

Outline for Today

- Finish Chapter 3 - Antigen recognition by the Immune System
- Review

Antigen Recognition

- B and T cells recognize antigen differently, and respond differently
- B cells recognize **unprocessed antigen** and produce **antibodies**
- T cells recognize only **processed antigen, in the context of MHC I or MHC II on an Antigen Presenting Cell.**

TABLE 3-5 Antigen recognition by T and B lymphocytes reveals qualitative differences

Primary immunization	Secondary immunization	SECONDARY IMMUNE RESPONSE	
		Antibody production	Cell-mediated T_H response*
Native protein	Native protein	+	+
Native protein	Denatured protein	-	+

* T_H is a subset of $CD4^+$ T_H cells that mediate a cell-mediated response called delayed-type hypersensitivity (see Chapter 14).

TABLE 3-7 Receptors of innate and adaptive immunity

Characteristic	Innate immunity	Adaptive immunity
Specificity	Specific for conserved molecular patterns or types	Specific for details of antigen structure
Self/nonself discrimination	Perfect: evolutionarily selected to distinguish phylogenetic differences. Never recognizes self.	Excellent; but imperfect. Occasional reaction with self antigens

RECEPTORS OF THE ADAPTIVE IMMUNE SYSTEM

Receptor (location)	Target (source)	Effect of recognition
Antibody (B-cell membrane, blood, tissue fluids)	Specific components of pathogen	Labeling of pathogen for destruction and removal
T-cell receptor (T-cell membrane)	Proteins or certain lipids of pathogen	Induction of pathogen-specific humoral and cell-mediated immunity

REVIEW

- The Immune System can be divided into the **Innate** and the **Acquired/Adaptive** systems

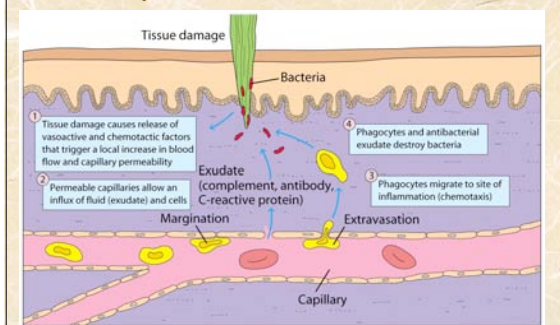
The **Innate** immune system consists of **non-specific** mechanisms to resist disease

- Includes macrophages/monocytes, basophils, eosinophils, neutrophils
- The **Acquired** immune system demonstrates the characteristics of **specificity** and **memory**.
 - Includes T lymphocytes, B lymphocytes, Dendritic Cells.

Innate Immune System

- **Anatomic Barriers** - skin, mucous membranes, etc.
- **Physiologic Barriers** - temperature, pH, chemical mediators
- **Phagocytic/Endocytic Barriers** - macrophages, neutrophils.
- **Inflammatory Barriers**

1. **Rubor** (redness). 2. **Tumor** (swelling) 3. **Calor** (heat)
4. **Dolor** (pain) 5. **Functio laesa** (loss of function)

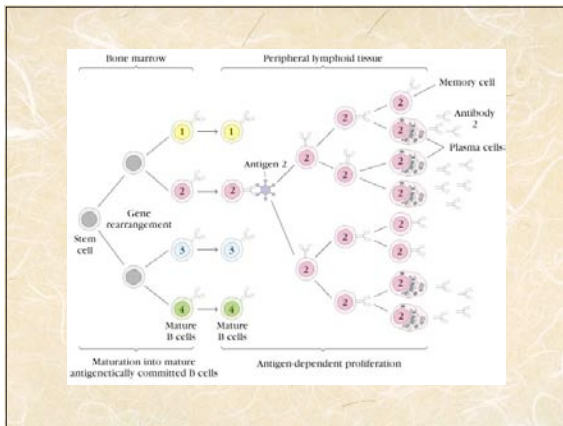


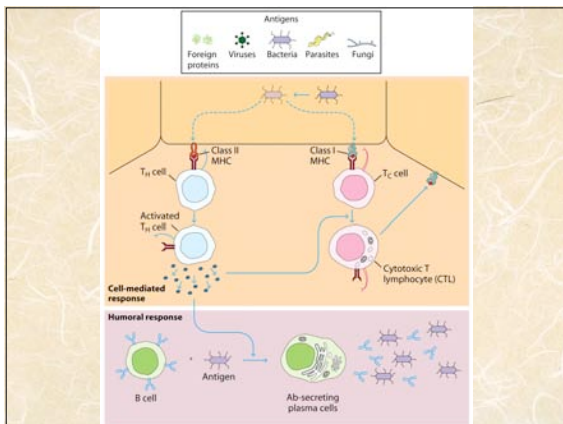
Adaptive/ Acquired Immunity

● **Specificity** and **Memory** are a result of:

