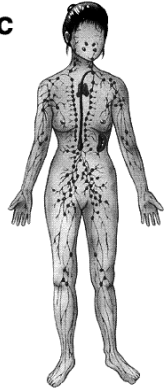
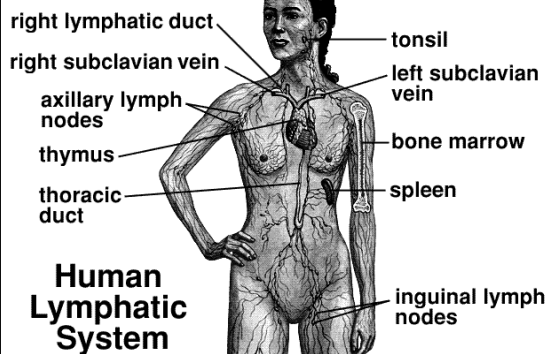


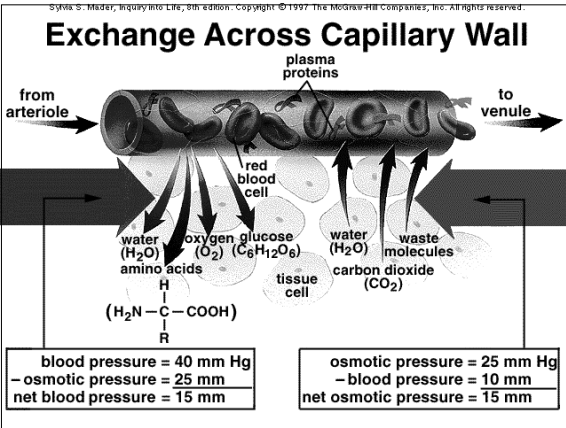
Lymphatic System



Lymphatic System - Structures

- Lymphatic vessels
- Lymphatic tissues and organs





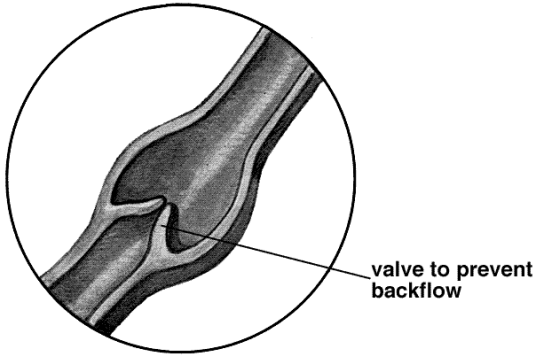
Lymphatic System - Functions

- Returns leaked plasma to blood vessels
- Cleanses lymph of bacteria & other foreign matter
- Provides site for surveillance by cells of immune system

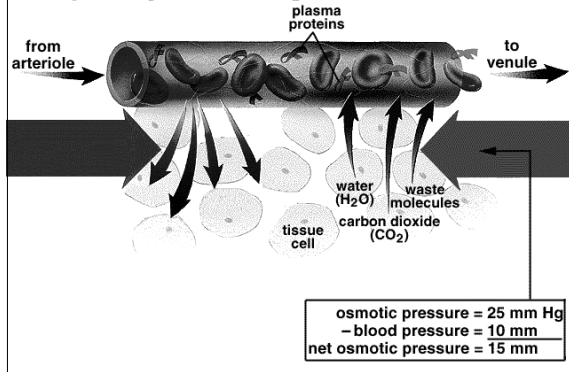
Lymphatic Vessels

- Structure
 - Thin-walled, permeable vessels
 - Valves prevent backflow
 - Contain lymph
- Functions
 - Picks up excess tissue fluid, returns it to bloodstream

