LYMPH GLAND

By : Group 1
ANATOMY LYMPH NODE
Lymphatic Organs

- Red bone marrow
- Thymus gland
- Lymph nodes
- Lymph nodules
- Spleen

Primary organs

Secondary organs
Lymph Node Structure

- Afferent lymphatic vessel
- Valve to prevent backflow
- Capsule
- Nodule
- Sinus
- Hilum
- Efferent lymphatic vessel
Lymph Nodes

- Firm, smooth-surfaced, bean-shaped with large convex surface and smaller concave area, the hilus.
- Lymph node is divided into cortex (contains the germinal centres- lymphocytes are continually produced) and medulla.
• Organisational order
  Afferent lymph vessel ➔ subscapular sinus ➔ medullary sinus ➔ efferent lymph vessel
• Except in pig the organisational order reversed
• Lymph centre
  - carnivor and ruminant-fewer but individually large lymph nodes
  - pig and horse-large numerous of relatively small lymph nodes
Lymph Nodes

• Lymph nodes have two functions;
  i. they filter the lymph as it slowly passes through
  ii. they are battlegrounds where lymphocytes and foreign agents are destroyed during an infection.
Lymphatic System Function

• Have three obvious functions
  • i. Drainage
    • Collect water and that has leaked out of the blood in capillary beds due to fluid pressure and returned it to the bloodstream
  • ii. Disposal
    • Foreign cells and materials /cellular debris are brought to the lymph nodes for disposal
  • iii. Delivery
    • Picked up fats that had been absorbed in the small intestine and delivers it into the bloodstream.
HISTOLOGY OF LYMPH NODE
Lymph nodes are small lymphoid organs distributed throughout the body at specific locations and connected to other nearby nodes by lymphatic vessels carrying lymph fluid. A node consists of two main regions cortex (long left arrow) and medullar (arrowhead). The blood vessels and efferent lymphatic channel pass through hilum (bottom arrow). The primary function of lymph node is to respond to non-self antigens and generate antigen-specific soluble antibodies from mature plasma cells.
The lymph node is covered with a continuous collagenous capsule (arrowhead) which is only incomplete at the hilum where a single nodal artery enters the node and a single vein and a single efferent lymphatic vessel exit the node (arrow).
LYMPH CELL
Lymph cell

- Include:
  - T cell
  - B cell
  - NK cell
  - Mast cell
  - Reticular cell
  - Dendritic cell
    - Follicular
    - Interdigitating
• **Primary follicles:** lymphoid follicles without a germinal centre.

• **Secondary follicles:** lymphoid follicles with a germinal centre. These mostly contain B-cells.
T cells

- **T-cells**, which are made in the bone marrow, but have to migrate and reside in the Thymus before they are matured.
- The T cells migrate to the deep cortex ("paracortex")

**Function:**
- Manage the immune response
- Attack and destroy foreign cells
afferent lymphatic vessels

Paracortex (T zone)
mainly T-cells

Cortex (T+B zone)

radial sinus

germinal center
(secondary follicle)

subcapsular sinus

Primary follicles
(B zones)

medullary sinus

medulla

efferent lymphatic vessel

capsule
B cells

- **B-cells**, which are made and matured in the bone marrow
- The B cells migrate to the nodular cortex and medulla

**Function:**
- Produce plasma cells, which secrete antibodies
- Antibodies immobilize antigens
• [LYMPH NODE, NORMAL HISTOLOGY]. This image shows two secondary B-lymphoid follicles and intervening paracortical zone composed of T-cells. The secondary follicles are composed of an outer mantle zone (#1) and an inner germinal center (#2). The paracortical zone is composed almost entirely of small CD3+ T-cells. The mantle zone B-cells are composed of naïve B-cells and represent outer extension of primary follicular B-cells.
• [LYMPH NODE, NORMAL HISTOLOGY]. A reactive lymphoid follicle shows bcl-2 expression by mantle zone B-cells (arrowhead) and all T-cells inside (long thin arrow) or outside of germinal centers.
Macrophage

Reticular cells on reticular fibers

Lymphocytes - T & B Cells

Reticular fiber
T lymphocytes and cancer cell. Coloured scanning electron micrograph (SEM) of T lymphocyte cells (red) attached to a cancer cell. T lymphocytes are a type of white blood cell that recognise a specific site (antigen) on the surface of cancer cells or pathogens and bind to it. Some T lymphocytes then signal for other immune system cells to eliminate the cell. The genetic changes that cause a cell to become cancerous lead to the presentation of tumour antigens on the cell's surface.