1. Antigenic Specificity
2. Receptor Diversity
3. Immunologic Memory
4. Self/Non-self Recognition

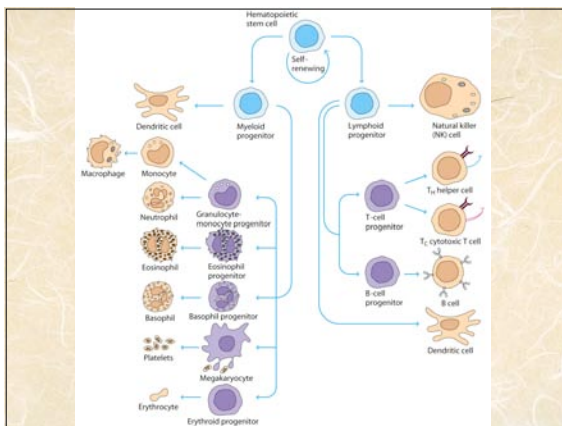
These are a result of the actions of **B cells**, **T-cells**, and **Antigen Presenting Cells**.





Where do the Immune Cells come from?

- All blood cells (including erythrocytes) arise from a common **pluripotent stem cell**, which has the characteristic of Self-Renewal.
- In adults, **hematopoiesis** occurs in the bone marrow



Primary Lymphoid Organs

- Bone Marrow - B cells (except in certain species)
- Thymus - T cells

This is where lymphocytes are produced, and educated to recognize foreign antigen appropriately

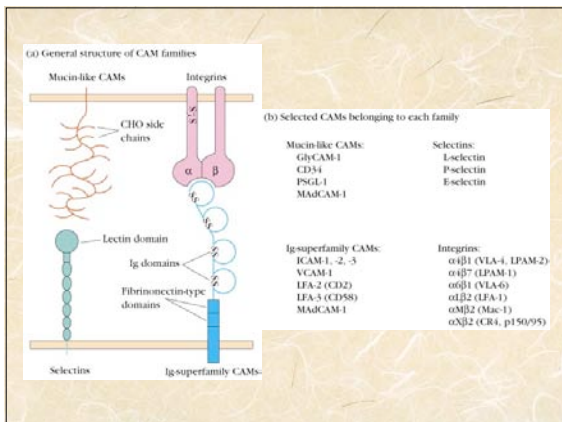
Secondary Lymphoid Organs

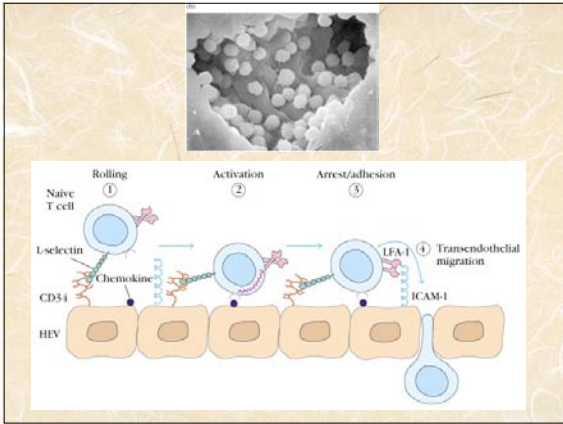
- Lymph Nodes
- Spleen
- Peyer's patches
 - Contain GERMINAL CENTRES of B cells
 - Is the site of the immune response, generation of memory.

Tertiary Lymphoid Tissue

- Mucosal surfaces, skin, etc.
- Any place that undergoes immune surveillance
- Typically contains resident antigen presenting cells, dendritic cells, may contain intra-epithelial lymphocytes

Lymphocyte Recirculation gets the cells to secondary and tertiary organs for surveillance





Antigen Response

- The **immunogenicity** of antigens is determined by:
 - Foreignness
 - Molecular Size
 - Chemical Composition/ Heterogeneity
 - Susceptibility to Antigen Processing, Presentation.
 - Host Factors

Immunogenicity

- Host Factors which regulate immunity include:
 - Genotype of the Recipient Animal
 - Immunogen Dosage, Route
 - Adjuvants
 - Prolong Antigen Persistence,
 - Enhance co-stimulatory signals
 - Induce Granuloma formation
 - Stimulate Non-specific proliferation

Antigen Recognition by B cells

- By surface ANTIBODY.
- Recognition occurs in the binding/variable region of the antibody
- Binding is determined by 3-D structure, and may involve non-adjacent determinants

Antigen Recognition by T cells

- Occurs via the T-Cell Receptor chains, which MUST recognize both peptide and either Class-I or Class-II MHC proteins (not both).
- Class I MHC - on ALL nucleated cells of the body: binds internally produced/processed antigen
- Class II MHC - only on specialized APCs: binds externally produced, phagocytosed and processed antigen.

