

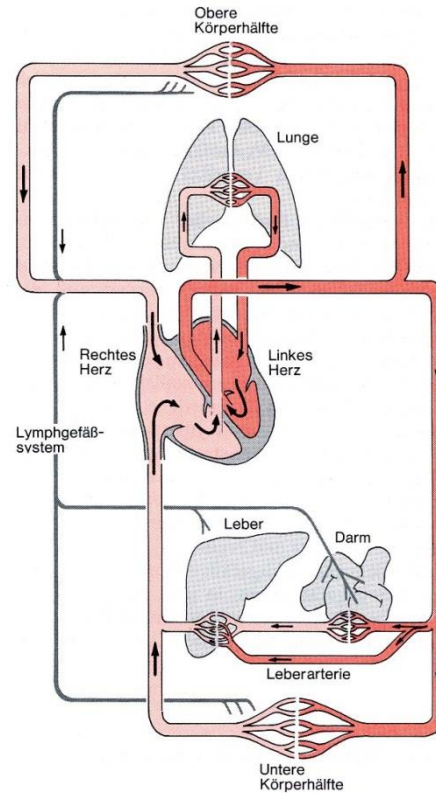
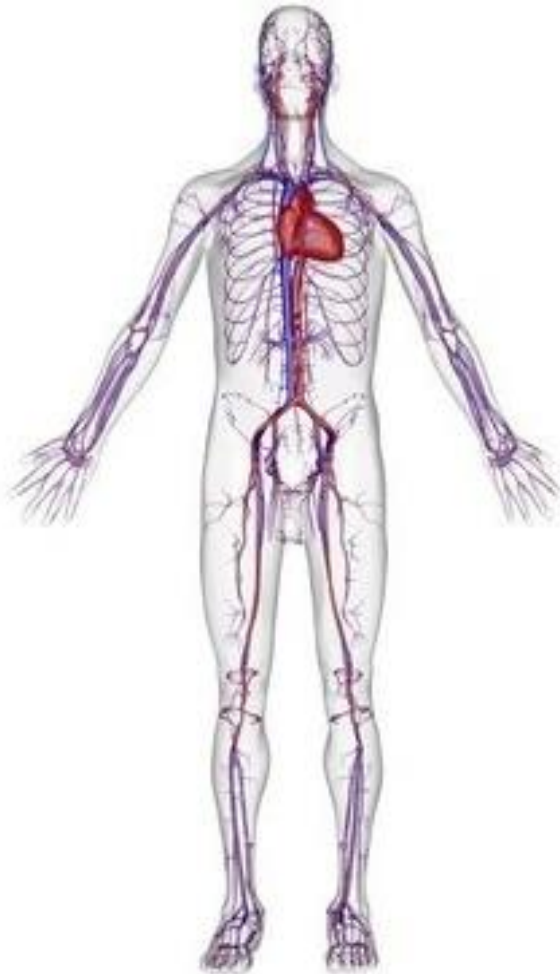
Lymphatic organs 1:

Lymph node. Tonsils.

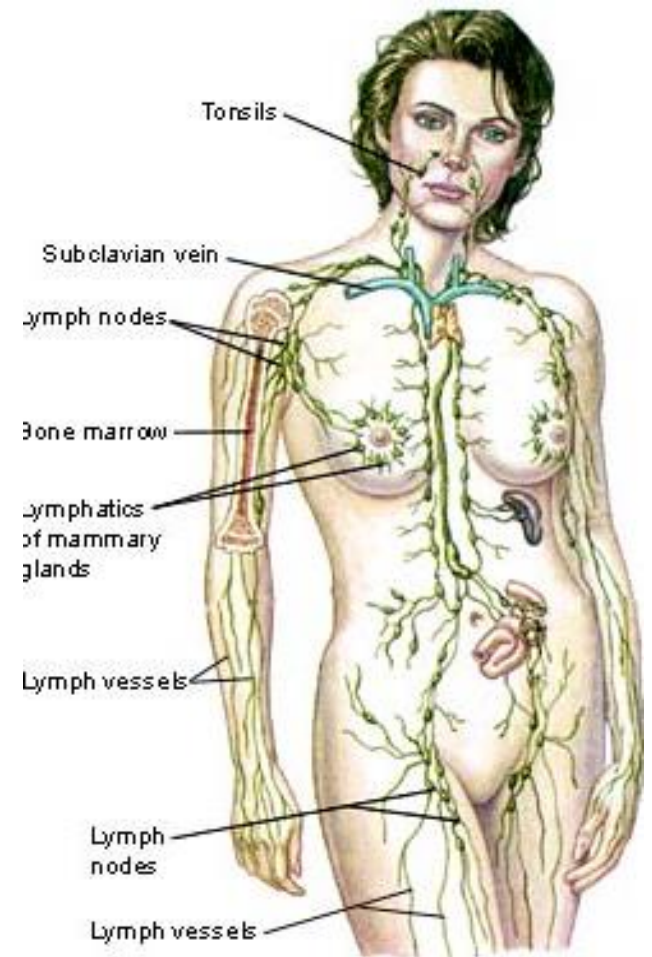
János Hanics M.D.

FLUID CIRCULATION OF THE BODY

BLOOD

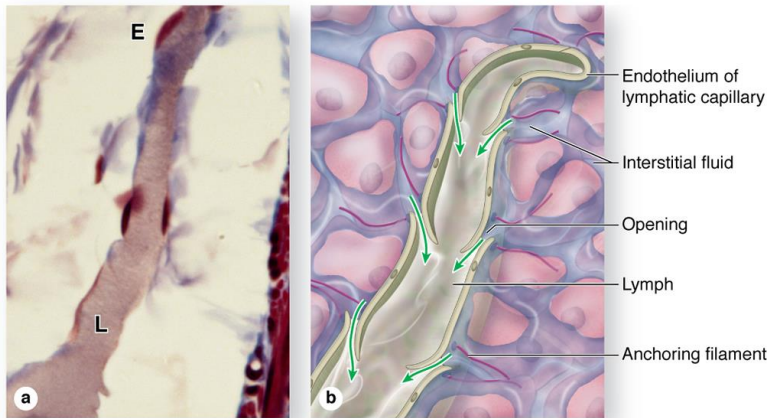
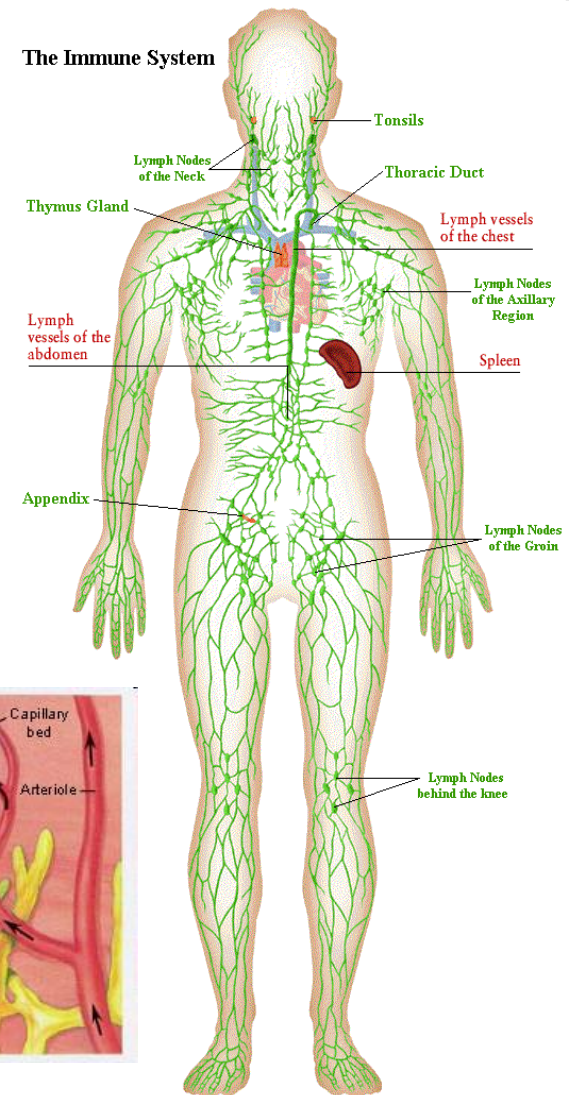


LYMPH

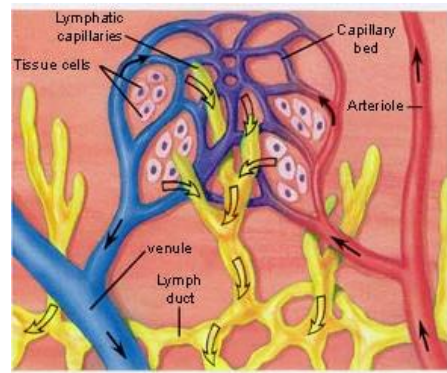


Lymphatic circulation

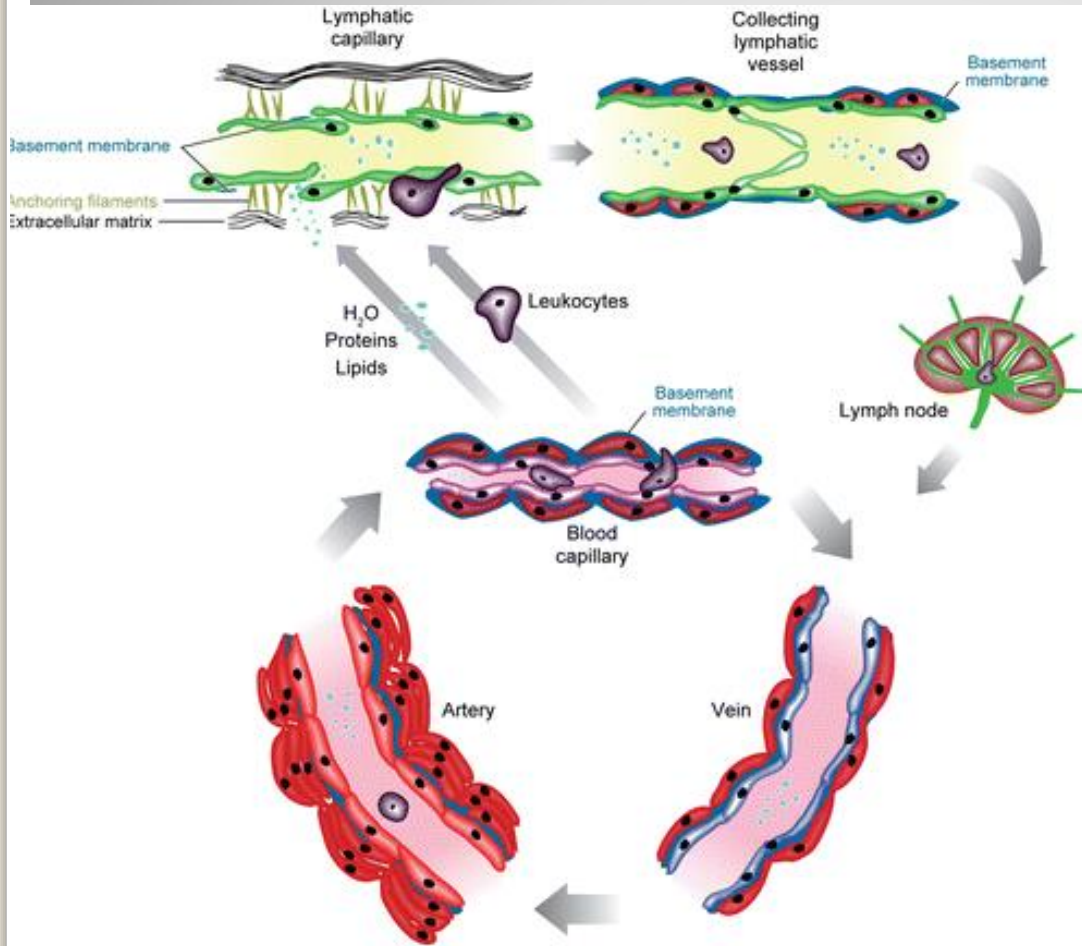
- Components
 - **Lymph** (fluid)
 - Vessels – **lymphatics**
 - Structures & organs
- Functions
 - Return tissue fluid to the bloodstream
 - Transport fats from the digestive tract to the bloodstream
 - Surveillance & defense



Lymphatic capillary

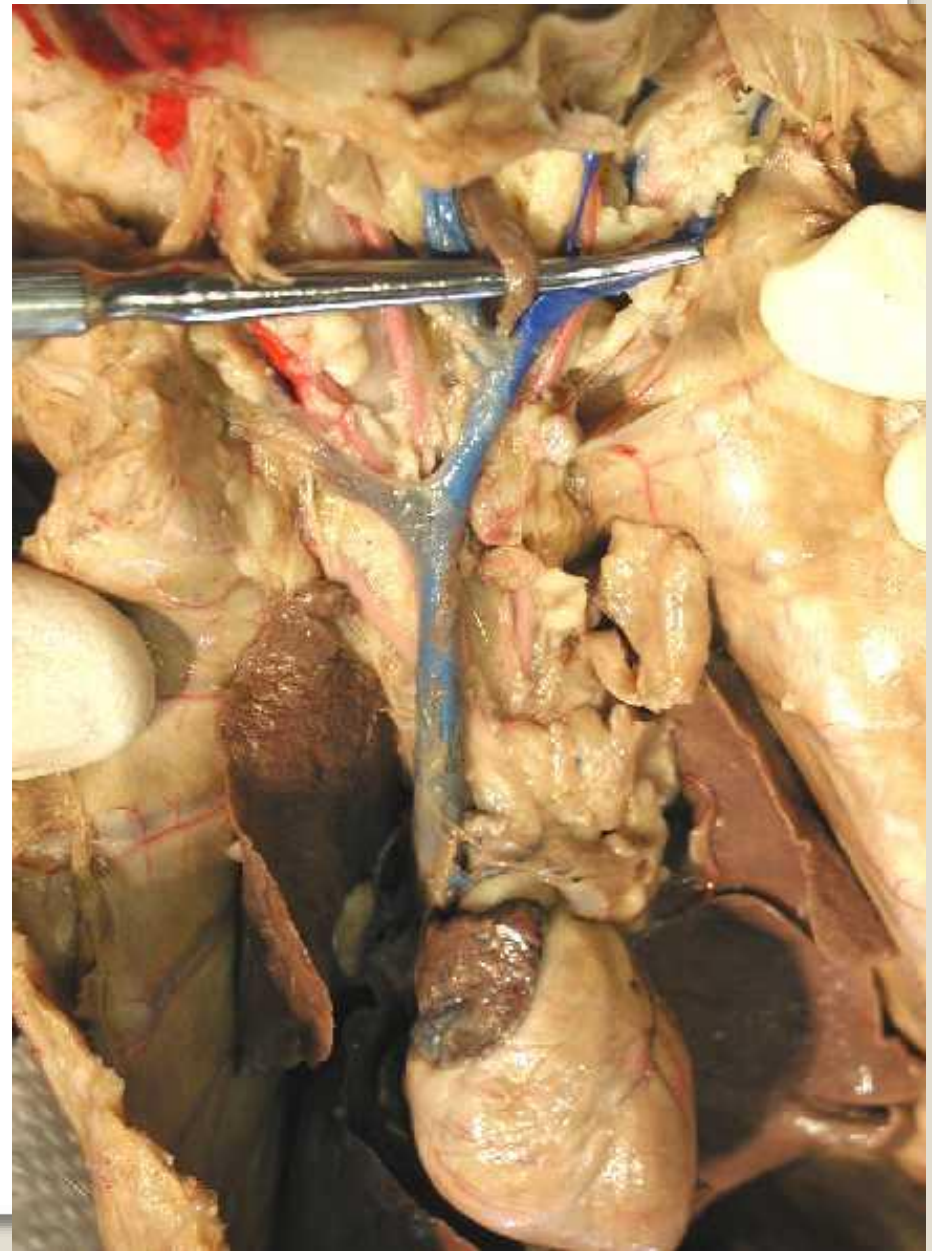
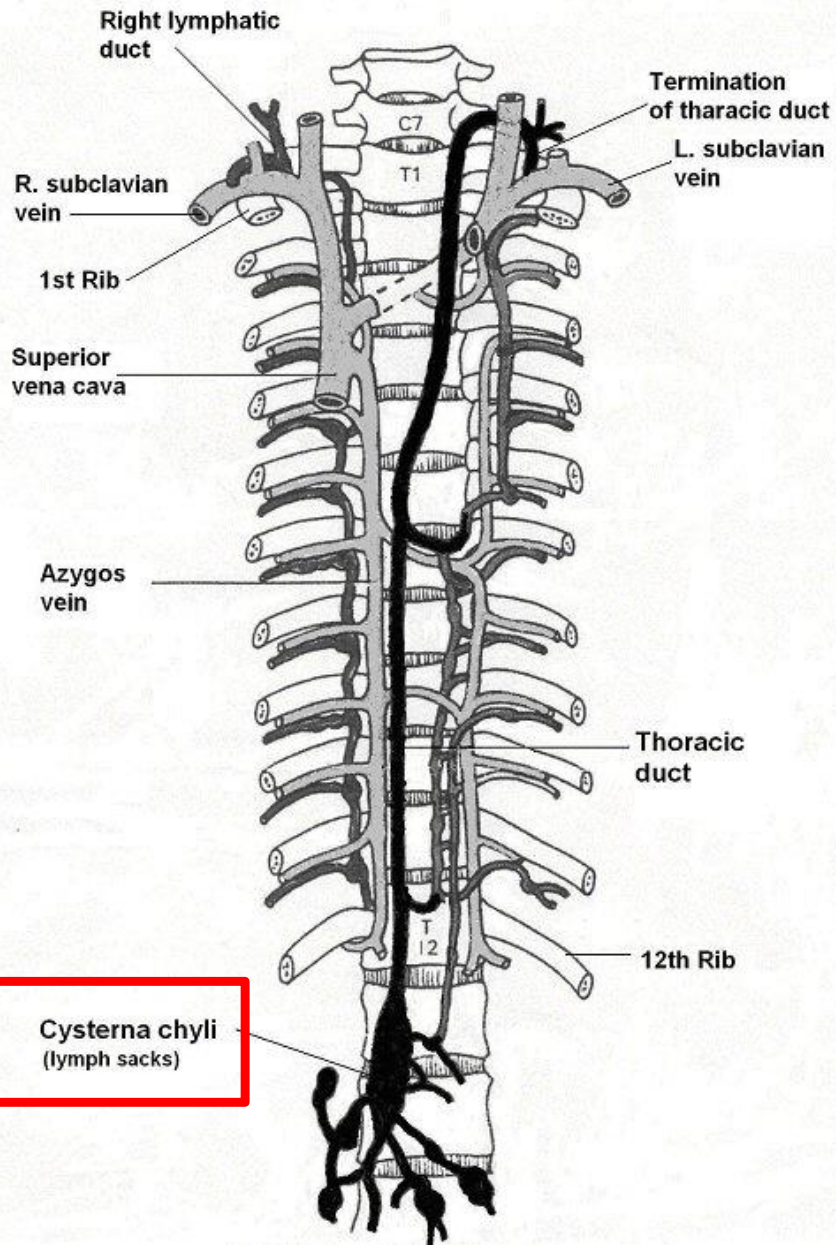


