組織學實驗: 淋巴結、脾臟、胸腺組織學 Histology laboratory: Histology of lymph node, spleen, and thymus

Please study these slides before coming to the class!

### **Sources of the Pictures & Text**

- Histology: A Text and Atlas (4<sup>th</sup> ed),
  M.H. Ross & W. Pawlina
- Wheater's Functional Histology (5<sup>th</sup> ed),
  B. Young & J.W.Heath

### Photomicrograph Taken by Department of anatomy, Kaohsiung Medical University

#### Learning Objective Microscopic structure of lymphatic system



- 1. Lymphatic vessel:
  - 93W4094 Lymphatic vessel (cs) H&E;
- 2. Lymph node:
  - <u>93W6559</u> Lymph node, H&E;<u>93W3236</u> Reticular tissue m&nfr;
- 3. Spleen:
  - 93W4130 Spleen, H&E;
  - 93W6560 Spleen, H&E;
- 4. Thymus:
  - H7295 Thymus, H&E;
- 5. Palatine tonsil:
  - 93W6555 Palatine tonsil, H&E





Fig.1b En: Endothelial cell

**Fig.1a 93W4094 Lymphatic vessel (cs) H&E.** Lymphatic vessels have the same tunics as blood vessels, but their walls are always much thinner. This reflects the fact that lymph flows under very low pressure. To direct the flow of lymph, lymphatic vessels contain more valves (V) than veins. The black dashed line rectangle shows the orientation of figure1b.

**Fig.1b** The valve consists of a single layer of endothelial cells (En) at each side.



**Fig.2 Diagram of lymph node structure.** Surrounding the lymph node is a capsule of dense connective tissue from which trabeculae (pink) extend into the substance of the node. Under the capsule and adjacent to the trabeculae are, respectively, the subcapsular sinus and the trabecular lymphatic sinuses (green). Afferent lymphatic vessels (arrows) penetrate the capsule and empty into the subcapsular sinus. The subcapsular sinus and trabecular sinuses communicate with the medullary sinuses.

**Fig.3 93W6559 Lymph node, H&E.** The dense outer portion of the lymph node is the cortex. It consists of aggregations of lymphocytes organized as nodules and a nodule-free deep cortex. The innermost portion, the medulla, extends to the surface at the hilum, where blood vessels enter or leave and where efferent lymphatic vessels leave the node. Surrounding the lymph node is the capsule.



Fig.4 93W6559 T: Trabecula; LN: Lymphatic nodule

**Fig.4 Photomicrograph of a lymph node.** This photomicrograph shows the cortex, deep cortex, and medulla. The capsule is composed of dense connective tissue from which trabeculae (T) penetrate into the organ. The lymphatic nodules (LN) in the black dash line circles are the characteristic of the outer cortex. The deep cortex is nodule free. It consists of densely packed lymphocytes. In contrast to these areas, the medulla is a less dense area.



Fig.5 93W6559 SS: Subcapsular sinus; MZ: Mantle zone; GC: Germinal center T: Trabecula; TS: Trabecular sinus

Fig.5 Photomicrograph of a lymphatic nodule. The capsule is composed of dense connective tissue from which trabeculae (T) penetrate into the organ. Immediately below the capsule is the subcapsular sinus (SS), which receives lymph from the afferent lymphatic vessels after they penetrate the capsule. The subcapsular sinus is continuous with the trabecular sinuses (TS) that course along the trabeculae (T). The area (black dashed line) shows the lymphatic nodule with a pale germinal center (GC) and a darker stained mantle zone (MZ) surrounding it. B cells proliferate and differentiate in the germinal centers.



Fig.6 93W6559 MS: Medullary sinus; \*: Medullary cords

**Fig.6 Photomicrograph of the medulla of a lymph node.** The medulla consists of narrow strands of anastomosing lymphatic tissue called medullary cords (\*), separated by light-appearing spaces, the medullary sinuses (MS). The medullary sinuses receive lymph from the trabecular sinuses as well as lymph that has filtered through the cortical tissue.