Lymphatic Vessel



Capillary Exchange — Venous End

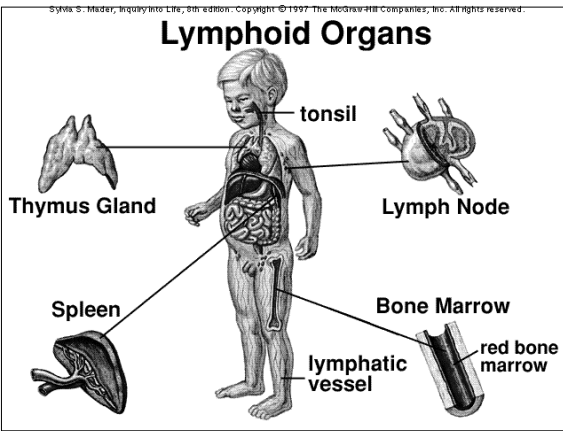


Composition of Lymph

- **Mostly water**
- **Small amounts of dissolved protein**

Lymphoid Organs

- Lymph node
- Spleen
- Thymus
- Tonsils
- Peyer's patches



Body Defenses

- Nonspecific defense system
 - Intact skin & mucus membranes
 - Inflammatory response
 - Proteins produced by body cells
- Specific defense system - immune system
 - Antibody-mediated immunity
 - Cell-mediated immunity

Surface Membrane Barriers

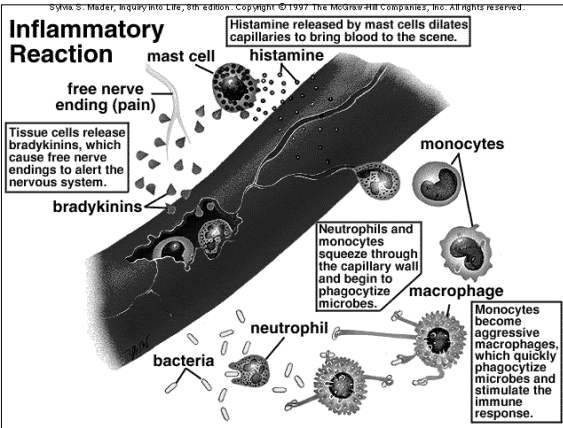
- **Body's first line of defense**
- **Structures**
 - Skin & mucus membranes
- **Functions**
 - Acid pH of skin & vaginal secretions - antibacterial
 - HCL secreted by stomach
 - Salvia & tears - antibacterial enzyme
 - Sticky mucus in digestive & respiratory tracts

Nonspecific Defense - Cells

- **Phagocytes**
 - Neutrophils and macrophages
 - Phagocytosis
- **Natural killer cells**
 - Attack and kill cancer cells and virus-infected body cells
 - Lysis

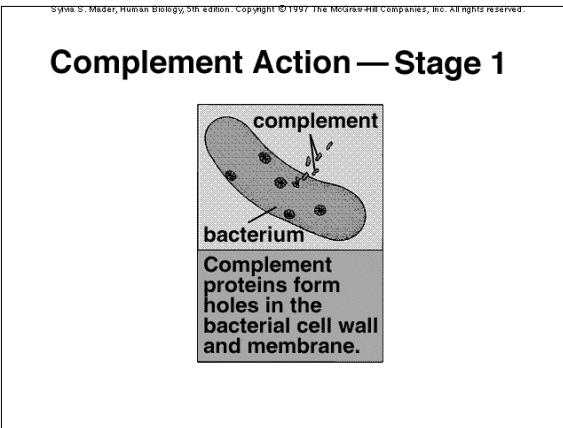
Inflammatory Response

- **Body's second line of defense**
- **Nonspecific response to injury**
- **Cardinal signs**
 - Redness
 - Heat
 - Swelling
 - Pain

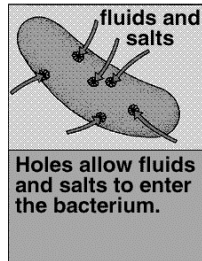


Antimicrobial Chemicals

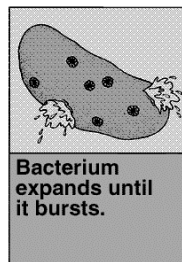
- **Complement**
 - Plasma proteins
 - Lyses microorganisms
- **Interferons**
 - Proteins released by virus-infected cells
 - Protects uninfected cells from viral takeover