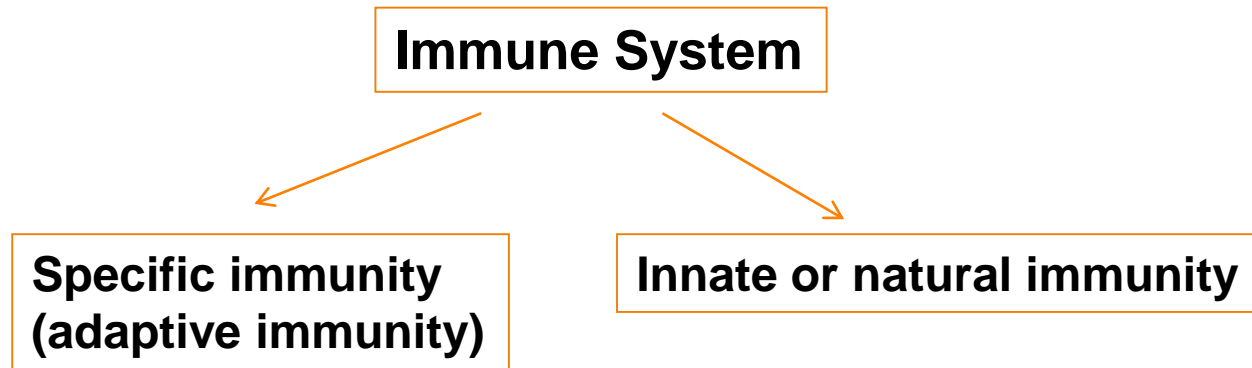
LYMPH VESSELS



- Originate as lymph capillaries
- Capillaries unite to form larger vessels
 - Resemble to veins in structure
 - Connect to lymph nodes at various intervals
- Lymphatics ultimately deliver lymph into 2 main channels
 - **Right lymphatic duct**
 - Drains right side of head & neck, right arm, right thorax
 - Empties into the right subclavian vein
 - **Thoracic duct**
 - Drains the rest of the body
 - Empties into the left subclavian vein

THORACIC and RIGHT LYMPHATIC DUCT



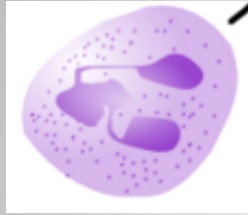


Both based on immune cells

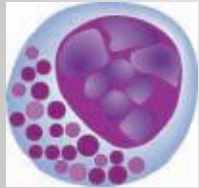
„TO DISTINGUISH SELF FROM THE FOREIGN“

Paul Ehrlich 1908

THE CELLS OF INNATE IMMUNITY



Granulocytes (neutrophils, eosinophils, basophils)
(PMN)

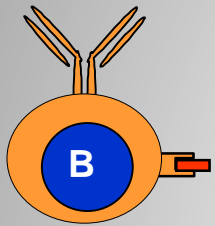


NATURAL KILLERS (NK)

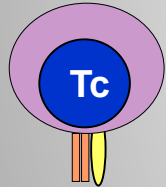


Makrophages

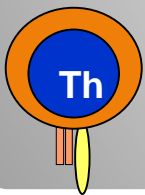
THE ELEMENTS OF THE ADAPTIVE IMMUNITY



B cells



citotoxic T cells
(CD8)

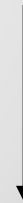


T-Zellen

T helpers:
Th1- and Th2-cells
(CD4)

Antigen-SPECIFIC CELLS : a GROUP OF CELLS IS FORMED SEPARATELY (identical in nature) The group has to share its identity with the others; encounters with the antigene...

Cloning!!!



Usually there is „leftover” group: „memory cells“

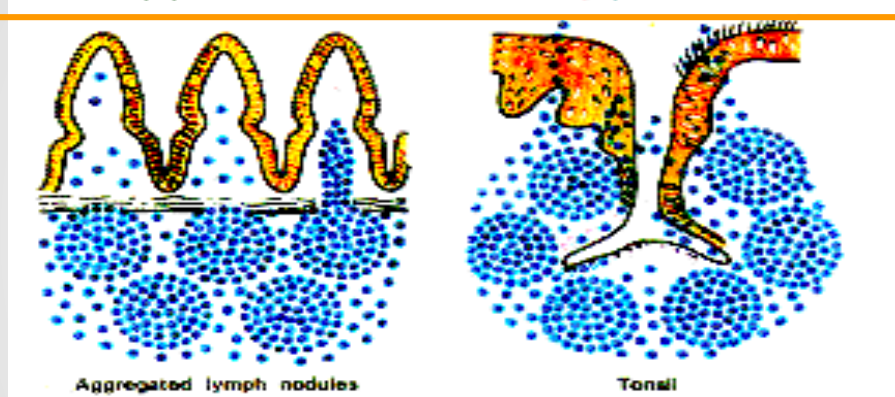
LYMPHATIC ORGANS

Diffuse solitary
lymphocytic
accumulation



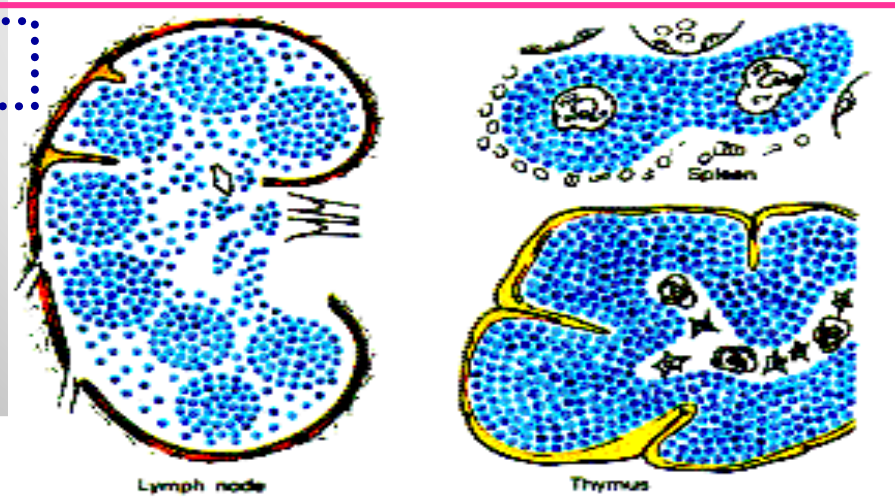
follicles (nodulus)

Aggregated
lymphocytic
aggregation
Peyer's
patches



Tonsils:
Immediately
below the
Epithelium -
infiltration

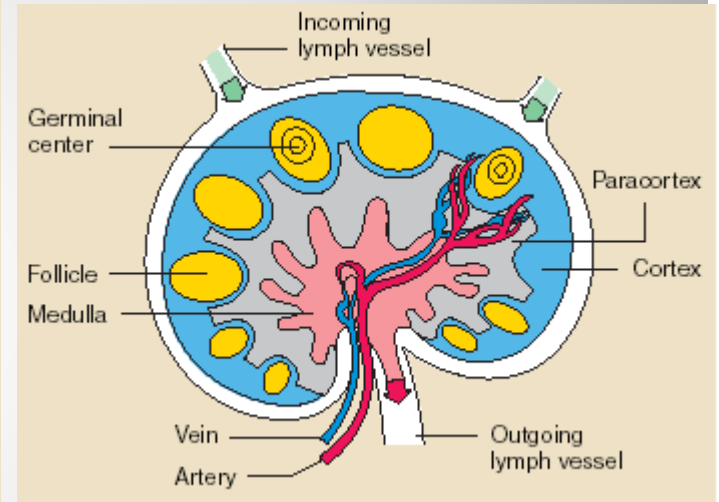
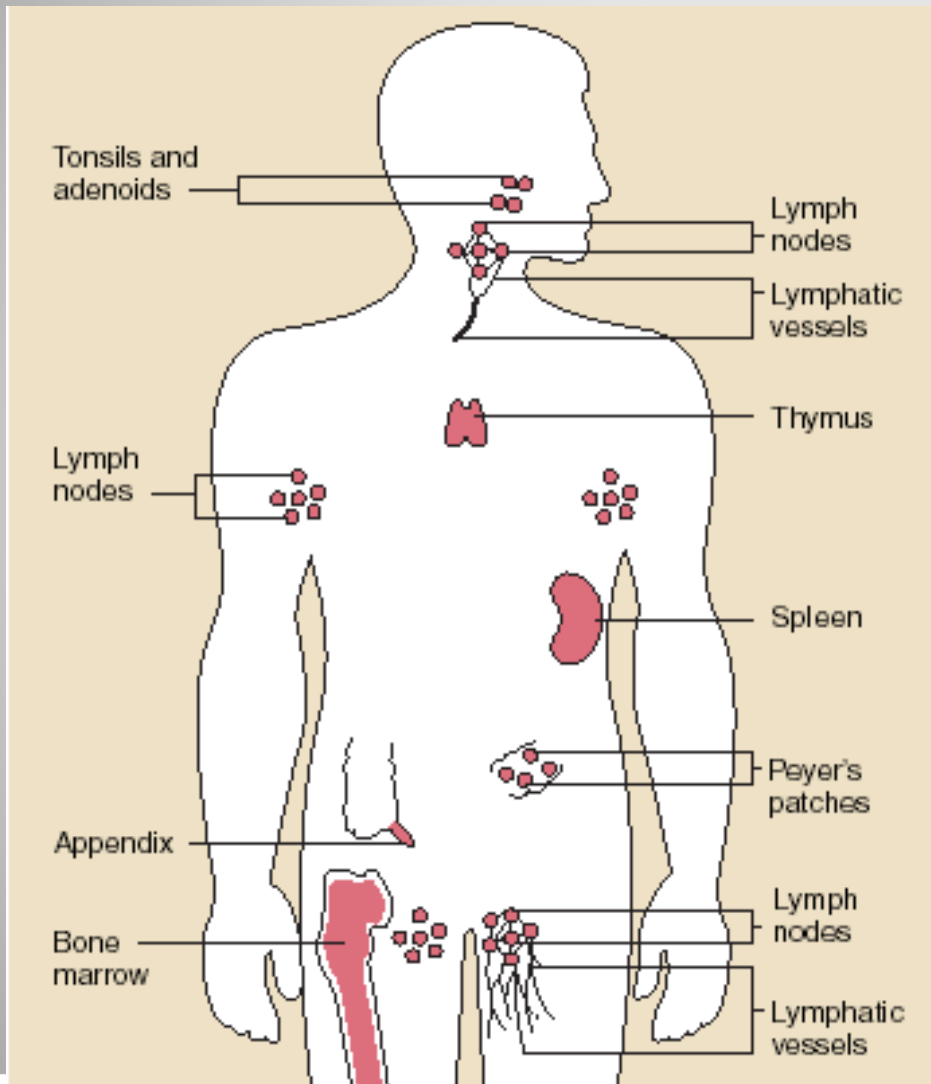
CT capsule



