Lymphatic System

- Lymph
- Lymphatic vessels

- Lymphatic tissue
- Lymph nodes
- Tonsils
- Spleen
- Thymus.

ISF Return

Immune Defense
Lymphatic Vessels → Return ISF to the blood

? Force

Blood flow

Arterial end

Blood capillary

Venous end

Filtration

Interstitial fluid

Excess interstitial fluid

? Force

Cardiovascular system

Lymphatic fluid (lymph) returns to

Tissue cells

Lymphatic capillary

Blood plasma

Reabsorption

Small amount

Most
Lymphatic Vessels

Why end here?
4 Types of Lymphatic Vessels

- Lymphatic capillaries
- Lymphatic collecting vessels
- Lymphatic trunks
- Lymphatic ducts.

Which one has the greatest pressure? The least?
The structure of lymphatic capillaries

- Lymph flow
- Lymph capillary
- Interstitial fluid
- Interstitial tissue
- Blood capillary
- Loose connective tissue
- Lymphocyte
- Incomplete or absent basal lamina
- To larger lymphatics
- Overlapping endothelial cells

Sectional view © 2011 Pearson Education, Inc.
Lymphatic Capillaries

- Lymph
- Opening
- Interstitial fluid
- Endothelium of lymphatic capillary
Where do we find lymphatic capillaries?

- Almost everywhere there are blood capillaries
- Exceptions?
Lacteals – Special Lymphatic Capillaries in the Small Intestine

- Found in villi.
- Absorb dietary fat
- Chyle = fatty lymph
Lymphatic Collecting Vessels

- Receive lymph from lymphatic capillaries
- Similar to veins
- Deliver lymph to and from lymph nodes
Right Lymphatic Duct and Thoracic Duct

- Right jugular trunk
- Right subclavian trunk
- Right lymphatic duct
- Right bronchomediastinal trunk
- Left internal jugular vein
- Left subclavian vein
- Superior vena cava
- Thoracic duct
- Lymph nodes
- Azygos vein
- Parietal pleura (cut)
- Cisterna chyli
- Diaphragm
- Inferior vena cava
- Left lumbar trunk
- Intestinal trunk
- Right lumbar trunk

Posterior thoracic wall, anterior view
Factors Promoting Lymph Flow
What If Lymph Cannot Flow?
Lymphatic Cells

- Reticular cells.
  - Make reticular fibers that form the scaffolding of lymph organs (stroma)

- Macrophages.
  - Kill foreign things
  - Activate the immune system

- Dendritic cells.
  - Kill foreign things
  - Activate the immune system
Lymphatic Cells

- **T lymphocytes.**
  - Kill infected/cancerous cells
  - Control immune system

- **B lymphocytes.**
  - Become plasma cells
  - Secrete antibodies
Lymphatic Structures

Primary

Sites of lymphocyte production and maturation:
1. RBM
2. Thymus

Secondary

House lymphocytes and initiate the immune response:
1. Lymph nodes
2. Spleen
3. Tonsils
4. MALT
Thymus

• Most active during fetal period/infancy
• No killing.
• T lymphocyte maturation
Aging and the Thymus
Lymph Nodes

- Filter lymph
- Receive lymph from afferent lymphatic vessels
- Send lymph to efferent lymphatic vessels
Lymph Nodes: 3 Main Superficial Locations
- Receives from afferent lymphatic vessels
- Drains into efferent lymphatic vessels
- Hilum
- Dense CT capsule
- Trabeculae
• Subcapsular sinus
• Cortical sinuses
• Diffuse tissue
• Follicles
• Reticular fibers
• B and T Lymphocytes
Lymph Node Medulla

- Medullary sinuses
- Medullary cords
- Diffuse tissue
- Reticular fibers
- T Lymphocytes

Antigen Challenge
Lymph Node
Lymph Flow

- A
- S
- C
- M
- E
Lymph Node Blood Flow

- Subcapsular sinus
- Capillary supply
- Capsule
- Paracortex
- Afferent lymphatic
- Postcapillary (high endothelial) venules
- Medullary sinus
- Efferent lymphatic
- Vein
- Artery
- Medullary cords
- Follicle of cortex
- Trabeculum
Spleen
Functions of the Spleen

- Destroying defective/aged RBCS
- Storing monocytes
- Storing platelets
- Destroying pathogens
- Antigen challenge
Capsule – Trabeculae – Reticular Fibers

- Capsule of the spleen
- Trabeculae
- Trabeculae and veins
- Pulp of the spleen
- Lymphatic nodules
- Vein
- Arteries
Red Pulp and White Pulp
Tonsils

• Ring of lymphatic tissue at the...

• 3 main types:
  – P
  – P
  – L
Tonsils

- CT capsule
- Surface lined by epithelium
- Crypts
- Follicles
• Located laterally in the posterior oral cavity.
• Largest and most often infected.

_palatine tonsils_
• Posterior nasopharynx.

• Why there?

• A.k.a adenoids.
Lingual Tonsil

• Base of the tongue

• Why there?
Lymphoid Tissue

- Aggregations of lymphoid cells
- Destroys pathogens and activates the immune system
- Types:
  - Diffuse
  - Lymphoid follicles.
MALT = Mucosa Associated Lymphatic Tissue

- Especially prominent in tracts
- MALT
  - GALT
  - BALT
- Can be diffuse or nodular.
Lymphoid Follicles/Nodules

- Solid, spherical clusters of lymphoid cells
- Found throughout the respiratory and digestive tracts
- Also in lymphoid organs
Peyer’s Patches

- Aggregates of lymphoid cells

- Found in the distal ileum
Appendix

- Blind outpocketing of the cecum
- Contains aggregates of lymphoid cells