Complement Action—Stage 2



Complement Action—Stage 3



Fever

- **Systemic response - increase body temperature**
- **Pyrogens released**
- **Increased body temperature inhibits bacterial growth**
- **Enhances body repair processes**

Immune System

- **Specific defense system**
- **Immune response**
 - **Is antigen specific**
 - **Is systemic**
 - **Has “memory”**
- **Types of immunity**
 - **Antibody-mediated or humoral immunity**
 - **Cell-mediated immunity**

Antigens

- **Any substance capable of exciting the immune system and provoking the immune response.**
- **Nonself**
 - **All foreign protein, nucleic acids, many large carbohydrates, some lipids**
 - **Pollen grains, microorganisms**

Cells of the Immune System

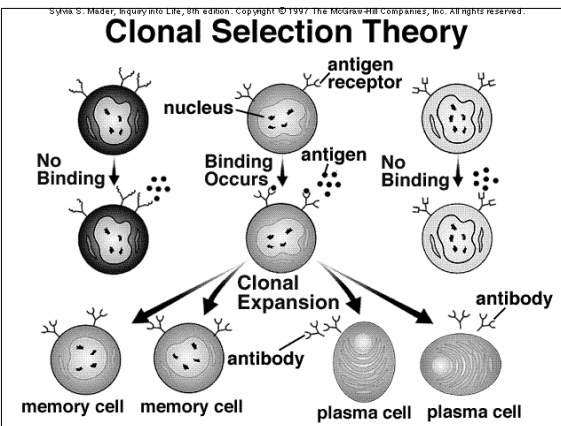
- **Lymphocytes**
 - **B lymphocytes**
 - **T lymphocytes**
 - **Immunocompetent**
 - **Capable of responding to a specific antigen by binding to it.**
- **Macrophages**
 - **Engulf foreign particles & present fragments of antigen on their surface.**

Development of Lymphocytes

- Hemocytoblast - in red bone marrow
- Immature lymphocytes
 - T cells migrate to and mature in thymus
 - B cells remain and mature in bone marrow
- Immunocompetent
 - Recognizes and binds to specific antigen
- Mature lymphocytes

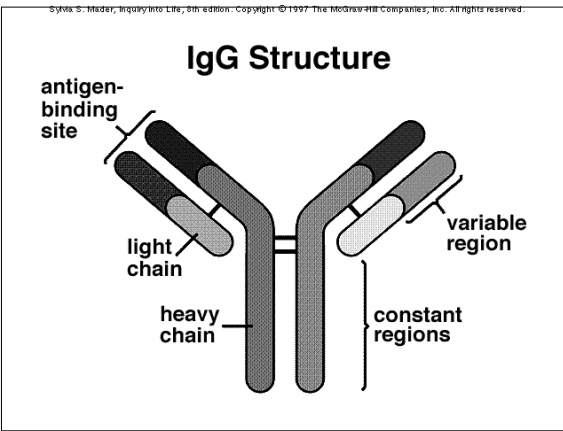
Humoral (Antibody-Mediated) Immune Response

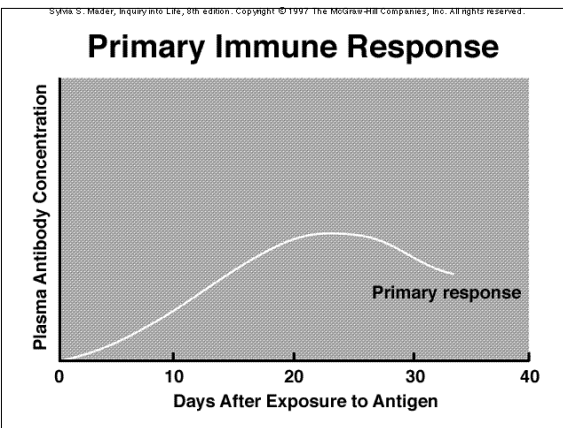
- Primary humoral response
 - Mature B cells - antigen binds to surface receptors
 - Plasma cells > antibodies
 - Memory cells