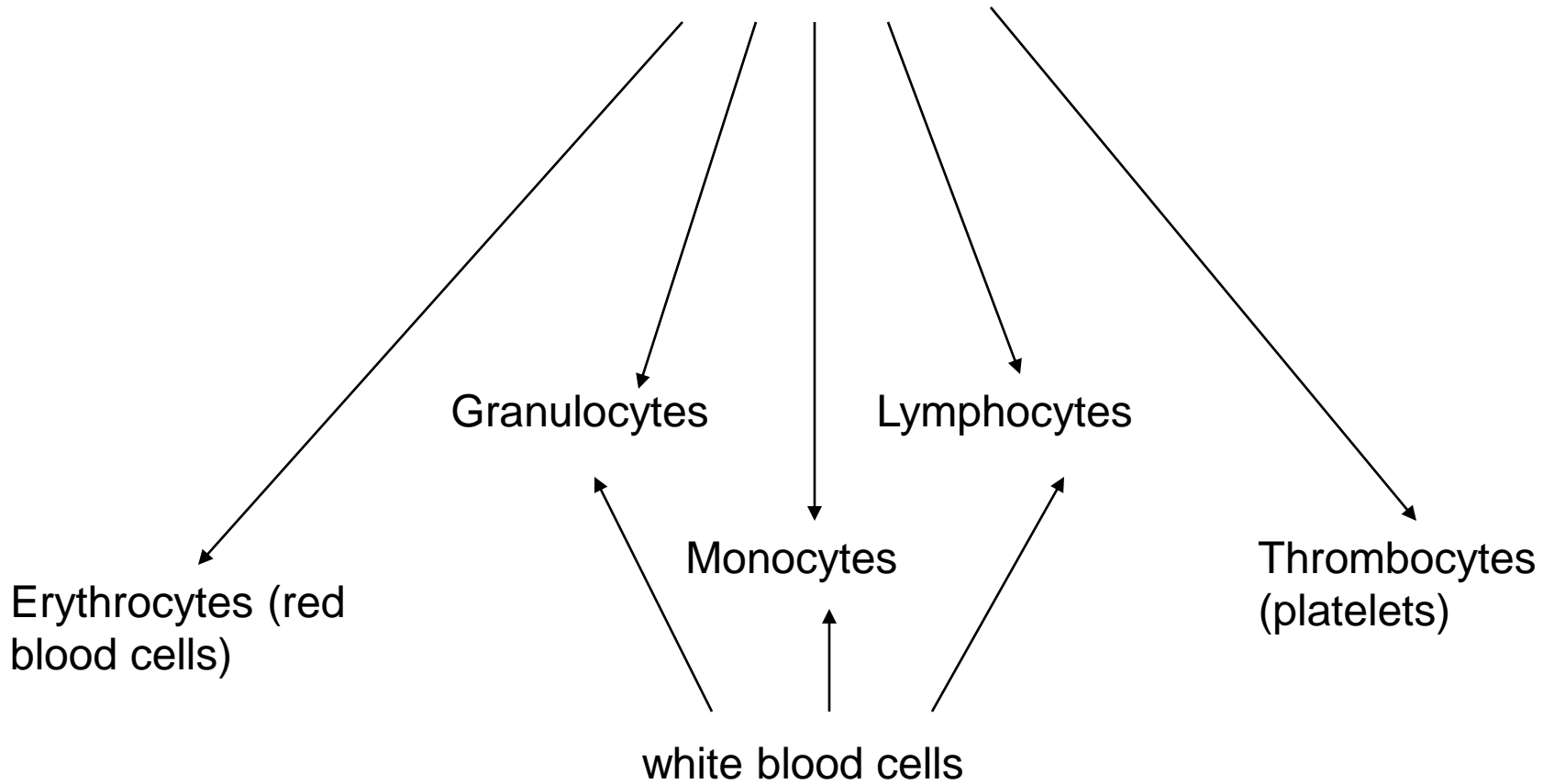
CT capsule

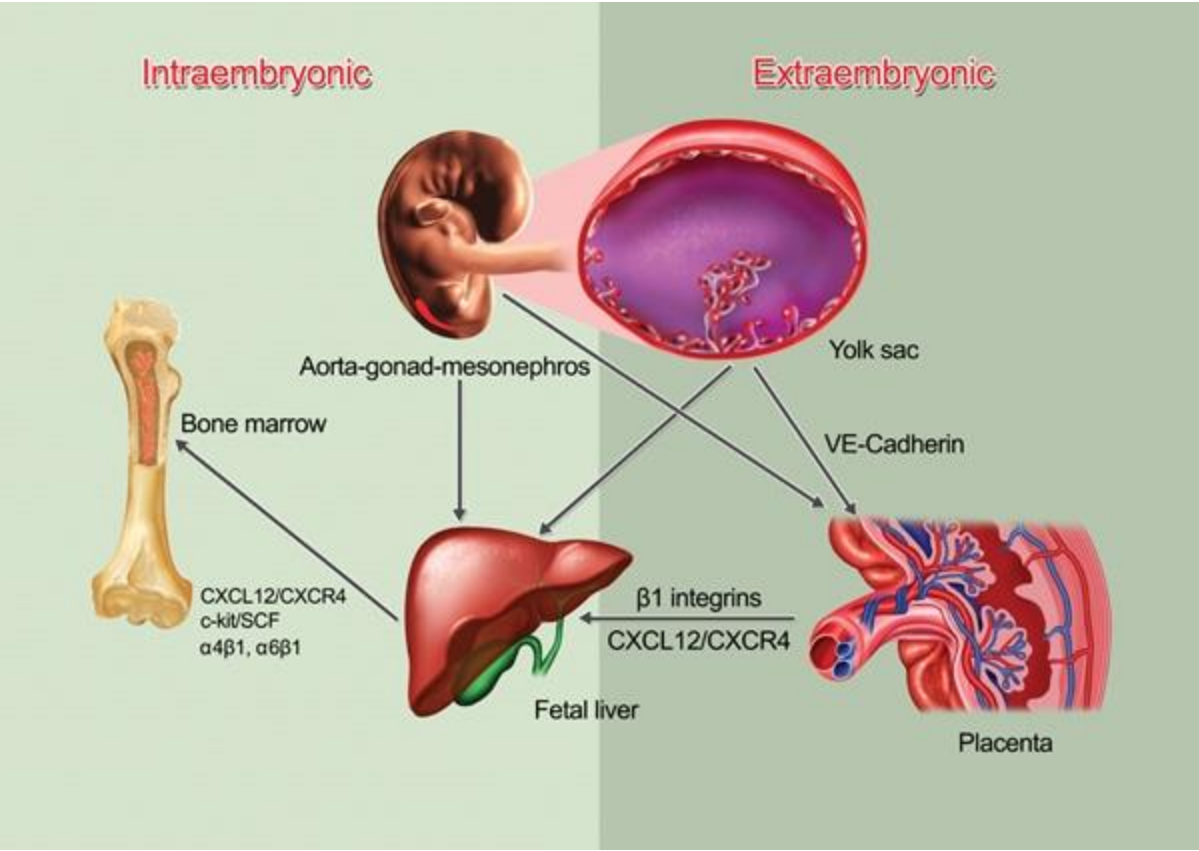
Lymph node:
Lymph vessels
Cortex/medulla
follicles

spleen:
follicles+ PALS
Thymus:
Cortex/medulla
Lobular structure



Pluripotential hematopoietic stem cells
(hemocytoblast)





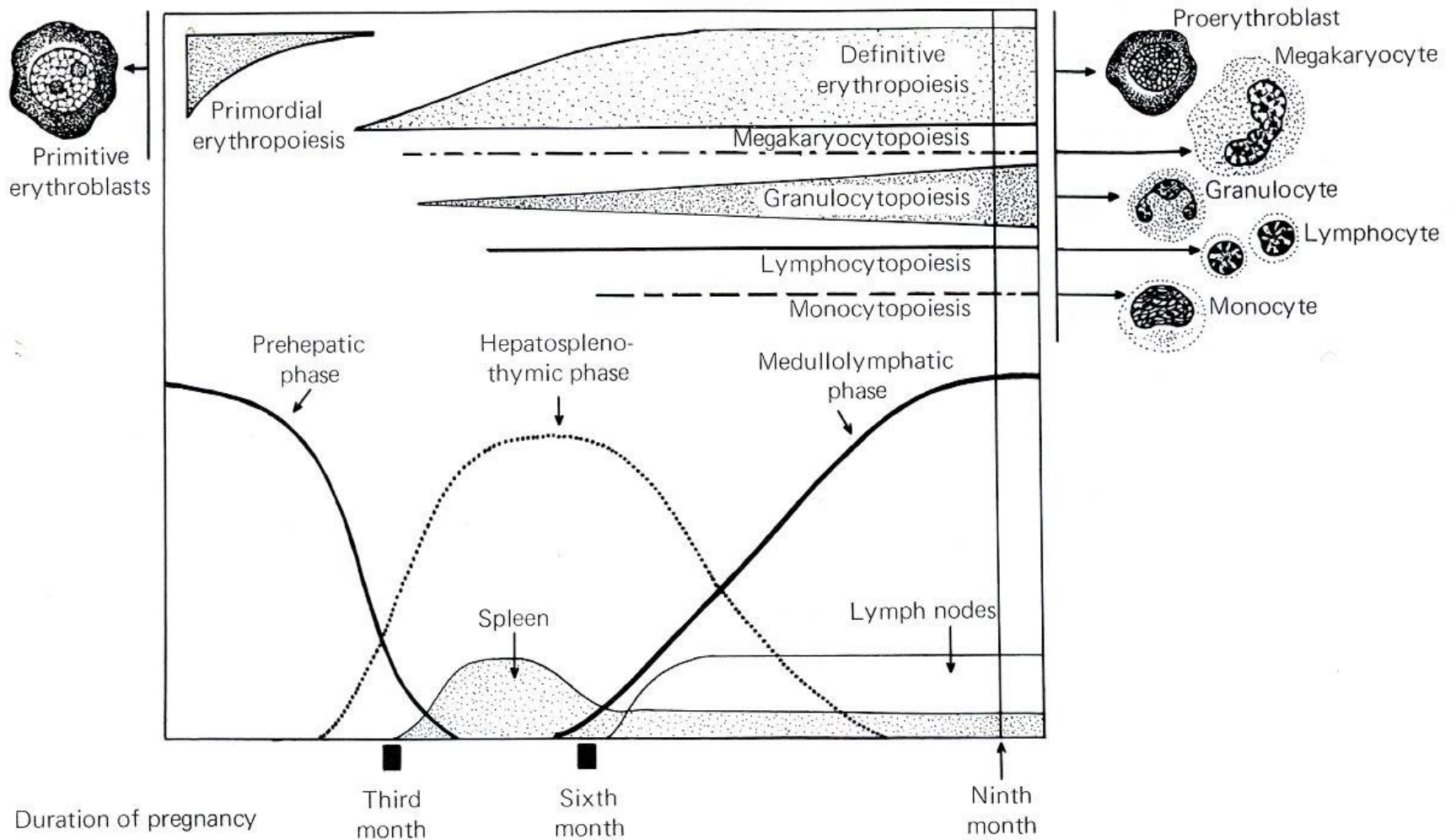


Figure 13-12. The main events in intrauterine hemocytopoiesis.

Liver and spleen early stations of hematopoietic stem cells

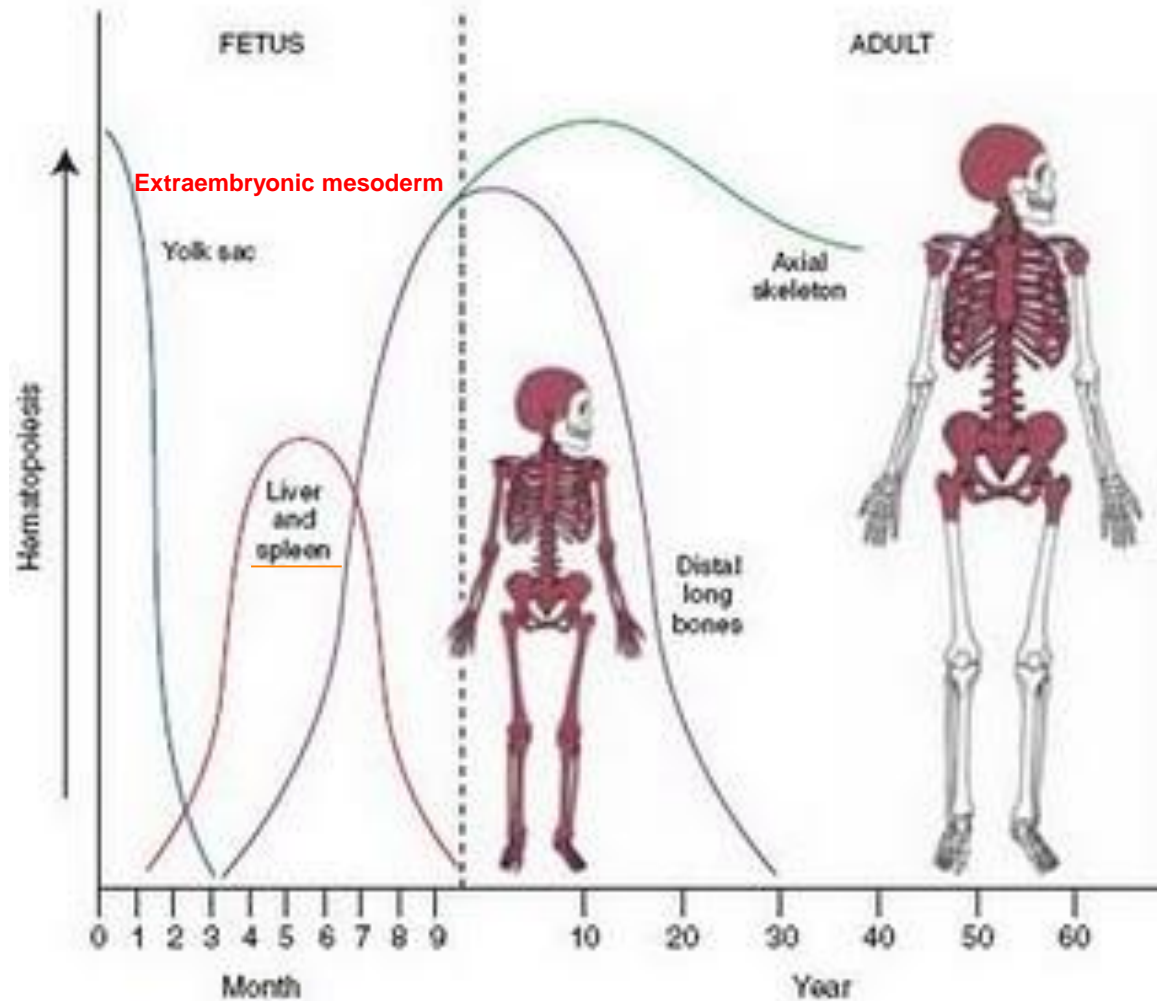
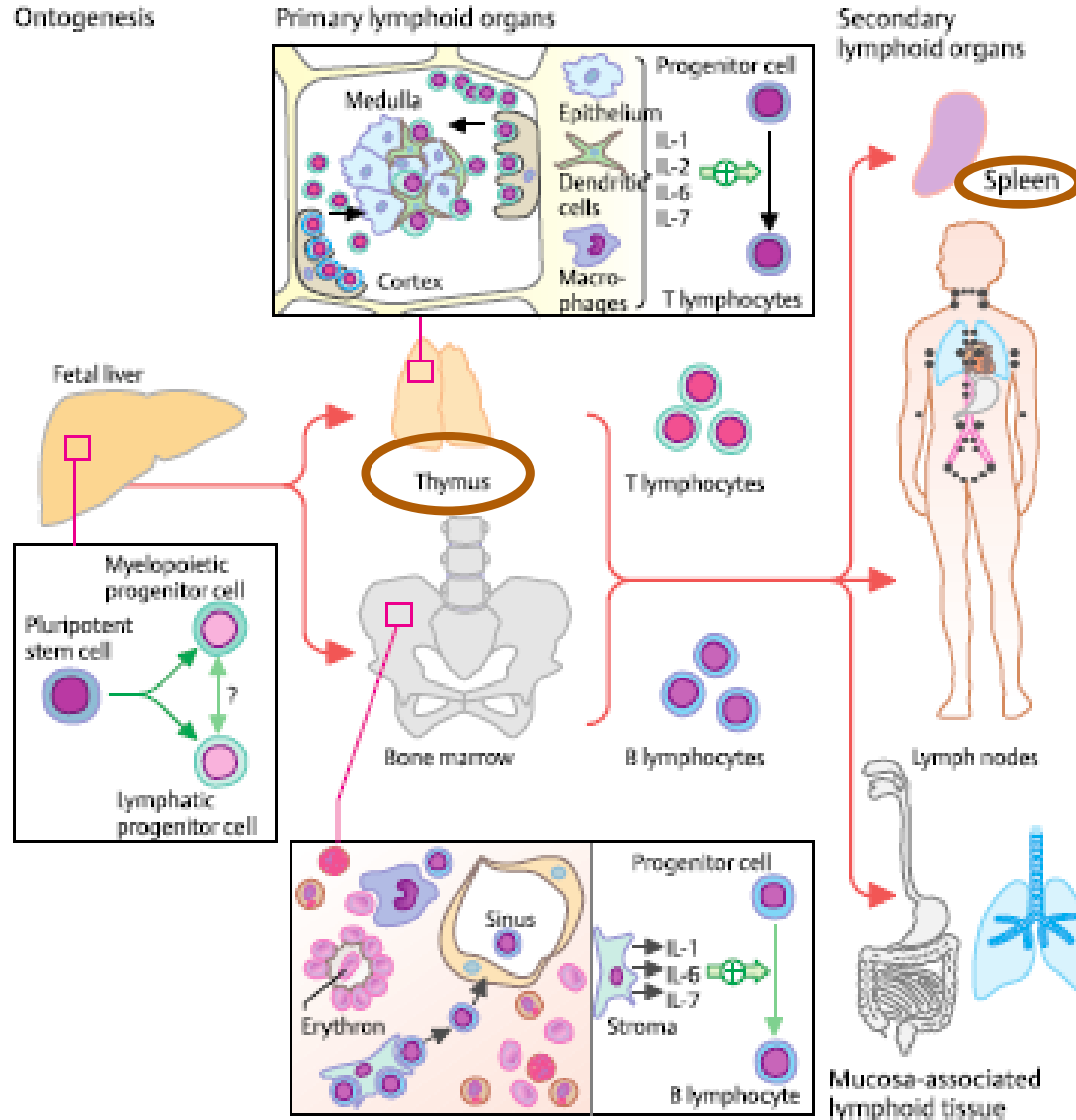


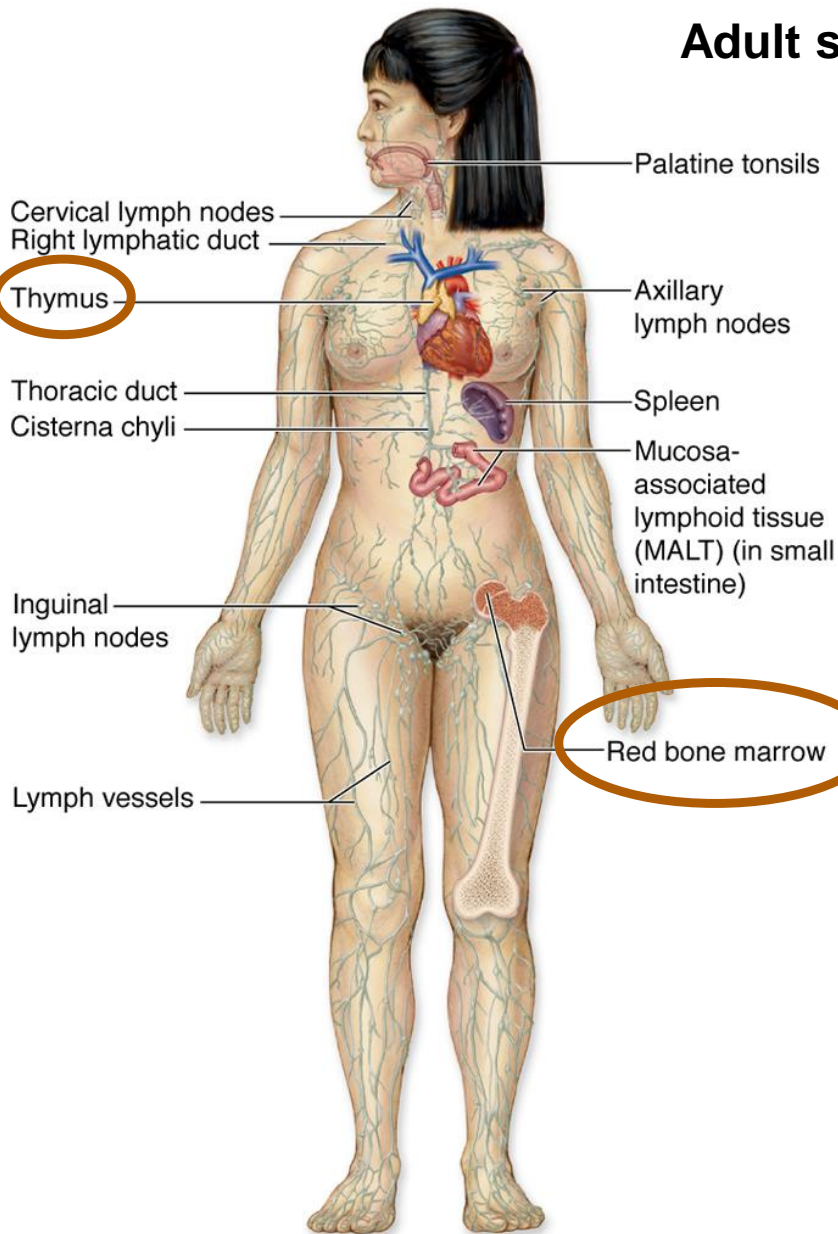
Figure 2.1 Marrow formation in fetus (left) versus the adult (right)

Primary and Secondary lymphoid organs



A. Structure of the lymphoid system

Adult stage of lymphatic organs



Primary lymphatic organs – serve as the site of production, development, and maturation.