Fig.7 93W3236 SS: Subcapsular sinus; LN: Lymphatic nodule; MS: Medullary sinus

Fig.7 93W3236 Reticular tissue m&nfr. The Manuel silver method makes the reticular fibers black, and the nuclear fast red stains the nuclei red. The main structural support for the lymph node is derived from the capsule and trabeculae, which extend into the node. From these, a fine meshwork of reticular fibers extends throughout the node, providing a supporting framework for the mass of lymphocytes and accessory cells within the cortex and medullary cords. The reticular network is particularly dense in the cortex, except for the follicular areas where it is relatively sparse. Compare this slide with the H&E staining slide (93W6559) and find out the distribution of reticular fibers only demonstrated by m&nfr staining.



Fig.8 93W4130 T: Trabecula; V: Blood vessel; CA: Central artery

**Fig.8 93W4130 Spleen, H&E.** Note the capsule with several trabeculae (T) projecting into the substance of the spleen. In the center, there is a trabecula containing a blood vessel (V). The substance of the spleen is divided into white pulp and red pulp. White pulp (in the black dash line circles) consists of lymphocytes arranged around a central artery (CA). The red pulp constitutes the other greater bulk of the splenic tissue.

# Red pulp CA White pulp S Red pulp \*: Splenic cord; CA: Central artery; T: Trabecula Fig.9b Fig.9a 93W6560

S: Splenic sinuses

**Fig.9a 93W6560 Spleen, H&E.** This figure reveals at higher magnification of the spleen. The white pulp contains lymphatic tissue that follows and ensheathes the central artery.

#### Fig.9b

The red pulp consists of splenic sinuses surrounded by splenic cords. The venous sinuses are filled with red blood cells and appear red in spleen, thus the name.



#### Fig.10 H7295 T: Trabecula; C: Cortex; M: Medulla

**Fig.10 H7295 Thymus, H&E.** Examination of the thymus at low magnification reveals the lobules separated by trabecula (T). Each lobule is composed of a dark-staining basophilic cortex (C) and a lighter-staining medulla (M). The cortex contains numerous densely packed lymphocytes, whereas the medulla contains fewer lymphocytes and is consequently less densely. The lobules are not completely separate units; rather, they are interconnected.



Fig.11a H7295Fig.11bTC: Thymic corpuscles; T: Thymocyte; arrow: epithelioreticular cells

Fig.11a Photomicrograph of thymus medulla. This high magnification photomicrograph shows the medulla with varying numbers of circular bodies called Hassall's corpuscles (HC). The corpuscles are isolated masses of closely packed, concentrically arranged epithelioreticular cells; these cells exhibit flattened nuclei. In addition to numerous thymocytes (T), the micrograph also shows epithelioreticular cells (arrows), with their large, pale-staining nuclei.

**Fig.11b** A higher magnification photomicrograph shows the basophilic thymocytes and the large, pale-staining epithelioreticular cells.



LN: Lymphatic nodule; arrows: Tonsillar crypt; SSE: Stratified squamous epithelium

**Fig.12a 93W6555 Palatine tonsil, H&E.** This micrograph shows the general structural features of palatine tonsil. The epithelium that forms the surface of the tonsil dips into the underlying connective tissue in numerous places, forming crypts known as tonsillar crypts (arrows). Numerous lymphatic nodules (LN) are evident in the walls of the crypts. The stratified squamous epithelium (SSE) lining the tonsillar.

## Summary

93W4094 Lymphatic vessel	Valve, Endothelial cell
93W6559	Capsule, Trabeculae,
Lymph node	Subcapsular sinus,
0014/0000	Trabecular sinus,
93VV3236 Poticular	Cortex, Deep cortex, Medulla,
tissue m𝔫	Lymphatic nodule, Mantle zone,
	Germinal center, Medullary sinus,
	Medullary cords, Reticular fibers

# Summary

93W4130 Spleen	Capsule, Trabeculae, White pulp, Central artery, Red pulp,
93W6560 Spleen	Splenic cords, Splenic sinuses
H7295 Thymus	Capsule, Cortex, Medulla, Lobule, Epithelioreticular cells,
	I hymic corpuscles, I hymocytes
93W6555	Stratified squamous epithelium,
Palatine tonsil	Crypts, Lymphatic nodule