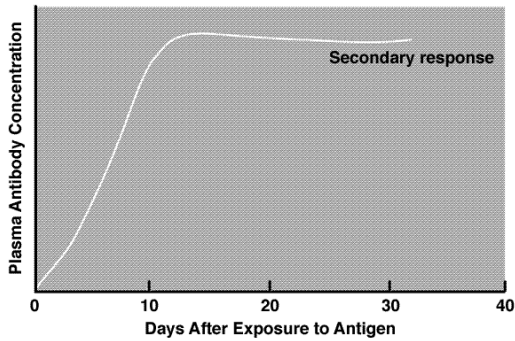
Antibodies

- Plasma proteins - immunoglobulins
- Made by B cells
- Structure
 - "Y" shaped
 - Antigen-binding site
- Classes
 - IgM, IgA, IgD, IgG, IgE





Secondary Immune Response



Antibody Function

- **Inactivates antigens by**
 - **Neutralization**
 - Block dangerous parts of toxin or virus
 - **Agglutination**
 - Cross-linking cell-bound antigens causes clumping
 - **Precipitation**
 - Cross-linking soluble antigens > become insoluble

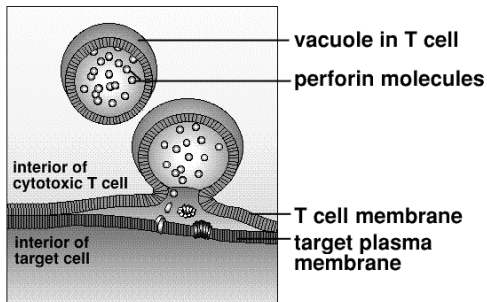
Cellular (Cell-Mediated) Immune Response

- **Macrophages engulf antigen**
- **Antigen presentation - macrophages processes antigen and displays processed antigen(non-self) plus self-protein on their surface**
- **T cells recognize non-self and self proteins**
- **T cell clones**

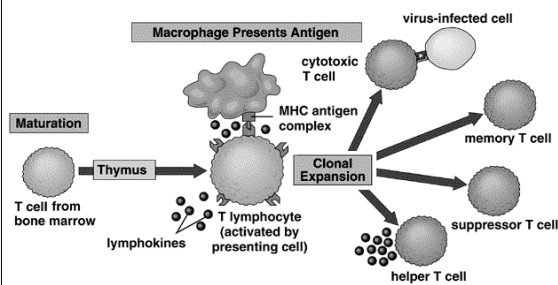
Classes of T-Cell Clones

- **Helper T cells**
 - Stimulate production of other immune cells
- **Cytotoxic (killer) T cells**
 - Kills virus-invaded cells, cancer cells, graft rejection
- **Memory T cells**
 - Generated during primary response, exist for years, respond quickly to second infection

Cell-Mediated Immunity



T-Cell Activation and Diversity



Acquired Immunity

- **Naturally acquired**
 - **Active**
 - Infection; contact with disease-causing organism
 - **Passive**
 - Antibodies from mother to fetus via placenta; to infant from mother's milk
- **Artificially acquired**
 - **Active**
 - Vaccine; dead or weakened pathogens
 - **Passive**
 - Injection of antibodies

Sylvia S. Mader, Human Biology, 5th edition, Copyright © 1997 The McGraw-Hill Companies, Inc. All rights reserved.

Producing Human Antibodies

1. Blood sample is taken from a patient.
2. Inactive B lymphocytes from the blood sample are exposed to an antigen. These cells then become plasma cells that can produce antibodies.
3. Plasma cells are fused with myeloma (cancer) cells.
4. Resulting hybridomas divide repeatedly, giving many cells, which produce monoclonal antibodies.

Organ Transplants and Rejection

- **Allografts**
 - Tissue grafts taken from an unrelated person
- **Tissue typing**
 - Blood types (ABO)
 - Matching cell membrane antigens
 - 75% match necessary

Disorders of Immunity

- **Allergies or hypersensitivities**
 - **Abnormally vigorous immune responses that causes tissue damage**
- **Immunodeficiencies**
 - **AIDS**
- **Autoimmune diseases**
 - **Multiple sclerosis, Systemic Lupus Erythematosus, Rheumatoid arthritis**

The End