- 1) Bone marrow
- 2) **Thymus**

Secondary lymphatic organs – are where immune cells encounter foreign substances

- 1) Lymphoepithelial organs (tonsils)
- 2) MALT (Mucosa-associated lymphoid tissue).
- 3) SALT (Skin-associated lymphoid tissue)
- 4) Lymphoreticular organs
 - Lymph nodes
 - **Spleen**

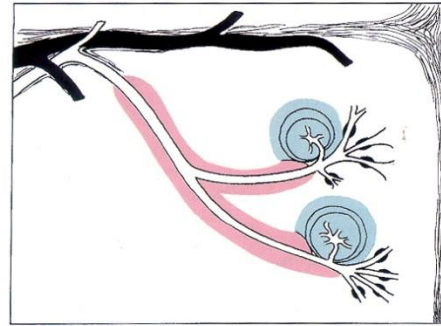
Structural components of the lymphatic organs (1)

Lymphoid follicles (nodules)!!!

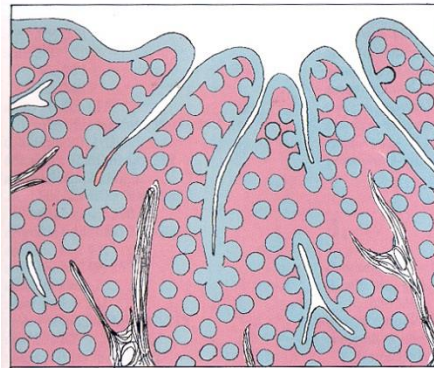
Cellular elements

- B and T lymphocytes
- Monocytes and macrophages
- Polymorph nucleated granulocytes
- Mast cells
- Plasma cells
- Nature killer cells

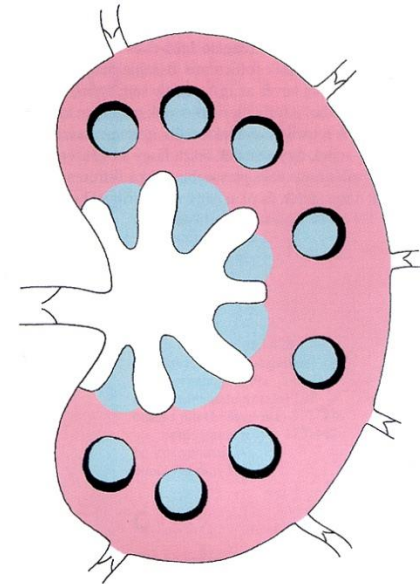
*Exception: thymus - lobules



Spleen



B- and T- cell regions



Lymph node

■ T-dependens
■ B-dependens

Tonsils

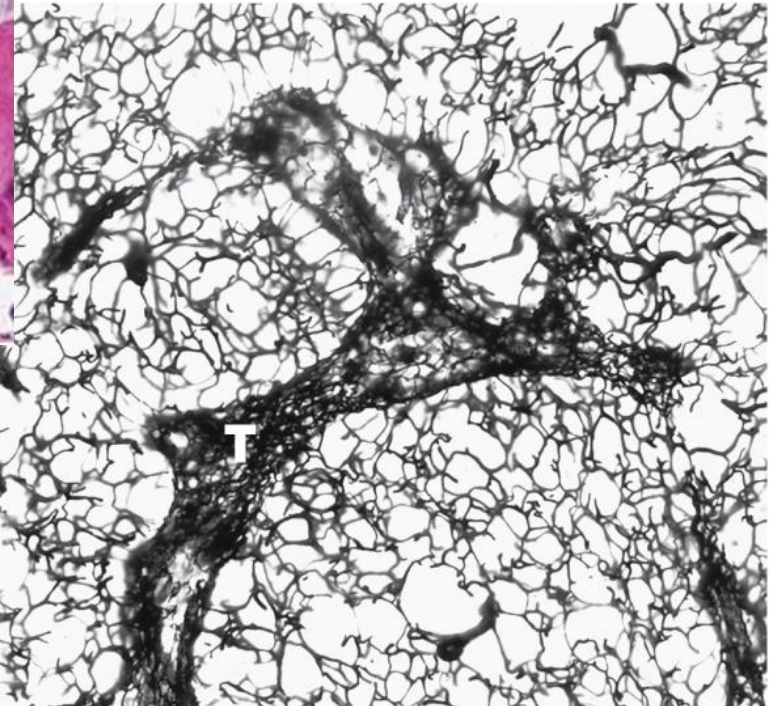
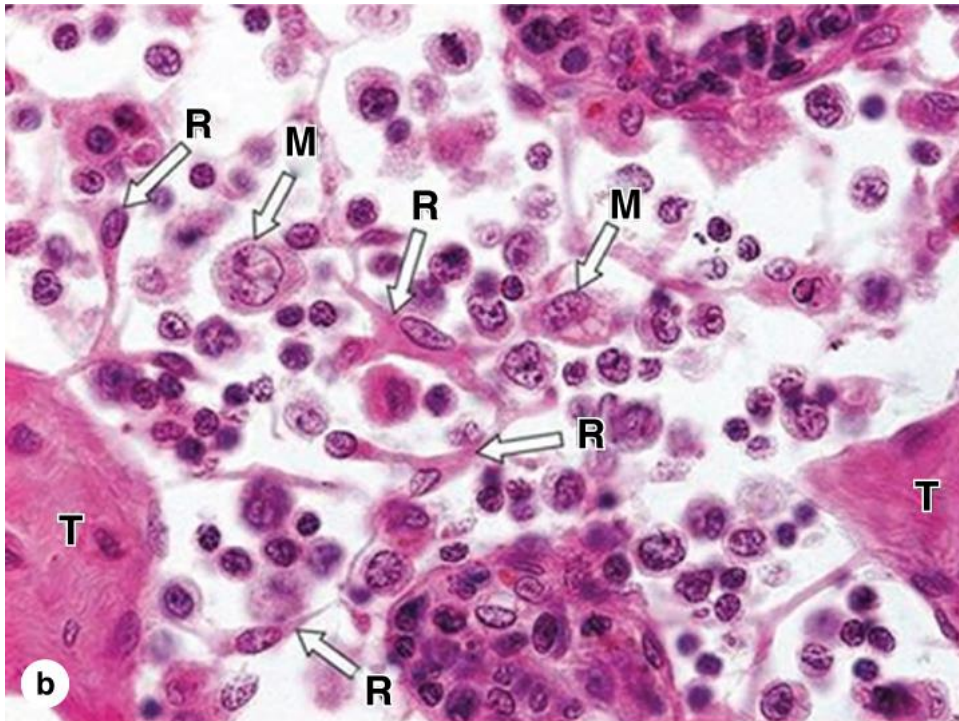
Structural components of the lymphatic organs (2)

Reticular connective tissue =
supporting framework

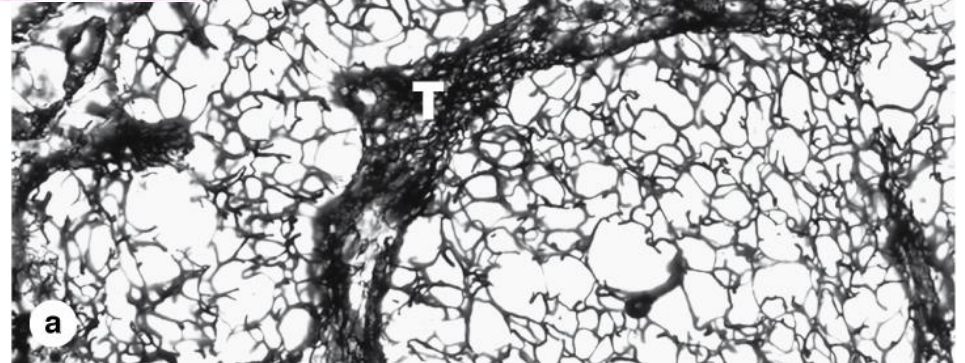


Fibroblastic reticular cell (R) –
mesenchymal origin

- exception:Thymus – epithelial reticular cell
- Endodermal origin

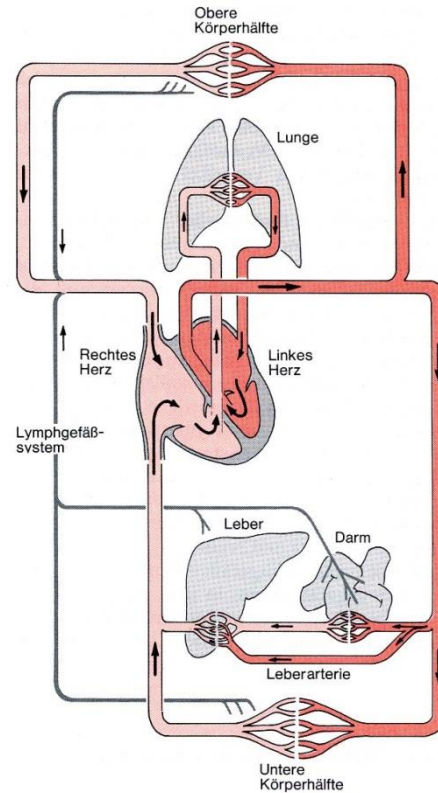
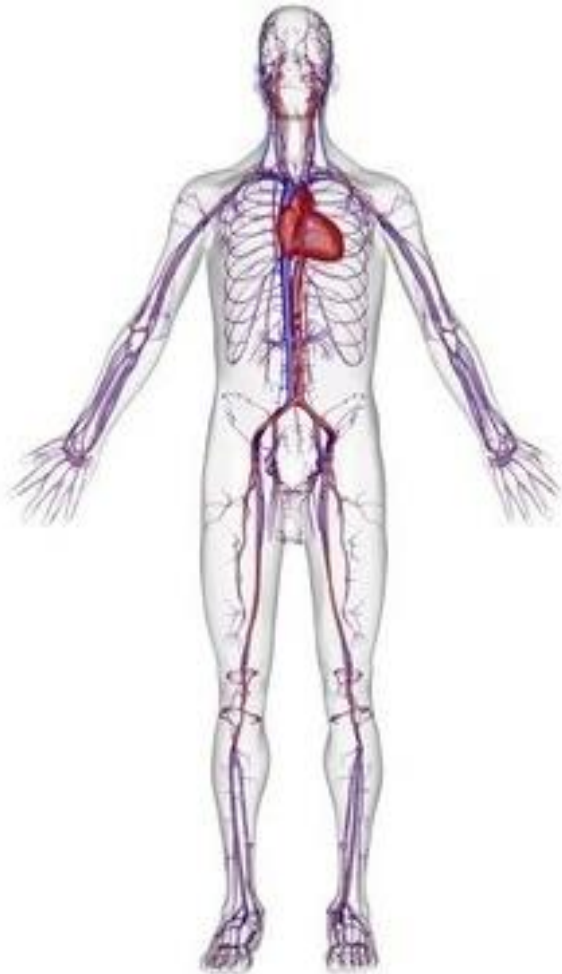


