The Chain of Infection

- Transmitted through a chain of infection (six links)
  - Pathogen: Disease causing microorganism
  - Reservoir: Natural environment of the pathogen
  - Portal of exit: How does it exit reservoir and cause infection
  - Means of transmission
    - Direct transmission
    - Indirect transmission
      - Vectors: Carrier of the pathogen from one host to another
  - Portal of entry
    - Penetration of the skin
    - Inhalation through mouth or nose
    - Ingestion
  - New host
Figure 17.1 The chain of infection
Definition: A functional system of diverse molecules, cells and lymphoid tissues that protect the body from foreign substances.

Provides Immunity = Resistance to disease.

Immunity is Provided In Two Ways:
- The Innate (non-specific) Defense System
- Adaptive (specific) defense system
Innate (nonspecific) Defense

Characteristics
- Responds to an invasion in minutes
- Response is the same for all invaders
- No memory

Uses two types of barriers:
- Surface
  - Skin
  - Mucous membranes
- Internal
  - Phagocytes (Ex. macrophages)
  - Fever
  - NK cells
  - Inflammation
Adaptive (specific) Defense

Characteristics
- It is extremely specific
- It is systemic
- It has memory
- Can distinguish self from non-self

Two arms in Adaptive Defense:
- Antibody-mediated immunity
  - Provided by antibodies (blood)
- Cell-mediated immunity
  - Provided by lymphocytes (WBCs)
Antigens

Definition: Substances that cause an immune response

- Usually large molecules, not normally present in the body
Three important types:

- **First Type:** B lymphocytes
  - Function: Produce antibodies
  - Responsible for Antibody-Mediated Immunity
Cells of the Adaptive Defense System

Three important types:

- Second Type
  - T lymphocytes
    - Do not produce antibodies
    - Responsible for Cell Mediated Immunity
    - Three populations:
      - T helper
      - T killer
      - T suppressor
Cells of the Adaptive Defense System

Three important types:

- Third Type:
  - Antigen presenting cells (APCs)
    - Engulf & digest Ags. and present the fragments to T lymphocytes
    - Presentation activates T and B lymphocytes
    - Ex. Dendritic cells
The Immune Response

Four phases of the Immune Response:

- First Phase
  - Antigens invade the body and replicate
  - APCs recognize invaders, engulf and digest them
  - APCs present fragments to T helper cells
The Immune Response

Four phases of the Immune Response:

- Second Phase
  - T helper cells multiply rapidly
  - T helper cells release cytokines that trigger production of T killer & B lymphocytes

- Cytokines = chemicals that stimulate T & B cell production
  - Ex. Interleukin
The Immune Response

Four phases of the Immune Response:

- Third Phase
  - T killer cells attack foreign cells and infected cells of the body (puncture membranes of target cells)

- B lymphocytes produce Abs
  - Abs bind antigen-bearing targets, marking them for destruction by macrophages
The Immune Response

Four phases of the Immune Response:

- Fourth Phase
  - Immune response slows
  - Memory B and T cells are formed
  - Homeostasis is restored by T suppressor cells
    - Dead cells, pathogens, etc. are scavenged by WBCs and filtered out by 1) liver 2) spleen 3) kidneys
Immunization

- Basis of immunization
  - Immune system has memory
  - Immune system retains strength against pathogen

- Vaccine
  - Weakened/killed version of microbe that is administered to stimulate an immune response
Types of vaccines

- **Active Immunity** – a person produces their own antibodies to the microorganism

- **Passive Immunity** – Injection of antibodies produced by other human beings or animals to a person exposed to a disease
Types of Pathogens

- Viruses
  - Nonliving matter
  - Parasites – hijack enzymes and necessary machinery from its host in order to reproduce
    - Normal function of cell is disrupted
    - Different viruses affect different types of cells
      - This determines seriousness of illness
Types of Pathogens

- Bacteria
  - Single celled organisms
  - Harmful and helpful bacteria
    - Harmful bacteria enter body through food/drink
    - Helpful bacteria in GI tract produce vitamins
      - Ex. Vitamin K
VIRUSES
Typical Life Cycle of a Virus

1. Virus penetrates cell
2. Protein coat is removed
3. Replicates DNA, proteins are made
4. New protein coat is made, genes are inserted
5. Viruses exit the cell
HIV

- Viral envelope
  - gp 120, gp 41
- Viral capsid
  - Contains RNA & enzymes (adi in the infection process)
- Retrovirus
  - Converts its RNA into DNA
HIV and AIDS

- Human Immunodeficiency (Virus)
  - The virus that causes AIDS

- Acquired Immune Deficiency Syndrome (AIDS)
  - Late stages of HIV infection
  - Body is no longer able to fight off infection
    - HIV + individuals suffer from bacterial infections, cancer, TB, etc.
  - AIDS does not kill you, opportunistic infections do
Contracting HIV

You **CAN** get HIV from a person who is infected through:

- **Sexual contact** with an infected person
- **Sharing needles** for drug injection with someone who is infected
- **Contaminated Blood Products** - Donated blood and blood products; Before 1985 donated blood was not tested
- **Birth** - Babies born to HIV-infected women may become infected; or through breast-feeding after birth.
HIV and AIDS

- **Diagnosis**
  - ELISA (Blood Test)
    - Detects Antibodies against HIV
    - If positive a CD4+ count is taken

- **Treatment**
  - No known cure
  - Antiretroviral medications
    - Taken every day for the rest of one’s life
Autoimmune Diseases

- Autoimmune diseases
  - Definition: When the body's immune system attacks its own tissues
  - Ex's. Rheumatoid arthritis, Systemic lupus erythematosus (Lupus)
The Lymphatic System

- Network of vessels and organs
  - Lymphatic vessels
    - Pick up excess fluid, proteins, etc. from blood stream
  - Lymph nodes
    - Act as filters to remove pathogens
  - Spleen
    - Contains cells to destroy old RBCs
  - Tonsils
    - Contain lymphocytes
  - Thymus
    - T-cells mature here