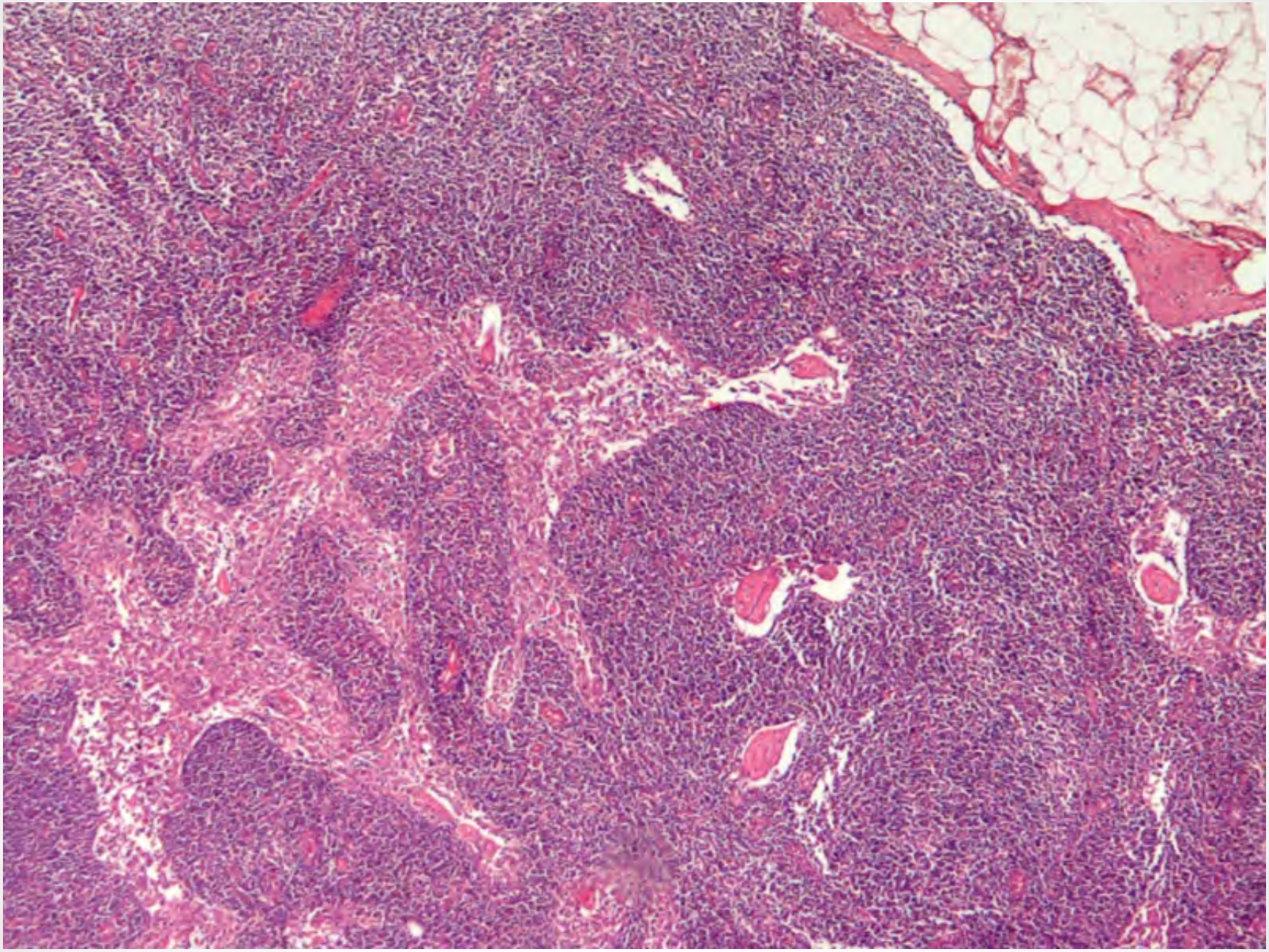
Reticular macrophages **in a network**

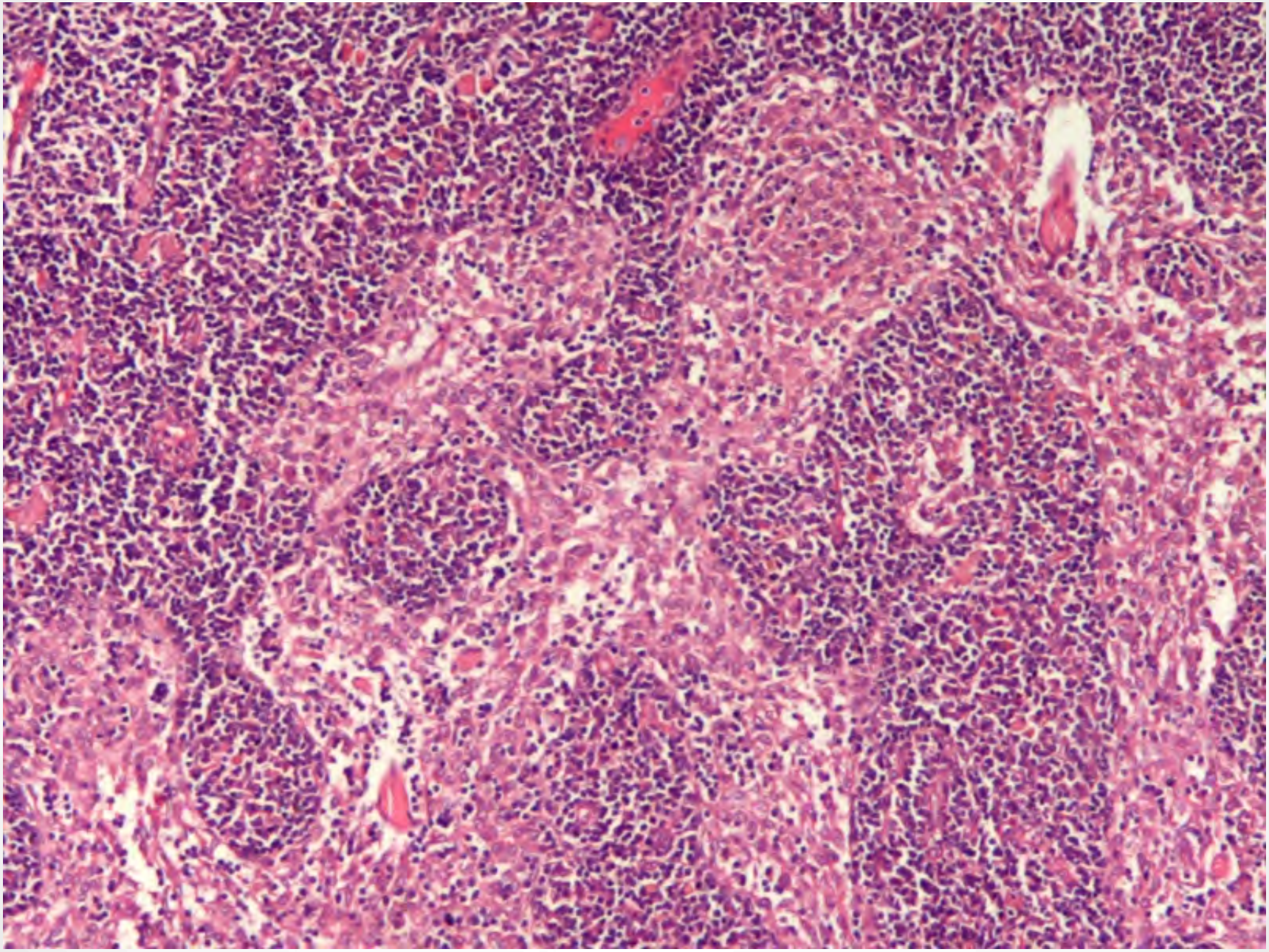
↓

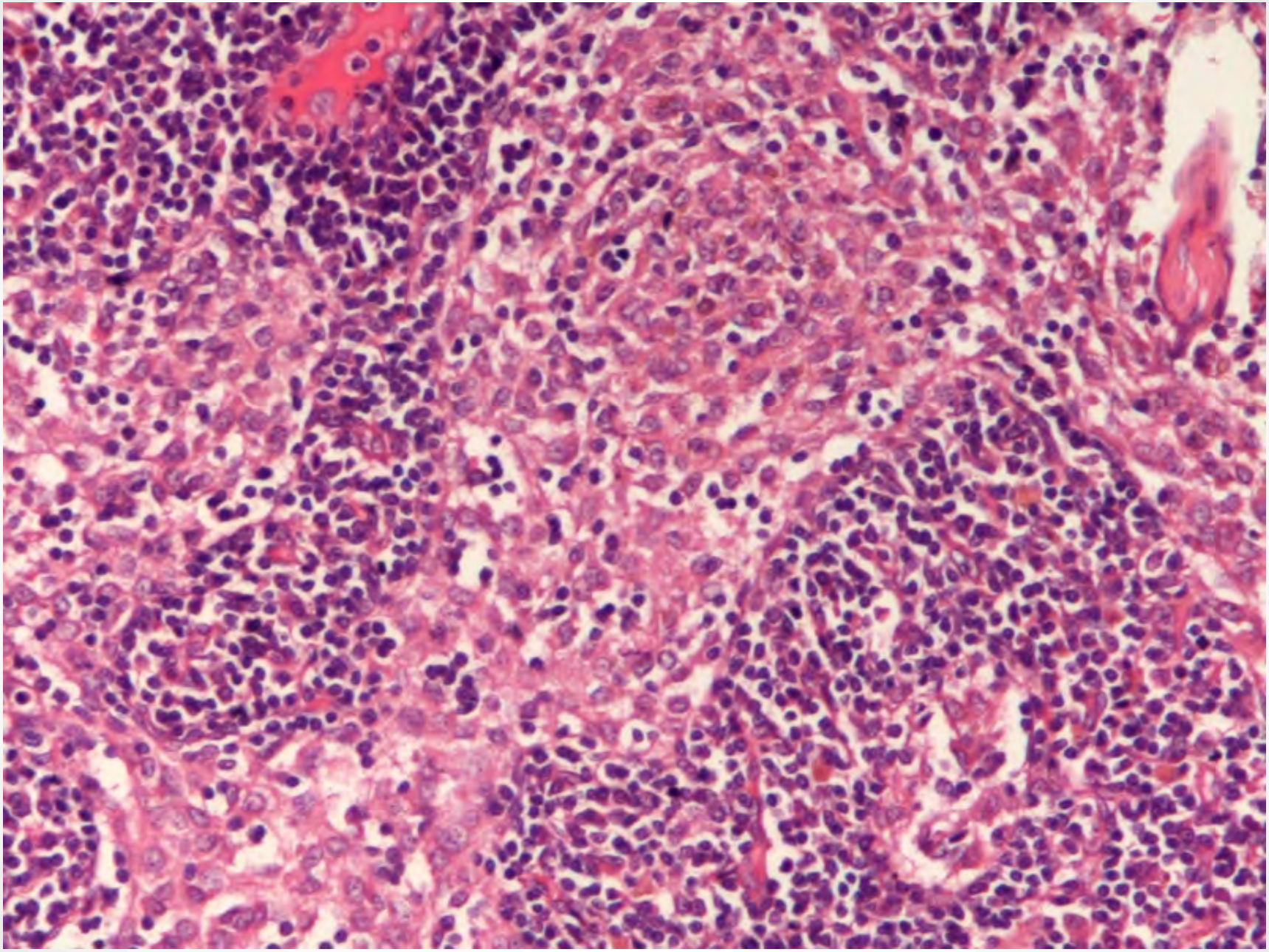
Intense stimulations = Sinus histiocytosis











Functions of germinal centres

Antigens from afferent lymphatics

↓

Dendritic cells entrap antigens on their surface and present them on cytoplasmic processes

↓

Naive B-lymphocytes (mantle zone)

Primary follicles → *Secondary follicles*

↓

Activated B-lymphocytes (germinal centres)

↓

Centroblasts (somatic hypermutations)

↓

Centrocytes

Low affinity antigens

Apoptosis → Macrophages with tingible bodies

High affinity antigens

→Clonal expansion

Terminal differentiation

(Cytokines from GC T-lymphocytes)