- Magnification: x2300 when printed at 10 centimetres wide.
Mast cells

- Mast cells are in round or oval in shape.
- Contain granules that are **metachromatic**
- easily seen in the connective tissue spread.
- Function:
  - play a large role in allergic responses because the release of histamine
  
  - The toluidine blue component of the stain applied to this slide renders the mast cell granules blue-purple.
they release the chemical known as histamine
Natural killer cell

- Natural killer cells (also known as NK cells, K cells, and killer cells)
- They are **not** T cells or B cells
- A **small fraction** (~2%) of the lymphocytes circulating in the blood
- They are **derived** from the **bone marrow**.
- They circulate in the blood and contain **cytolytic granules**.

- Simplified illustration of Natural Killer Cell (NK Cell). Original image is 3,500 x 3,500 pixels
NATURAL KILLER CELL IMAGE:

• A natural killer cell (NK Cell) is shown as a purple cell attached to a green target cell.

• These cells can act non-specifically to destroy transformed (i.e. cancer) cells or cells that have been infected by a virus.

• Cytotoxic granules are shown as blue spheres at the edge of the killer cell where it touches the target cell.
NK cells

• Function:

  – Most of these are called natural killer (NK) cells because they are already specialized to kill certain types of target cells, especially

    (a) host cells that have become infected with virus
    (b) host cells that have become cancerous.
Reticular cells

- **Reticular cells** and reticular fibres
- Form a delicate network between the capsule and trabeculae.
• Only their large and light nuclei are easily visible in the microscope.
Function

- Lymphocytes and macrophages are housed in the network of reticular cells.
- The reticular fibres are formed by them.
- They serve to keep the sinuses open.
- They support the massive number of lymphocytes and macrophages.

Beneath the capsule is a subcapsular sinus which lymph flows from the afferent lymphatic vessels.
Dendritic Cell

- Located in peripheral tissues or lymphoid tissues
- Function is to process antigen and present it on the surface to other cells of the immune system
• Function of dendritic cells in human may differ from the animal slightly.
  Eg: In brown rats, a type of dendritic cells exists appear to display killer-cell like activity
• Although typically described in mammals, dendritic cells have also been found in chickens and turtles
Dendritic cell in lymph node
Interdigitating Dendritic Cells

• Large, with abundant pale and ill-defined cytoplasm, a markedly irregular nucleus.
• Located in paracortex
• interact with T-lymphocytes to help T-cells function to remove the foreign matter.
• They are dendritic cells that is formed from Langerhans cells moved into lymph node from the skin
• They don’t have Birbeck granules
Dendritic cell

Langerhans cell
Follicular Dendritic Cells

• Same to interdigitating dendritic cells morphologically

• Cells of the immune system found in primary and secondary lymph follicles of the B cell areas of the lymphoid tissue

• Function: Bind foreign matter but do not process them like interdigitating dendritic cells. They keep it on their surface and transport it to other places where it can be processed, B-lymphocytes. B-lymphocytes will remove the foreign matter.
A paracortex with many lymphocytes and interdigitating dendritic cells (arrow)
Long arrow = Follicular dendritic cell

Germinal centre
Disease involved in lymph node
Lymphatic metastases (bitch). From an 11-year-old female Doberman with mammary carcinoma. Groups of large tumour cells with dark nuclei and eosinophilic cytoplasm within thin-walled lymphatic vessels. The other lymphatics in the section are dilated and the connective tissue is oedematous, which suggests possible lymphatic blockage by tumour deposits.

H & E. ×250.
Lymphosarcoma (dog).

Section of lymph node from a 4-year-old male dog showing dense sheets of large, immature lymphoid cells with round-to-irregular nuclei and prominent nucleoli. Several mitotic figures are present.

H & E. ×250.
• THANK YOU (^^,)

BLUE GLAUCUS
Positive stains

• Germinal centers have strong dense bcl6 and CD10 expression TdT (terminal deoxynucleotidyl transferase) is expressed by premature B and T cells

• B cells express CD19, CD20, CD79
  – Antigen stimulated B cells with the capacity to differentiate toward plasma cells express MUM1/IRF4 and CD138

• T cells express CD2, CD3, variable CD4 and CD8

• The different types of T-cell and B-cell cannot be distinguished using histological stains, but can be distinguished by immunostaining for the different cell surface markers that these cells express
Lymphatic System

• Water and solutes undergo ultrafiltration process caused by the pressure of the blood at the capillary beds to form interstitial fluids.

• the interstitial fluid will be returned to the blood by way of an open circulatory system (called the lymphatic system).
The lymphatic system is a one-way system consists of lymphatic capillaries, lymphatic vessels, lymph nodes and lymphatic organs.
• Excess fluid that is drained into blind-ended lymph capillaries is called the lymph.

• The lymph starts at the capillary beds, where they enter the lymph capillaries and later merges with the lymph vessels/lymph veins that are equipped with valves to prevent backflow of fluid toward the capillaries.

• At strategic locations, lymph veins enter lymph nodes, which are small, organized mass of lymph tissue. The lymph nodes produce lymphocyte. Lymph contains a higher number of lymphocyte than blood.