Lymphoid Tissues
Peripheral or Secondary Lymphoid Tissues

- Lymph nodes
- Spleen
- Mucosal associated-lymphoid tissues (MALT)
Secondary Lymphoid Tissues

- Trap antigen-bearing dendritic cells.
- Initiation of adaptive immune response.
- T cell and B cell activation.
Lymph Nodes

- Encapsulated bean-shaped structures,
- Full of lymphocytes, macrophages, and dendritic cells.
- Sites of Immune responses

- Morphologically divided into:
  - Cortex
  - Paracortex
  - medulla
Figure 1.8: Organization of a lymph node. As shown in the diagram on the left, a lymph node consists of an outermost cortex and an inner medulla. The cortex is composed of an outer cortex of B cells organized into lymphoid follicles, and deep, or paracortical, areas made up mainly of T cells and dendritic cells. When an immune response is underway, some of the follicles contain central areas of intense B-cell proliferation called germinal centers and are known as secondary lymphoid follicles. These reactions are very dramatic, but eventually die out as senescent germinal centers. Lymph draining from the extracellular spaces of the body carries antigens in phagocytic dendritic cells and macrophages from the tissues to the lymph node via the afferent lymphatics. Lymph leaves by the efferent lymphatic in the medulla. The medulla consists of strings of macrophages and antibody-secreting plasma cells known as the medullary cords. Naive lymphocytes enter the node from the bloodstream through specialized postcapillary venules (not shown) and leave with the lymph through the efferent lymphatic. The light micrograph shows a section through a lymph node, with prominent follicles containing germinal centers.
LYMPH NODE HISTOLOGY

- Germinal centers
- Macrophage
- Lymphocytes
Lymph Nodes

1. **Cortex**
   - Contains $1^\text{ary}$ & $2^\text{ary}$ follicles mainly B cells + GCs
   - mostly B cells, macrophages and follicular dendritic cells.

2. **Paracortex** → Mostly T cells, and dendritic cells.

3. **Medulla** → Mostly plasma cells
Lymph Nodes

• Lymphocytes enter via high endothelial venules (HEVs) or afferent lymphatic vessel.
• Lymphocytes exit via efferent lymphatics which drain into the thoracic duct and back to the blood
Spleen

- Largest lymphoid organ
- Major role in mounting immune responses to antigens in the bloodstream
- Filters blood and traps antigens
- White pulp
- Red pulp
Spleen white pulp

- Red pulp
- Marginal sinus
- Germinal centre
- T cell area
- Central arteriole

Marginal zone
Structure of the Spleen

- **White pulp**
  - populated primarily by T cells.
  - Primary lymphoid follicles are rich in B cells and some contain germinal centers (GCs).
  - Marginal zone, is populated by lymphocytes and macrophages
Spleen-function

• Destruction and removal of blood-borne antigens.

• Site of B cell maturation into plasma cells.

• Phagocytosis of bacteria and worn-out RBCs, WBCs and platelets.

• Storage of platelets
The Mucosal Lymphoid tissues

• Mucosal associated lymphoid tissue = MALT
• Gut associated lymphoid tissue = GALT
• Bronchial associated lymphoid tissue = BALT

Dual Functions:
defence against pathogens and prevention of response to commensal flora, food antigens or inhaled antigens.
GALT: Peyer’s Patches

• Located in ileum

• Structure:
  – dome-like “follicle-associated epithelium” (FAE)
    • M (microfold) cells that lack microvilli

  – underlying lymphoid follicle, containing dendritic cells, macrophages, T- & B-cells

• Function:
  – antigen-sampling: endocytosis / transcytosis
  – initiation of immune responses in naive lymphocytes
Gut-associated Lymphoid Tissues (GALT)
GALT- Peyer’s patch

3-color fluorescence staining-in cryosection of human Peyer’s patch.

B cells (CD20, green)
T cells (CD3, red)
Epithelium (cytokeratin, blue)
Payer’s Patches and intestinal mucosa
Antigen presentation at mucosal surface

- Microorganisms in lumen sampled by Microfold (M) cells
- Transported to dendritic cells in Peyer’s patch or lymphoid follicle
- Stimulate T cell and B cell responses
Lymphoid Follicles

- Primary follicles contain resting B cells
- Secondary follicles contain GCs (sites of B cell proliferation)
- T cells located around follicles
Germinal Centres (GC)

- Sites of intense B-cell proliferation, selection, maturation.

- Dark zone: rich in proliferating B lymphocytes, Light zone: contains FDCs and centrocytes.

- Follicular B cells in GC undergo class-switch recombination and somatic hypermutation
By the end you will be able to answer these questions

• What are the primary and secondary LTs and their respective functions?

• What are the main features and functions of Peyer’s patch (PP)?

• What is germinal centre, structure and its function?
Homework assignment:

1- Why do commensals not induce an immune response?

2- Why do pathogen induce an immune response?