Plasma cells **→ antibodies**

Memory T-lymphocytes

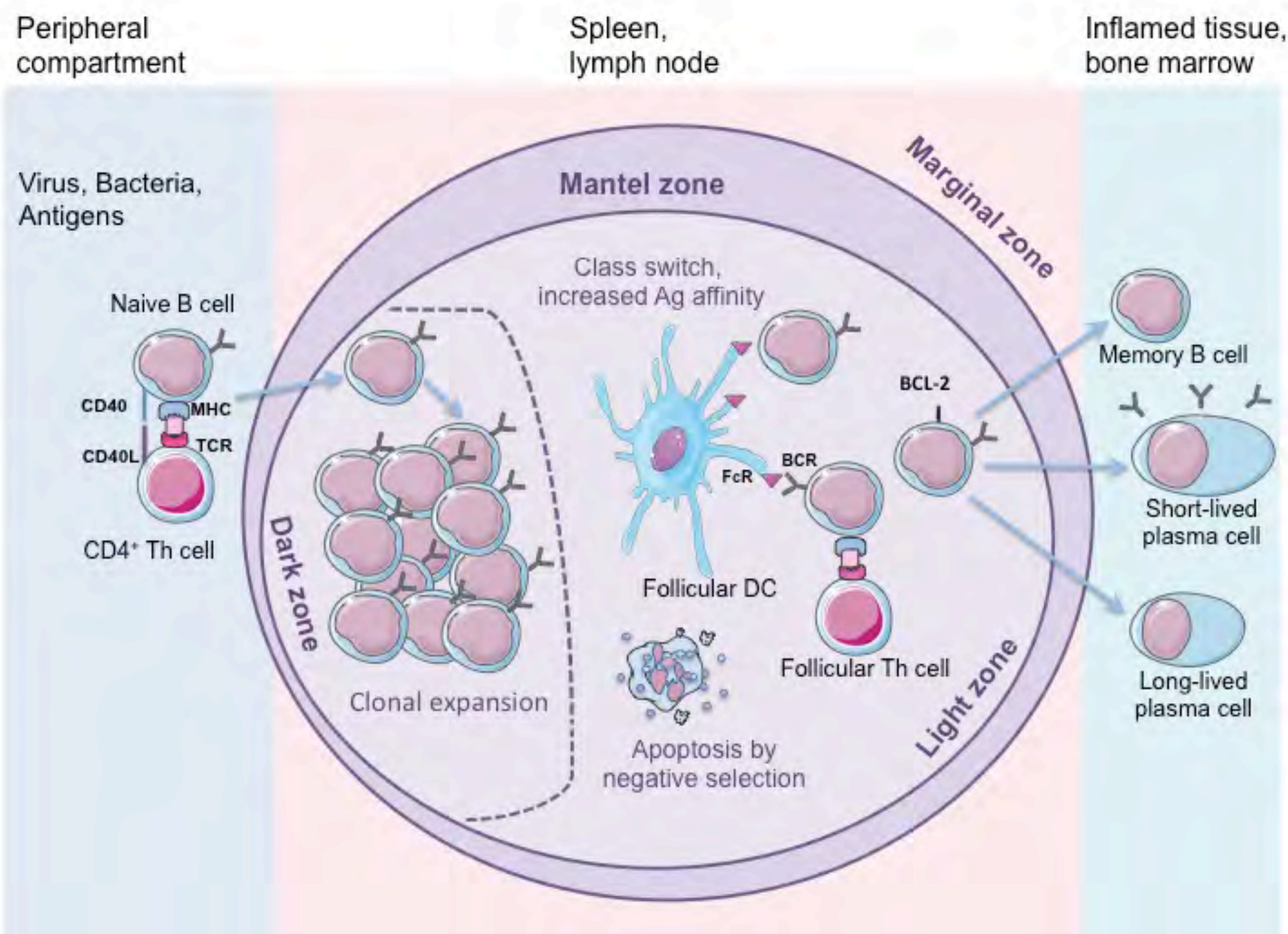
APOPTOSIS

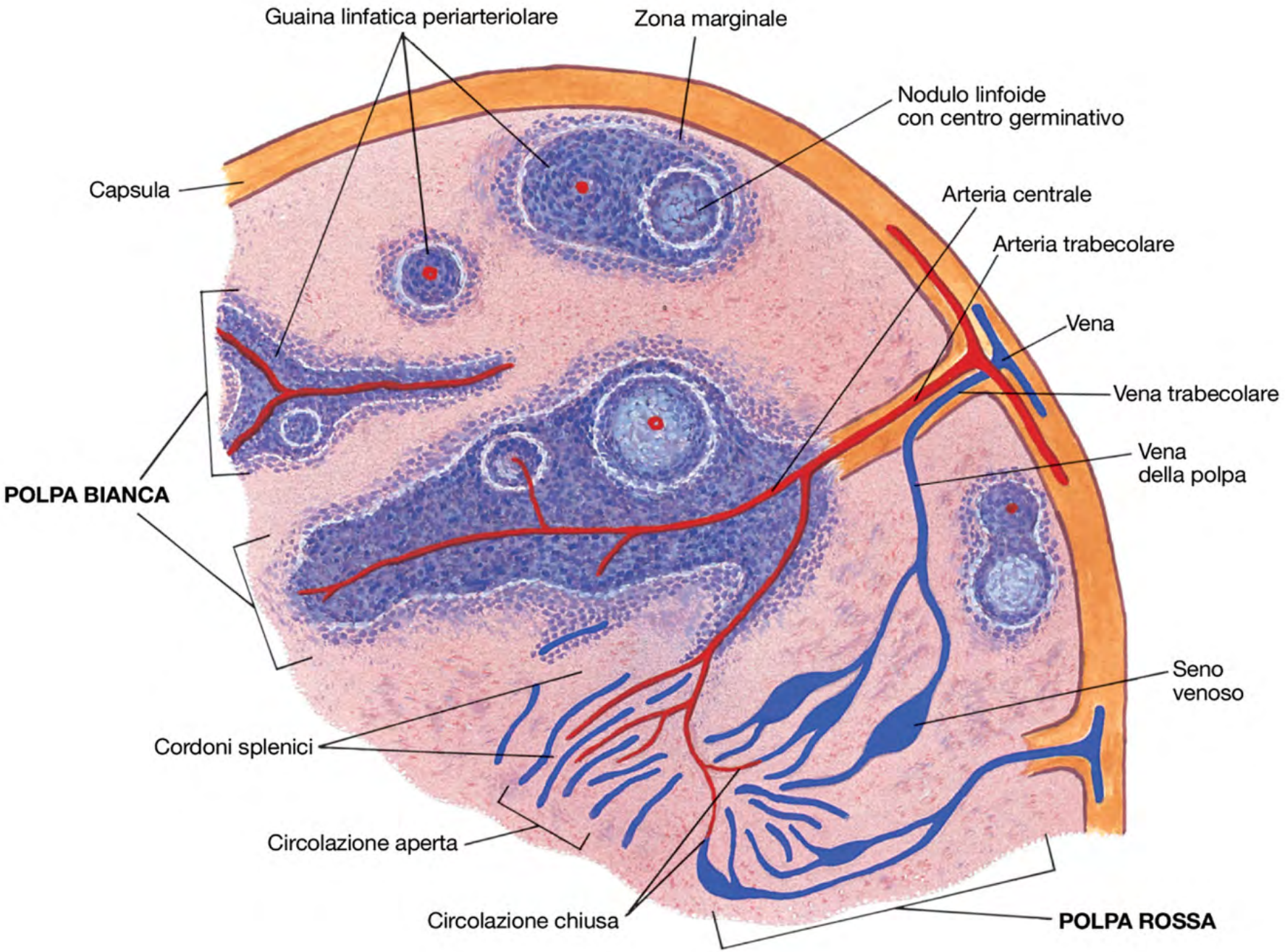
In immune organs removes harmful or exuberant cell clones
Regulated by bcl2 and p53

- **Clones with low affinity for antigens**
- **Negative selection (= no expansion)**
- **Clearing by apoptosis**

Massive apoptosis =

Viral infections
Follicular hyperplasia
Necortising lymphadenitis


Peripheral compartment
Spleen, lymph node
Inflamed tissue, bone marrow
Virus, Bacteria, Antigens
Naive B cell
CD40
MHC
TCR
CD40L
CD4+ Th cell
Mantel zone
Marginal zone
Class switch, increased Ag affinity
Dark zone
Clonal expansion
Follicular DC
FcR
BCR
BCL-2
Follicular Th cell
Apoptosis by negative selection
Light zone
Memory B cell
Short-lived plasma cell
Long-lived plasma cell



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