Reticular fibers

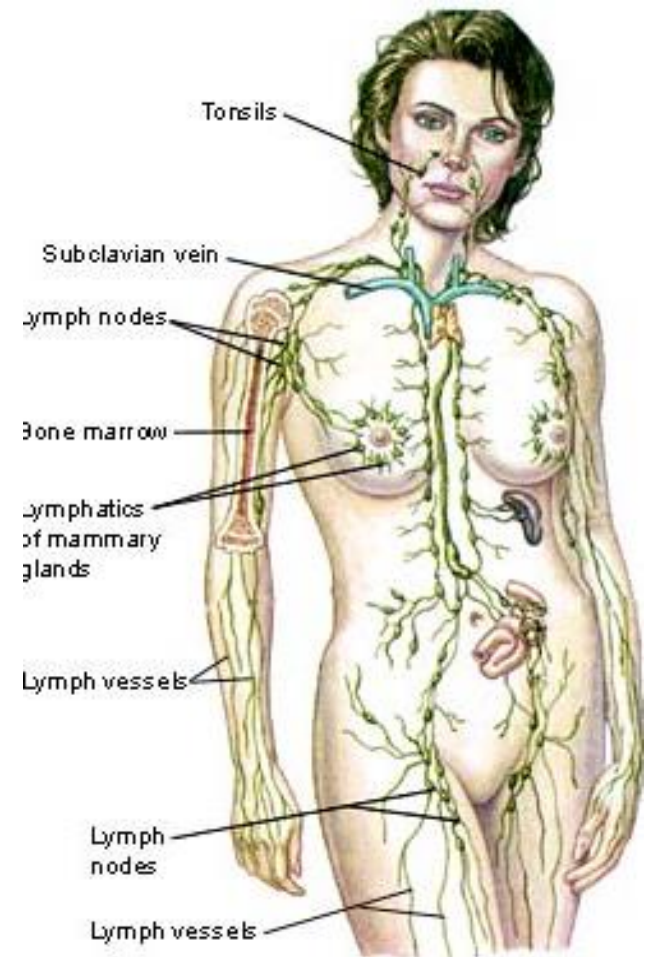


Lymph nodes

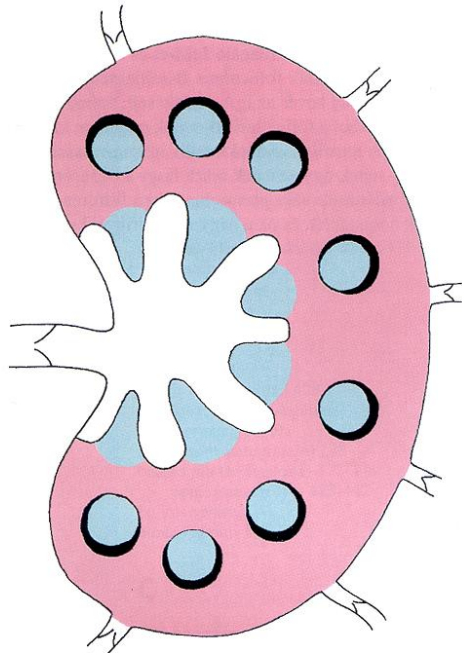
BLOOD



LYMPH

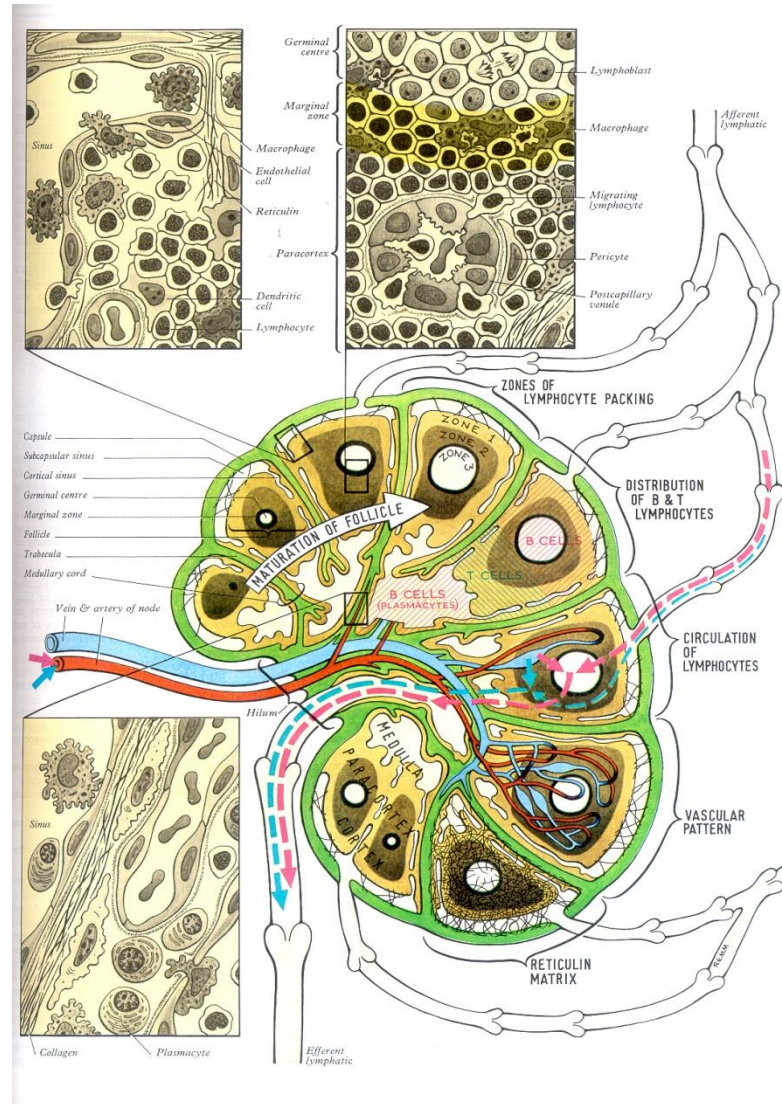


THE COMPOSITION OF LYMPH NODES

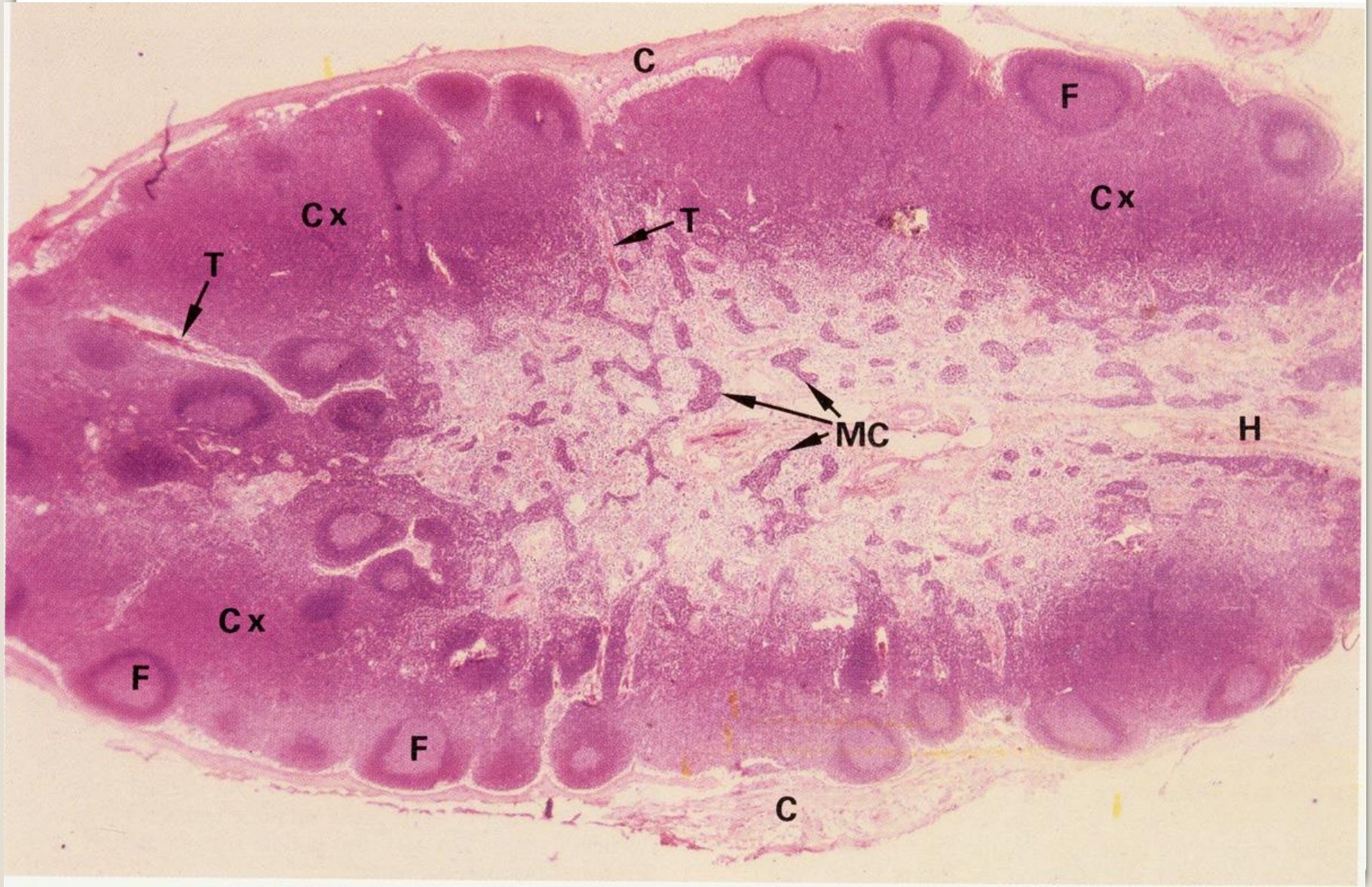


Lymph node

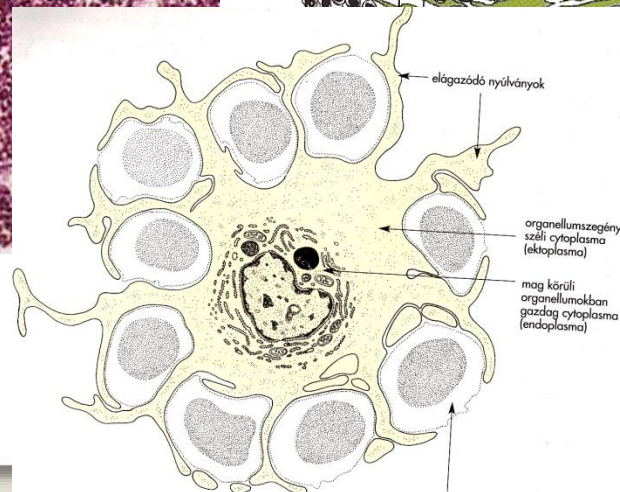
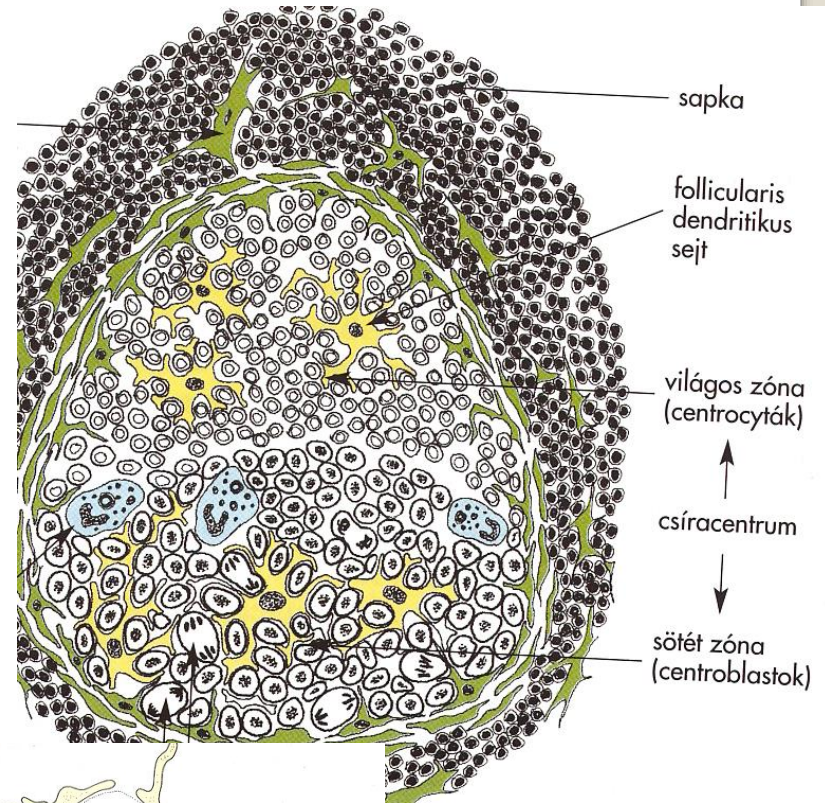
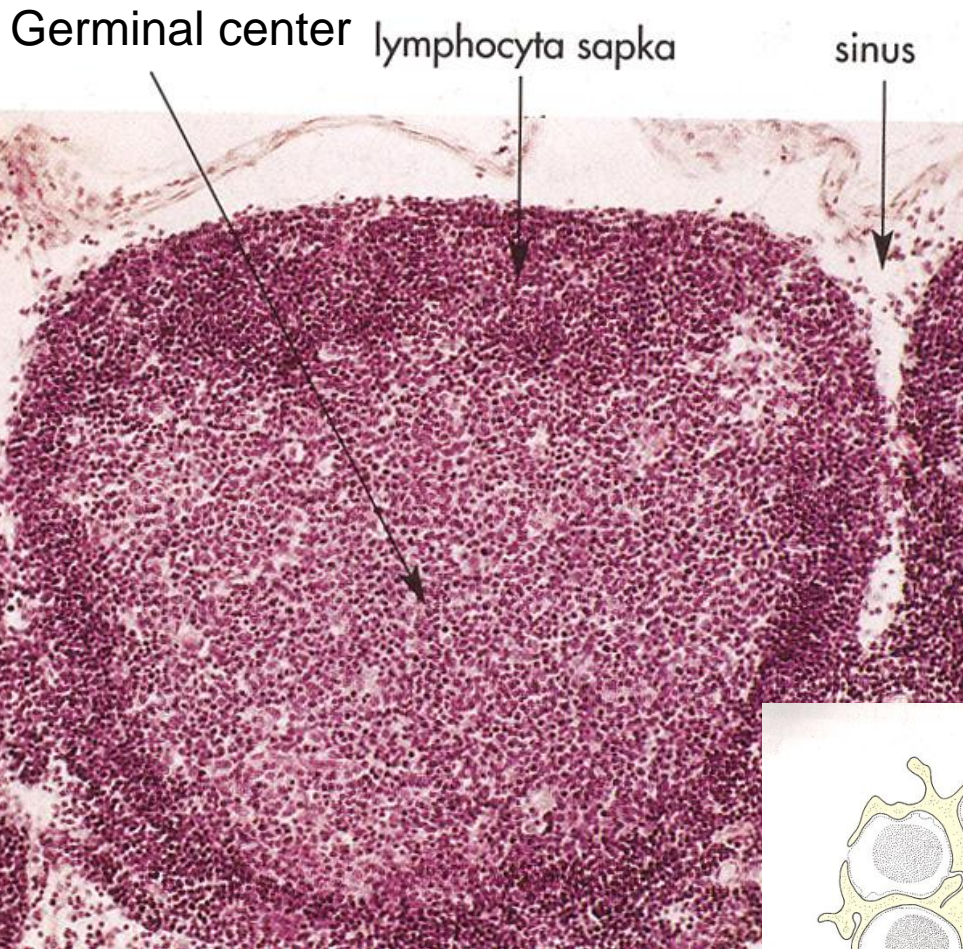
- T-dependens
- B-dependens



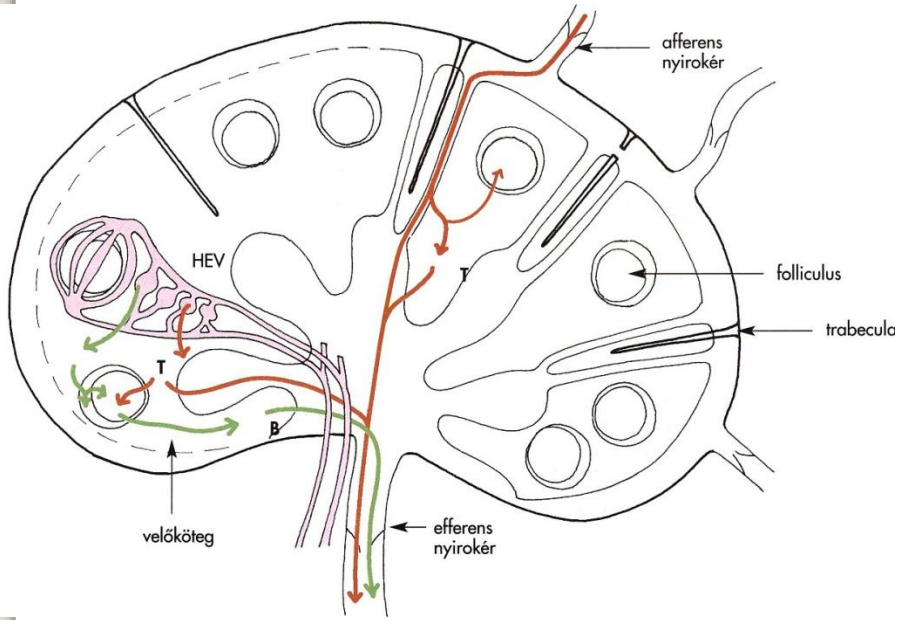
THE HISTOLOGY OF LYMPH NODES



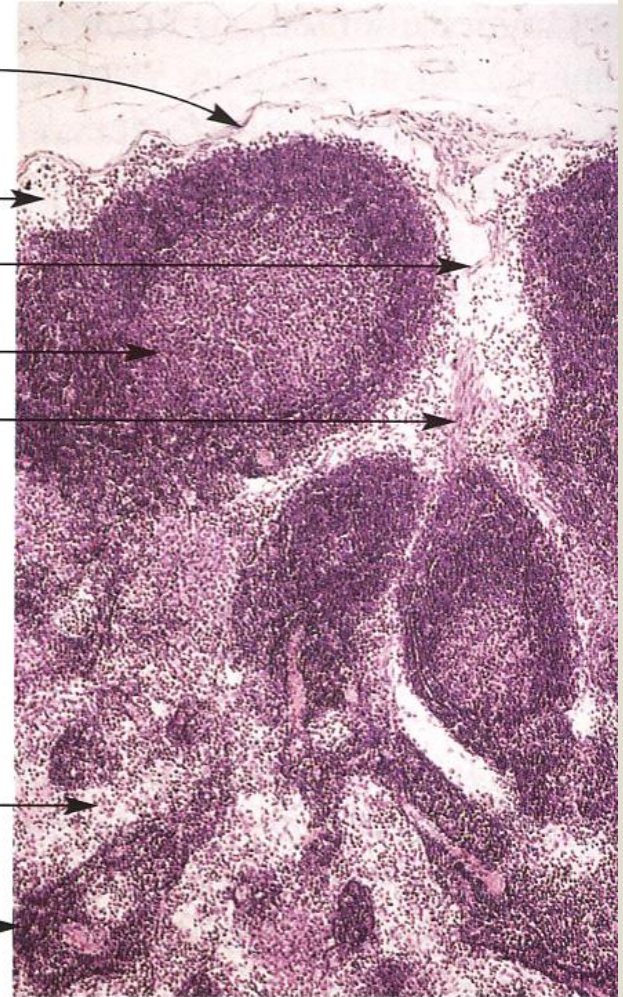
THE COMPOSITION OF LYMPH NODES



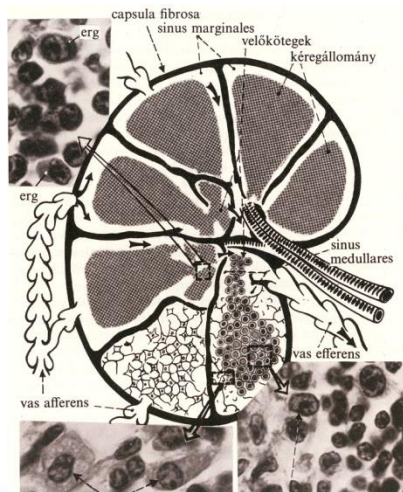
SINUSOIDS



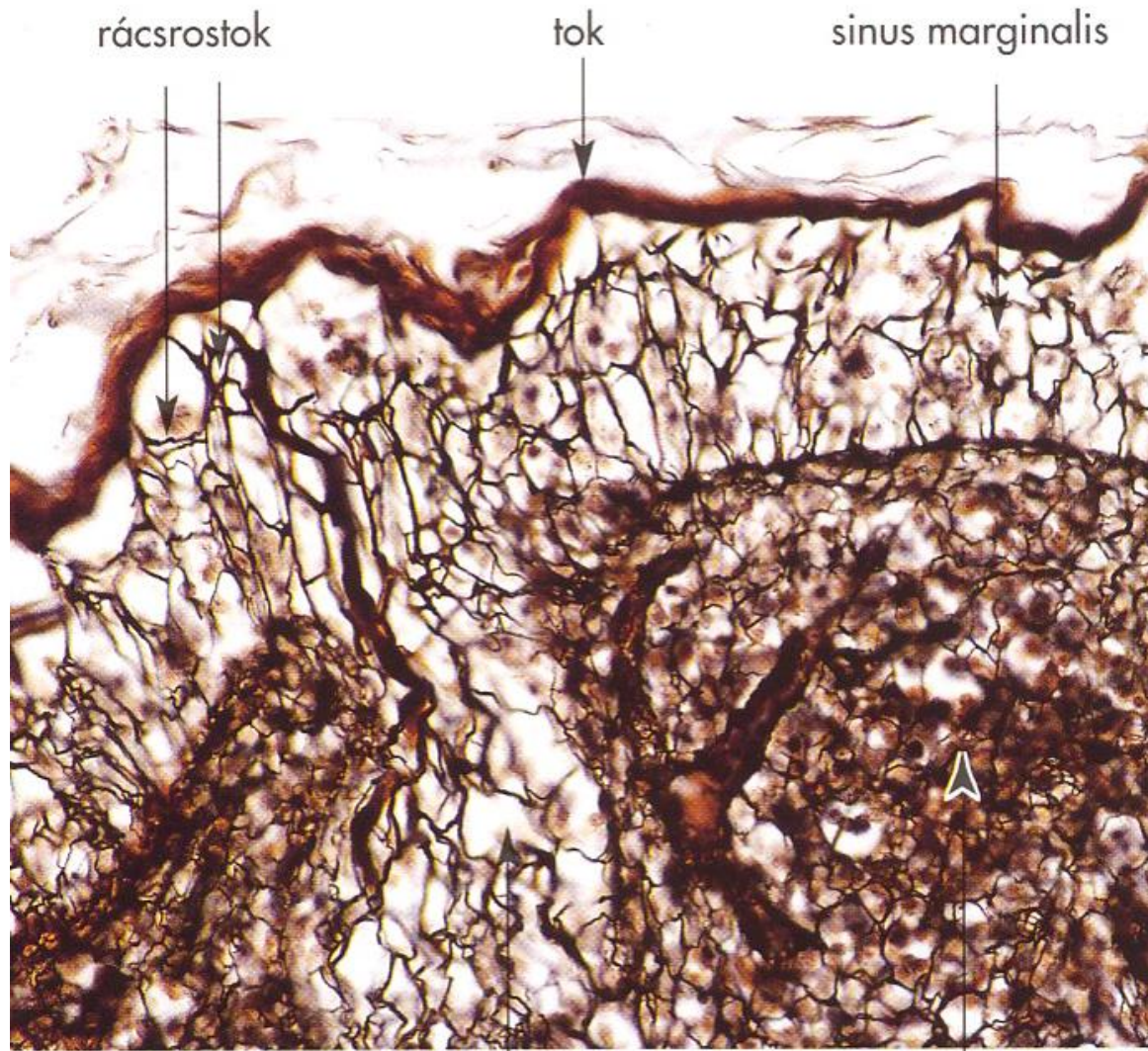
tok
 sinus marginalis
 inermidier sinus
 folliculus
 trabecula



velősínus
 velököteg



RETICULIN FIBRES



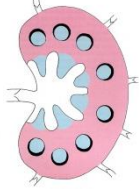
rácsrostok

tok

sinus marginalis

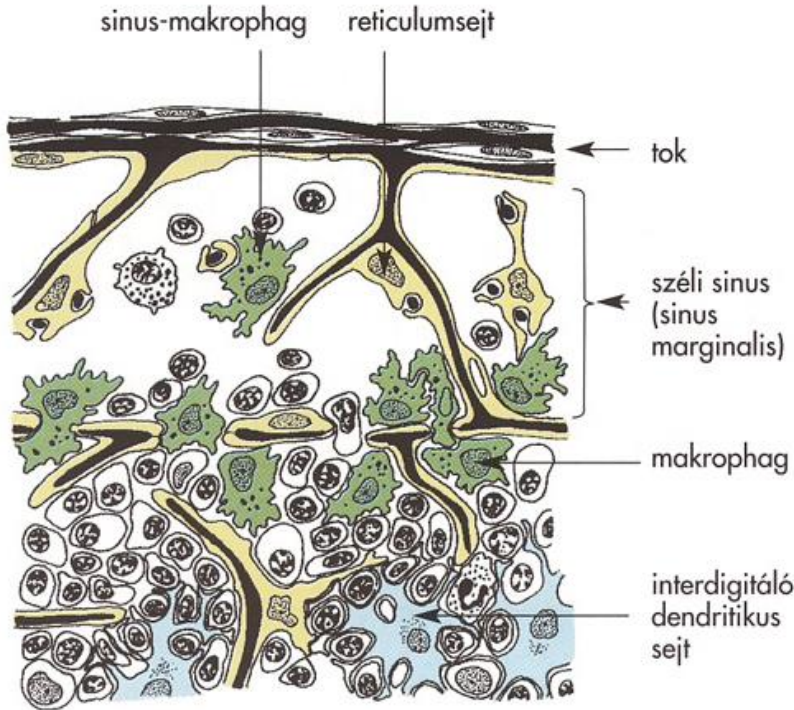
intermedier sinus

kéregállomány

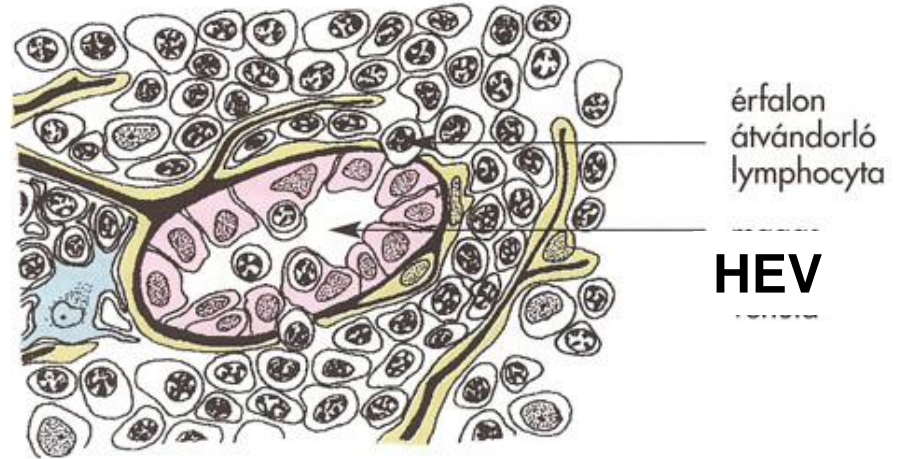


LYMPH NODES

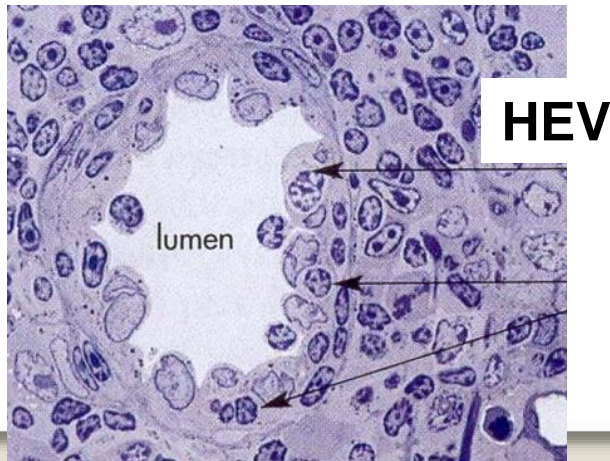
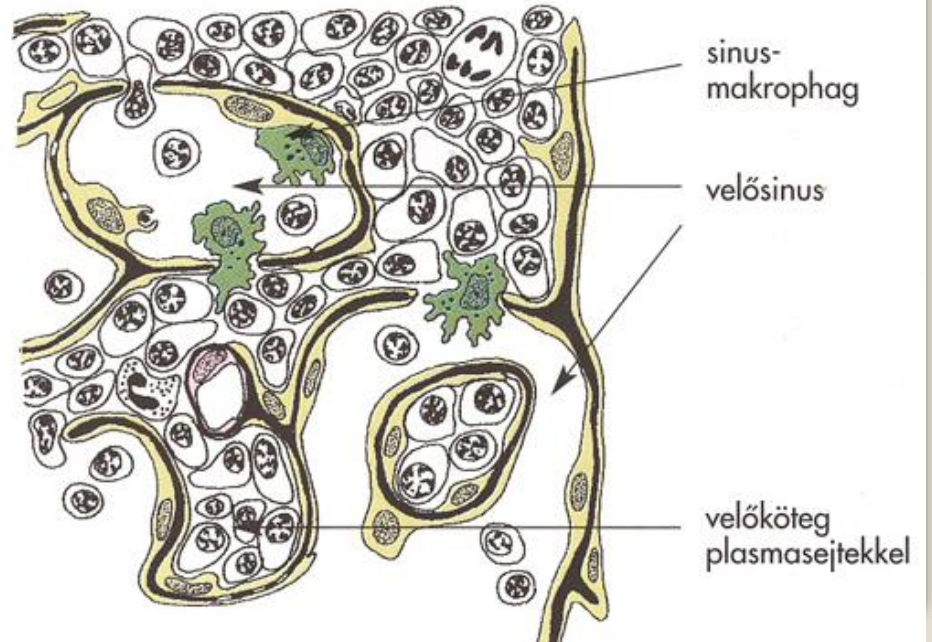
CORTEX

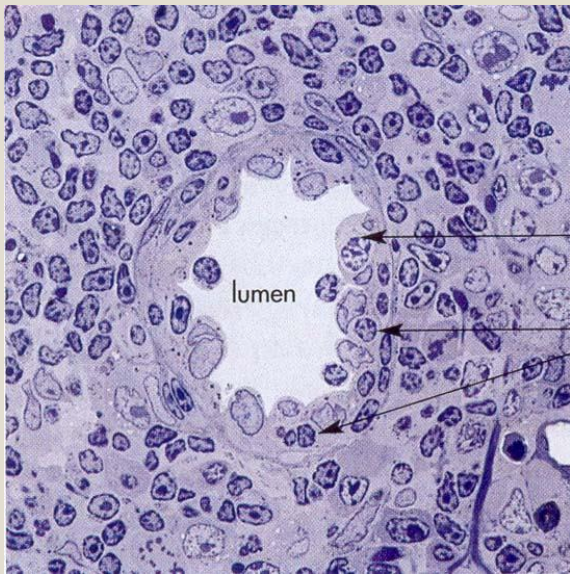


PARACORTEX



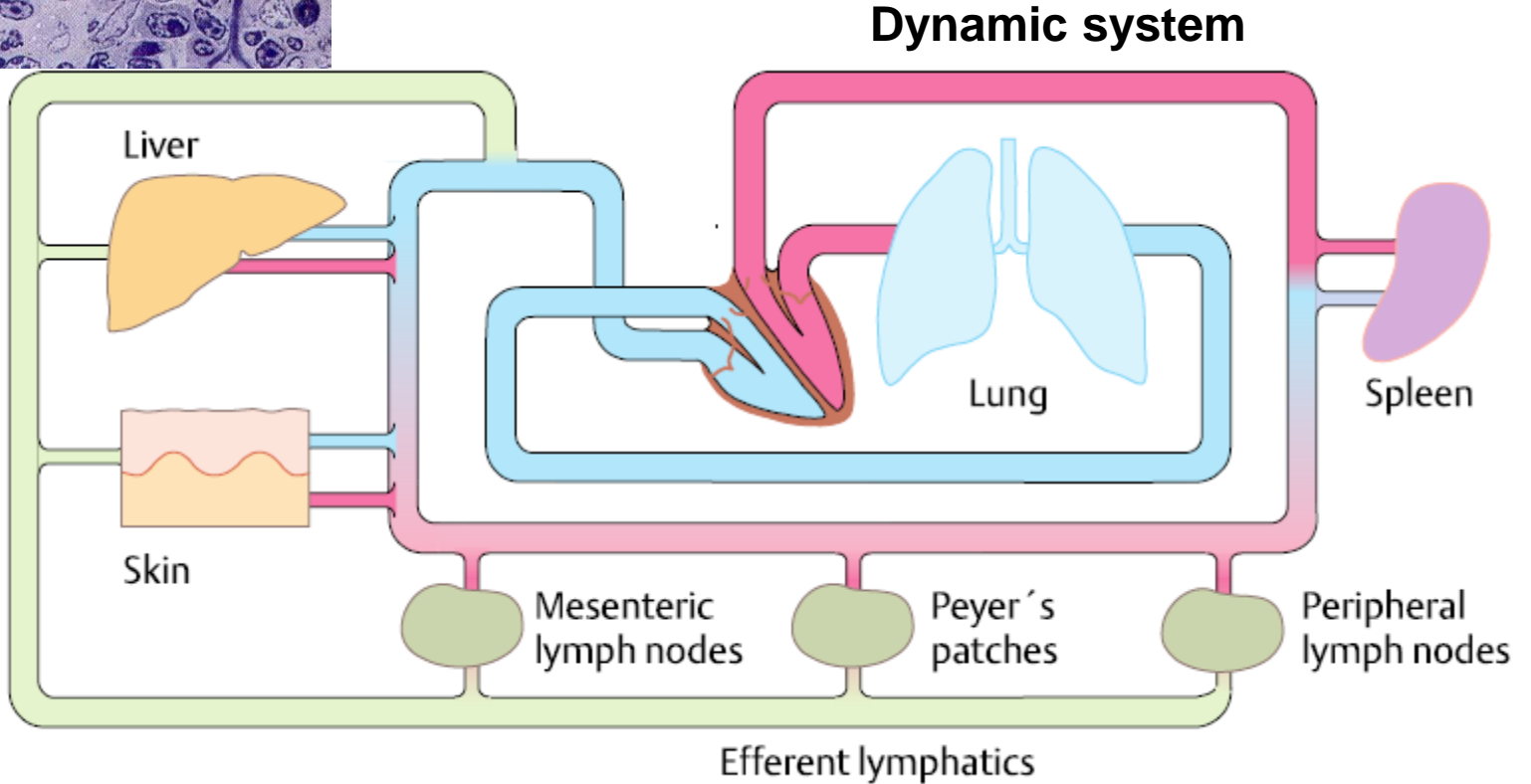
MEDULLA





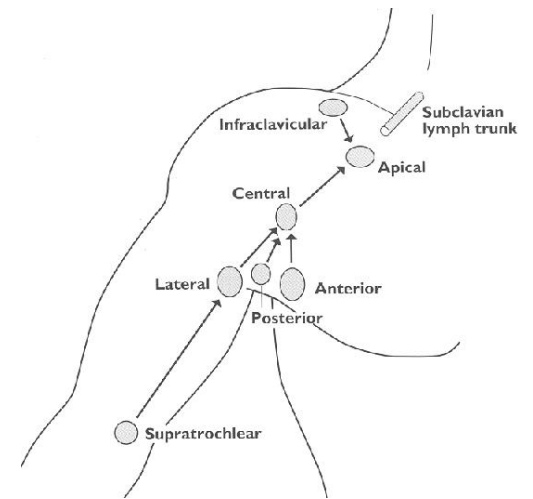
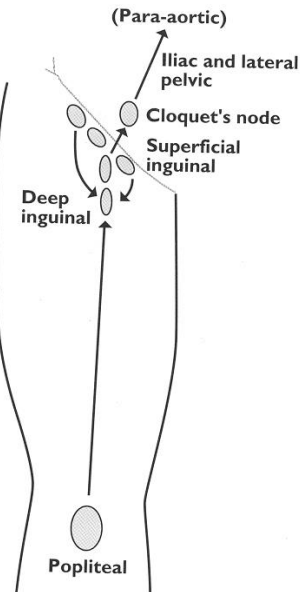
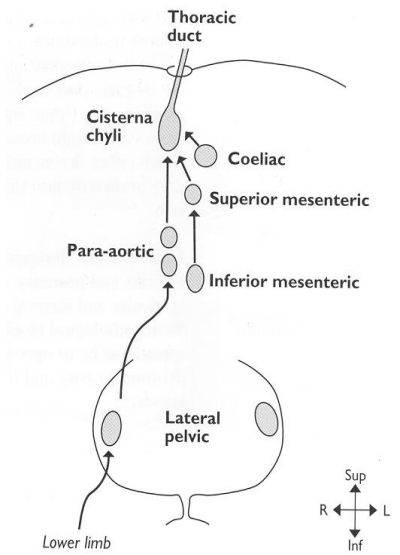
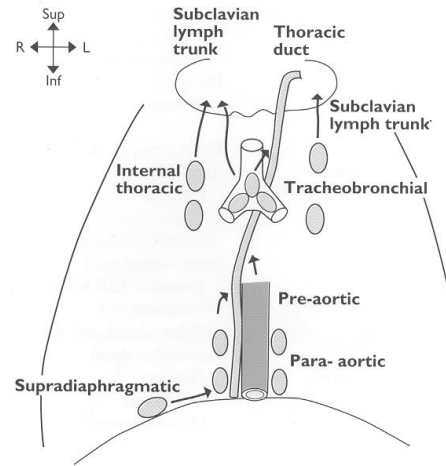
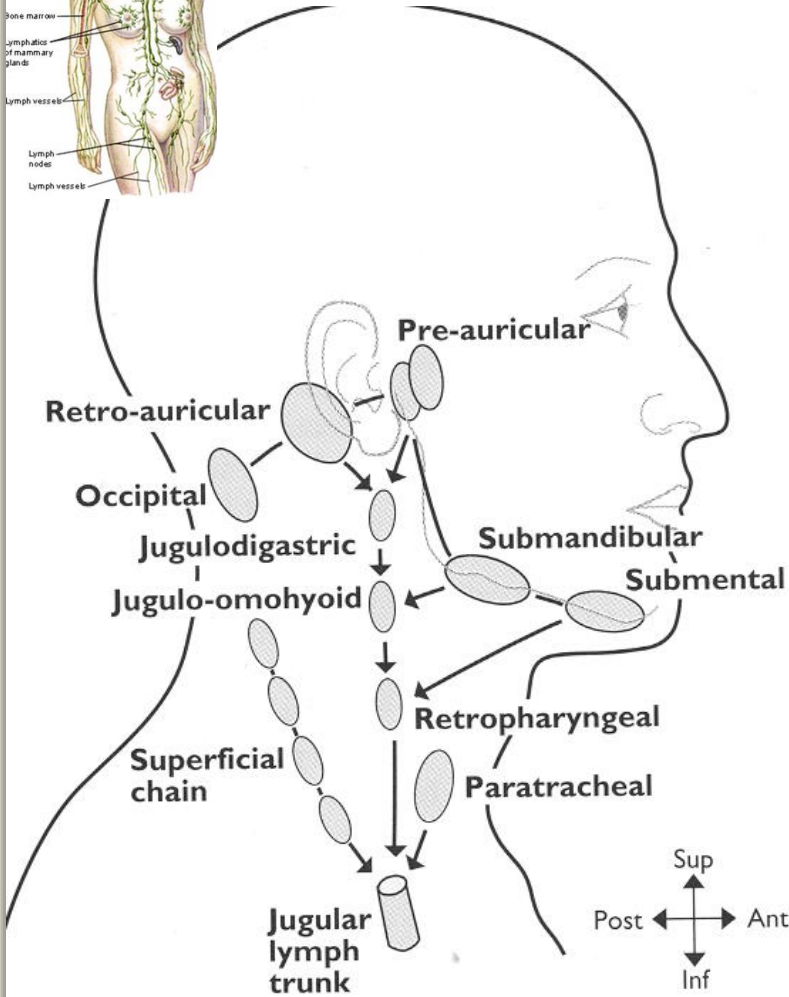
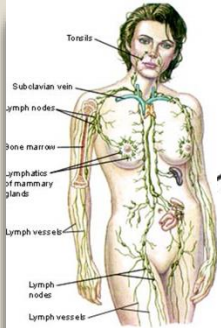
Lymphatic recirculation

HEV = high endothelial venules



B. Lymphatic recirculation

REGIONAL LYMPH NODES



CLASSIFICATION OF LYMPHATIC ORGANS - TONSILS

Lympho-epithelialis
„non capsulated”

Below the epithelium, superficial

Special
reticular

CT meshwork,
NO CAPSULE

Lympho-reticular
„encapsulated”

CT framework and capsule

Follicles

- sparse (foll. lymphatici solitarii)
- groups (foll. lymph aggregati)
- Peyer's patches
- Appendix

Thymus

Epithelial framework
NO FOLLICLES
T-lymphocytes

Lymph nodes

Nodi lymphatici

- primary
- secondary

Tonsils

- throat
- pharynx
- tongue
- (+ t. tubarii)

spleen

Haemolymphatic organ

- white pulp
- red pulp

TONSILS – WALDEYER'S RING



Hard palate

Soft palate

Adenoid

Tonsil

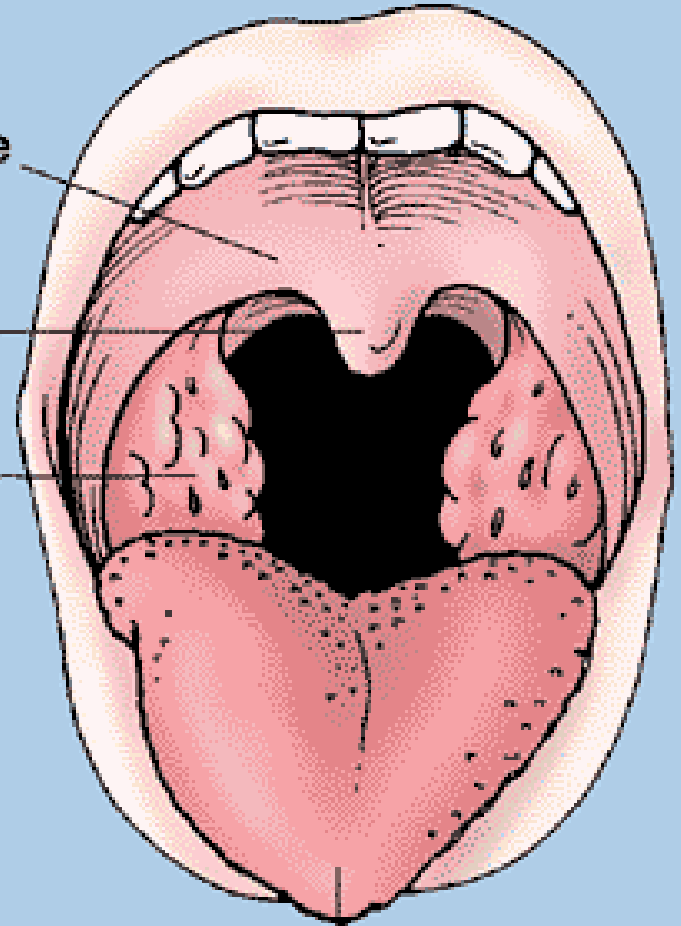
Tongue

Trachea

Soft palate

Uvula

Tonsil

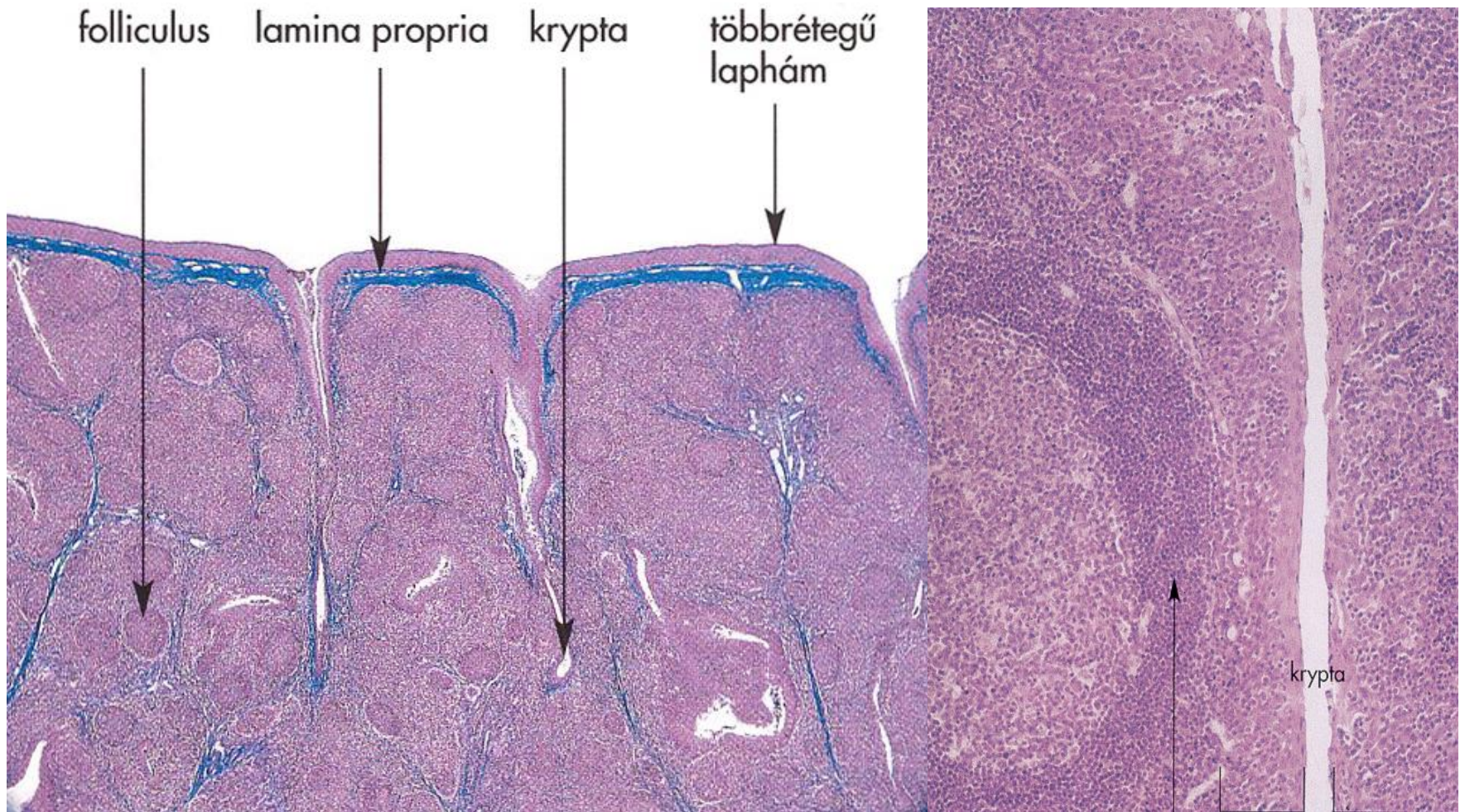


TONSILS GENERAL HISTOLOGY

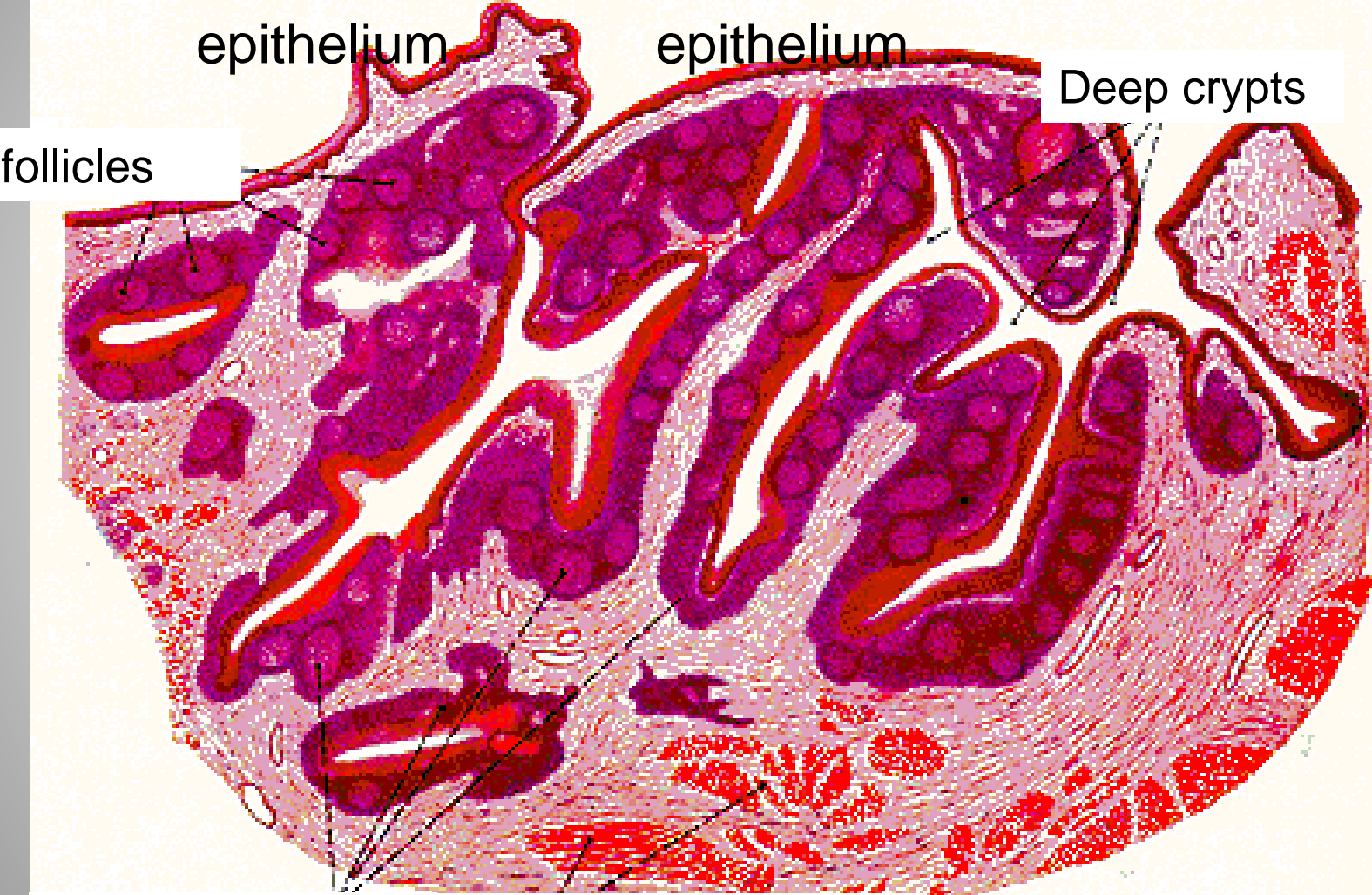
- ◆ BELOW THE EPITHELIUM
 - no capsule
 - BLIND SACS =(lacuna, crypt)
 - ◆ Epithelium infiltrated by lymph cells
 - ◆ Aggregated follicles
 - ◆ Faucial isthmus
- “the lymphatic ring of Waldeyer”



TONSILS GENERAL HISTOLOGY



PALATINE TONSIL



epithelium

epithelium

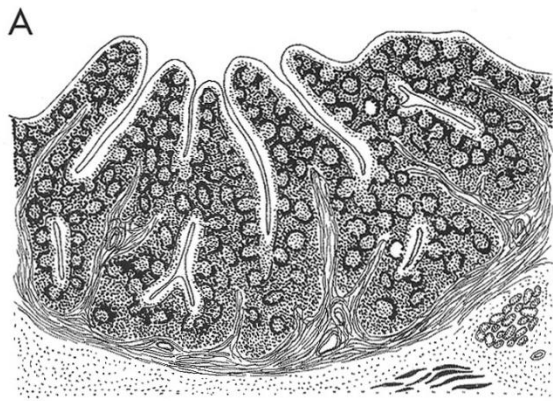
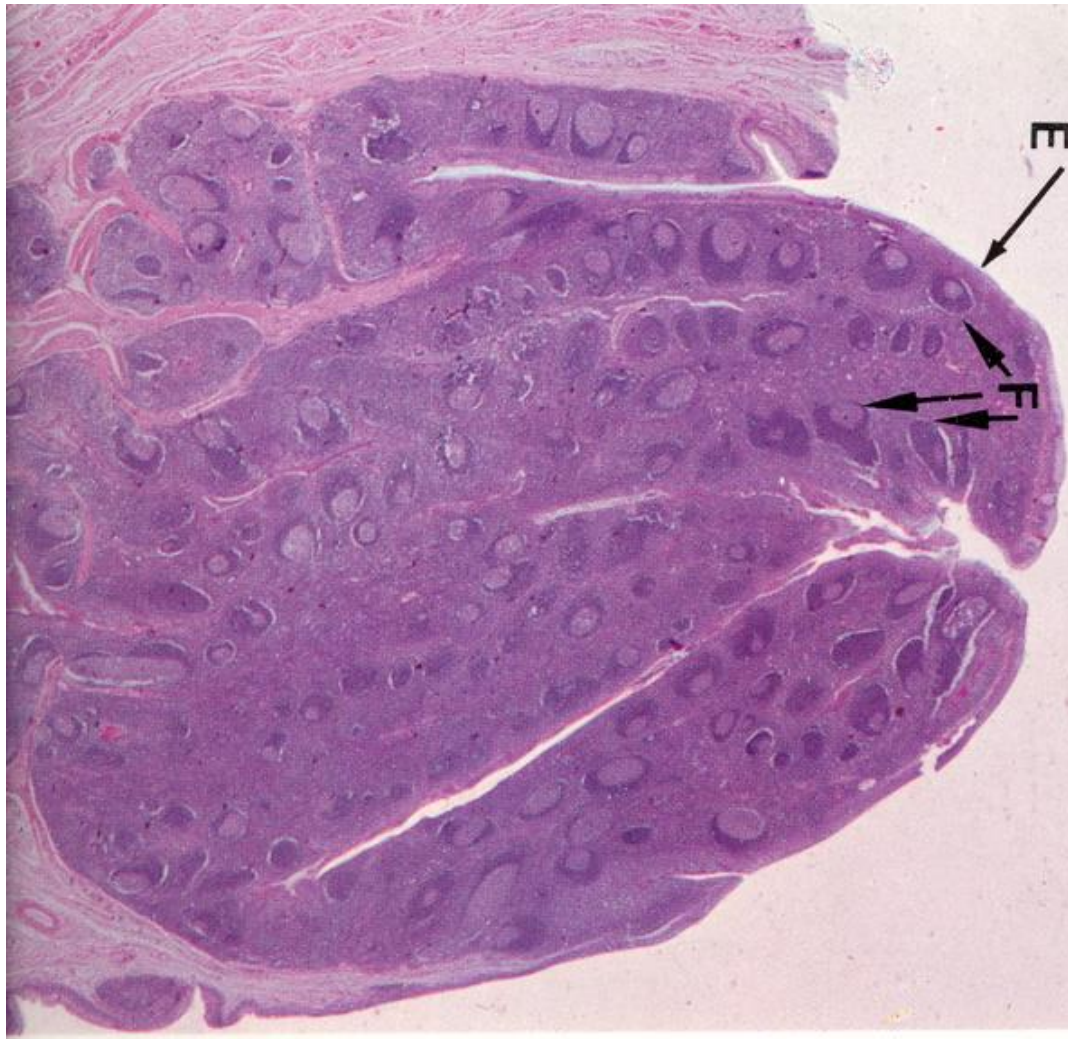
Deep crypts

follicles

Lymphatic tissue

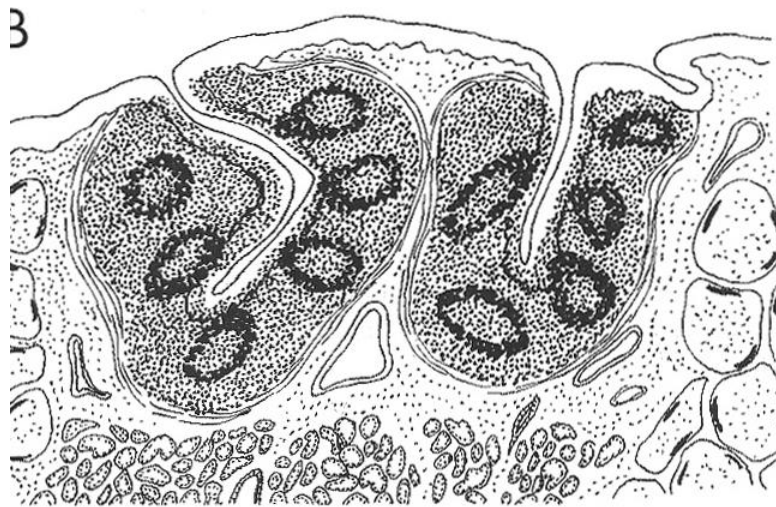
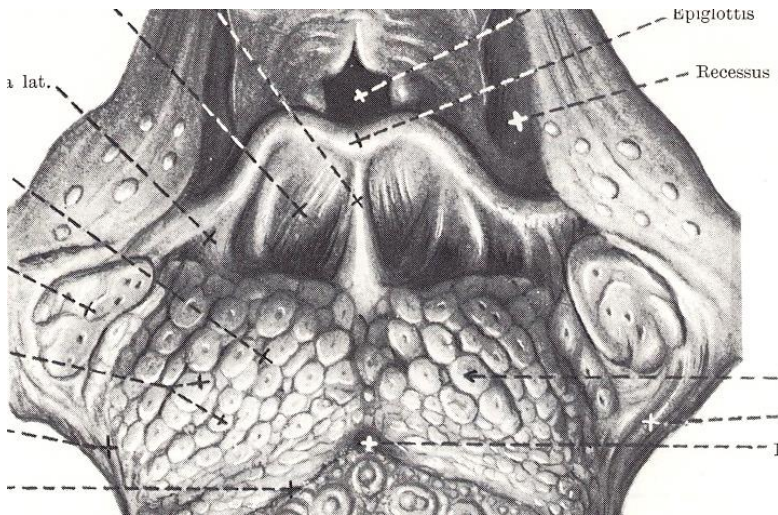
Skeletal muscle

PALATINE TONSIL

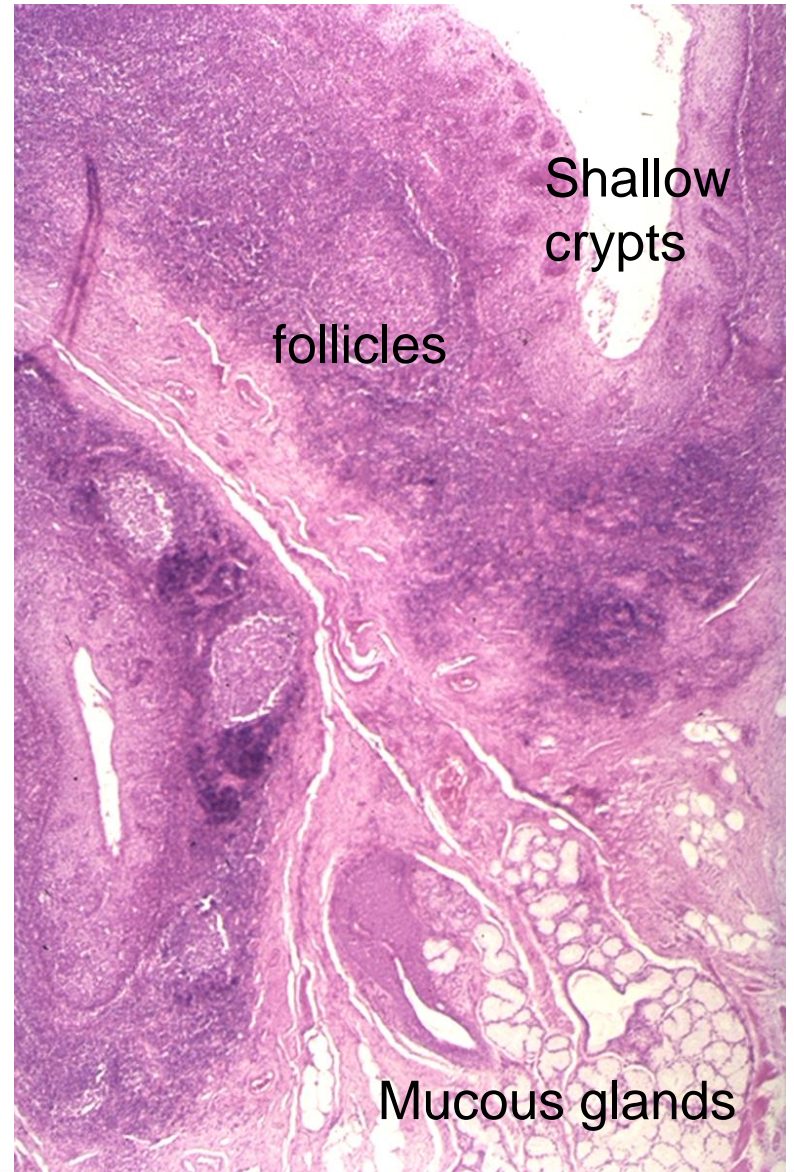


tonsilla palatina

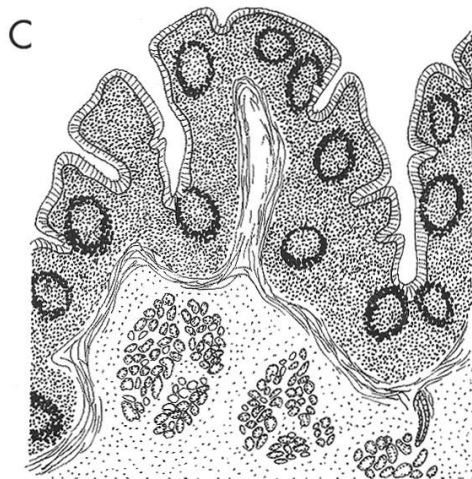
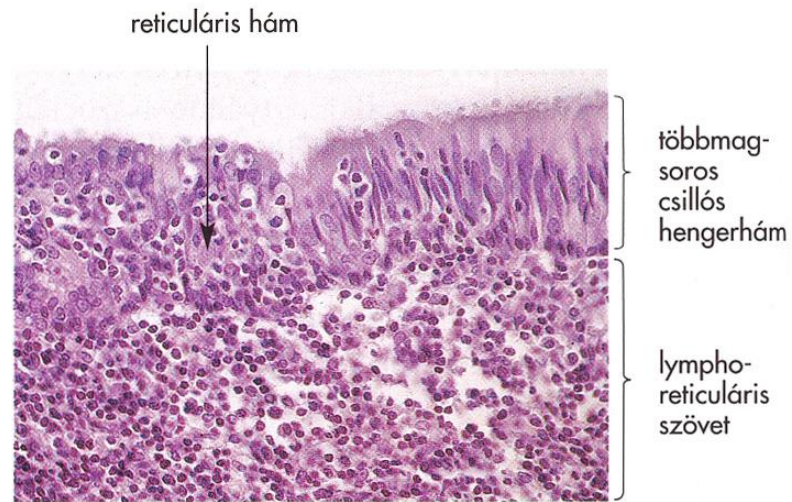
LINGUAL TONSIL



tonsilla lingualis



PHARYNGEAL TONSIL



tonsilla pharyngea



TONSILS - COMPARISON

tonsilla	palatina	lingualis	pharyngea
LOCATION	faucial isthmus	Root of the tongue	Post wall of pharynx
EPITHELIUM	Str squam	str. squam	Respiratory epithelium
LACUNAE	Deep bbranching	shallow	irregular
APPEARANCE	Large round	flat,	
LAYERS	hemi-capsulated glands, skeletal muscles	glands below, skeletal muscles/fat	Squam epith at places, glands, skeletal muscle
CLINICAL RELEVANCE	large in kids	No inflammation	Obliterates the choanae

MALT IN THE GI TRACT

MALT:

„mucosa-associated lymphoid tissue”

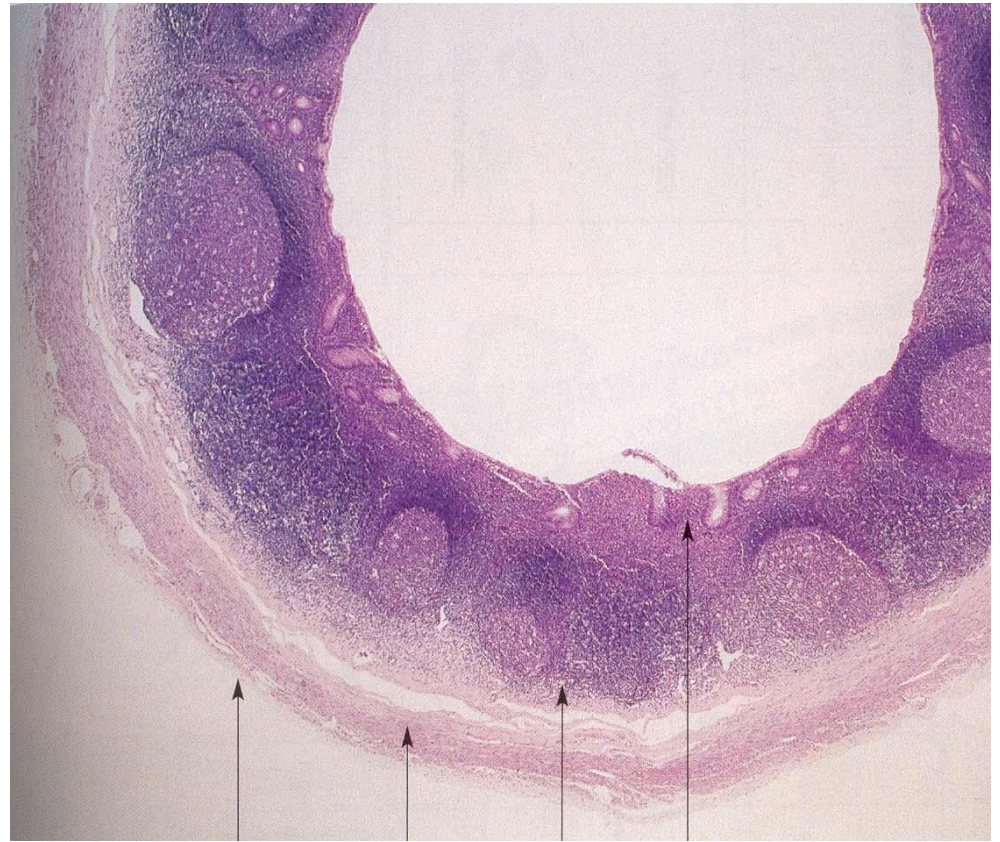


MALT IN THE GI TRACT

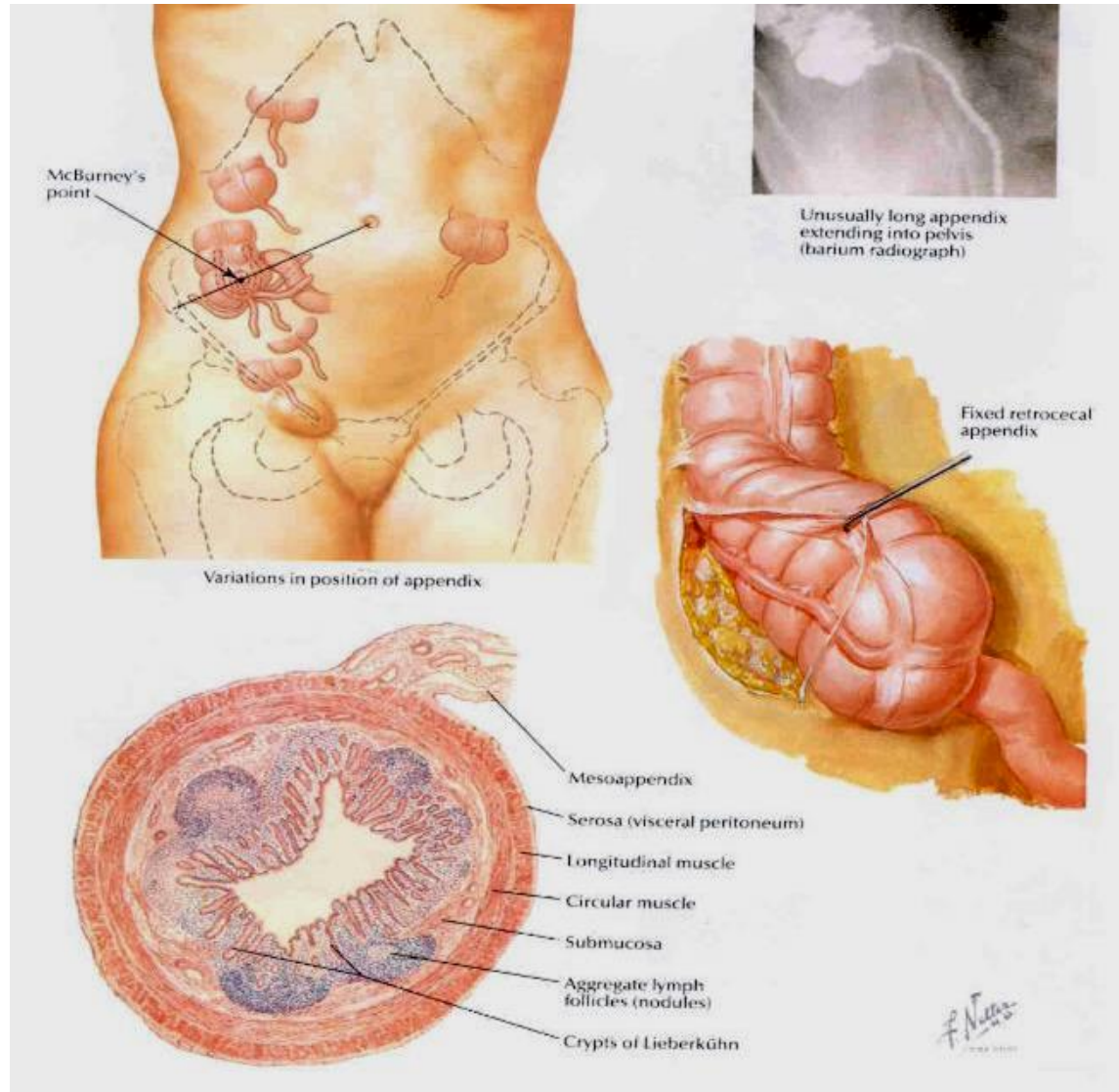
Peyer's patches/ Ileum

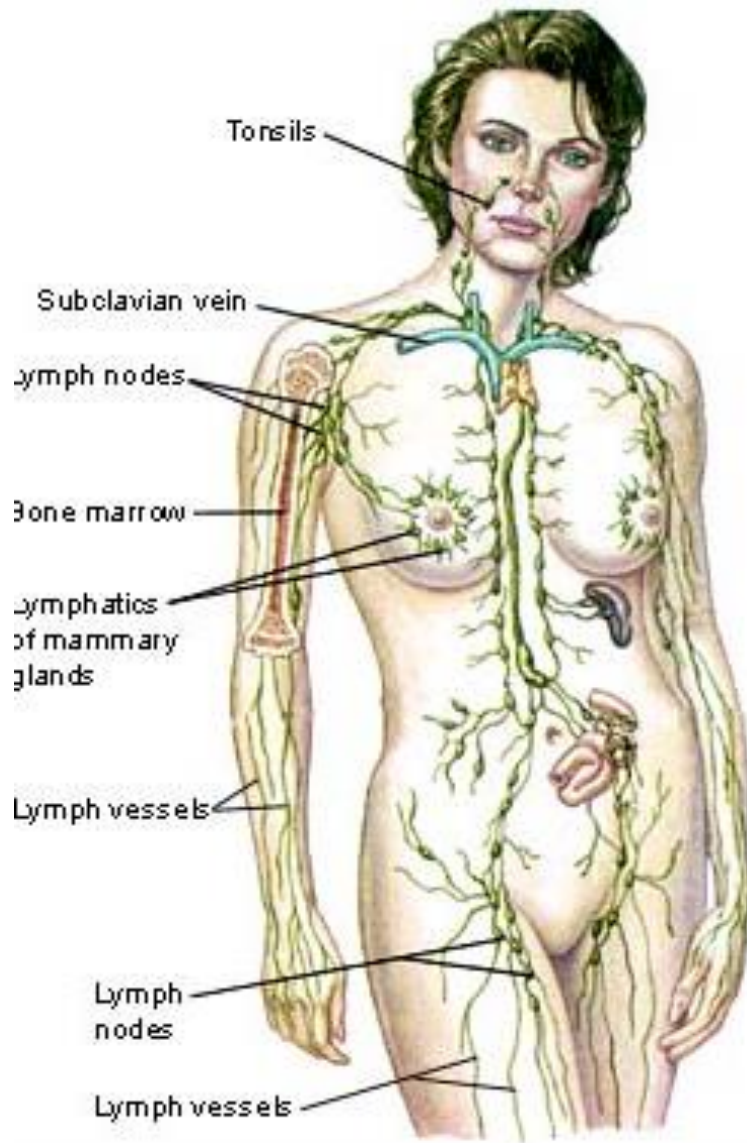


vermiform appendix



VERMIFORM APPENDIX





The Immune System

