

# Immune System

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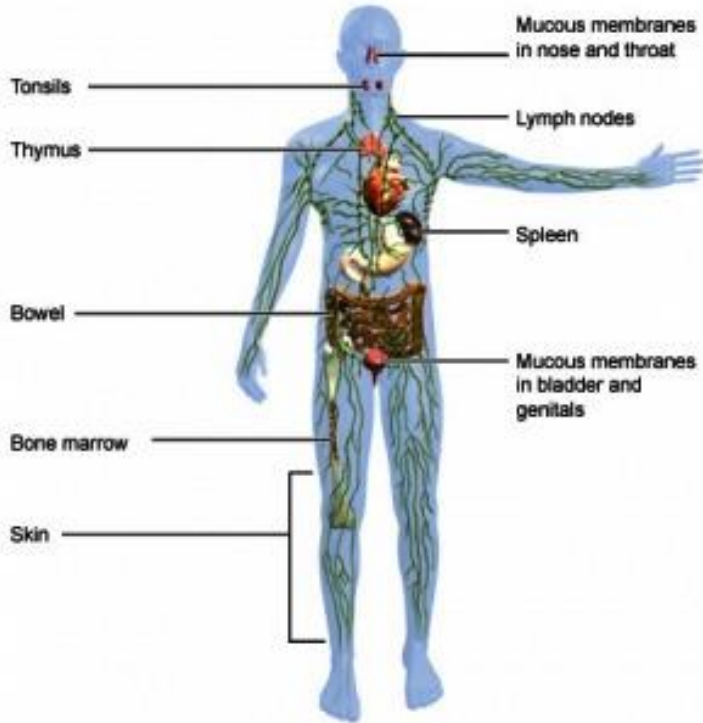
# Overview of the Immune System

<https://www.youtube.com/watch?v=G7rQuFZxVQQ>

# Structure related to function

- White blood cells (leukocytes) are found throughout the body in the thymus, lymphoid organs, and spleen
- White blood cells are small enough to travel through the bloodstream to the site of infection
- The white blood cells are spread out all over the body to prevent foreign invaders from spreading
- Spleen is a flattened organ that allows the immune system cells to gather and complete the work necessary
- Structure is related to function- stopping foreign invaders and infection throughout the body!

# Major Organs



Mucous Membrane- Shield body from pathogens  
Tonsils- Activate immune system (in close contact with outside)

Lymph Nodes- Drainage system

Thymus- Helps kill pathogens

Spleen- Stores defense cells

Bowel- Contains cells that produce antibodies, cleanses body from pathogens

Bone Marrow- Produces blood cells (white blood cells fight infection)

Skin- Protective shield against pathogens (barrier)

# Homeostasis

- The Immune System fights infection and disease, trying to keep the body healthy.
- Helps in the healing process by creating a fever and increasing blood flow to bring immune cells to the site of harm.
- When a person is under severe stress, the immune system is impaired
  - Decreases or stops certain hormones: the growth hormone, thyroid hormones
  - More susceptible to infections

# Innate vs. Acquired

Innate immunity	Adaptive immunity
<ul style="list-style-type: none"><li>• general protection (not antigen-specific)</li><li>• early phase of host response to pathogens without requiring prior exposure</li><li>• immediate maximal response</li><li>• does not alter on repeated exposure (no immunological memory)</li><li>* (rapid, non-specific, no memory)</li></ul>	<ul style="list-style-type: none"><li>• highly specific for a particular pathogen (antigen-specific)</li><li>• late phase response of antigen-specific lymphocytes to antigens</li><li>• lag time between exposure and maximal response</li><li>• improves with each successive exposure (immunological memory)</li><li>* (slower, specific, diverse, memory)</li></ul>

- Innate immunity: General protection that all humans are born with
  - No prior exposure to the invaders is needed
- Adaptive immunity: After a pathogen is exposed to the body, the antibodies remain present so to not let the invader attack again
  - Very, very specific to the kind of pathogen

# Evolution and Development

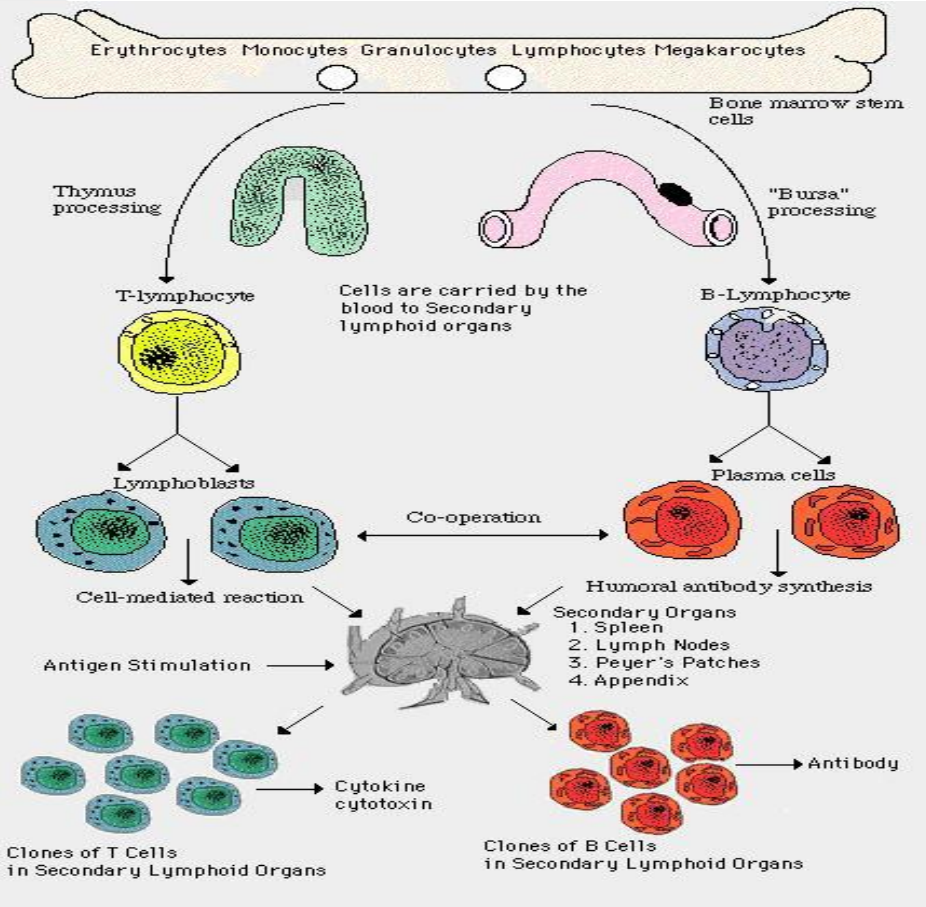
- Acquired Immunity evolves throughout a person's lifetime by creating more and more immunities to various illnesses that the body is exposed to
- Innate Immunity has roots in the amoeba (organism in pond water), which is seen as the earliest form of a macrophage due to the fact that it feeds on micro-organisms
- As an embryo
  - Stem cells of the immune system are in the spleen and liver
- As a child
  - Lymphocytes develop tolerance in the thymus and bone marrow, and then populate other lymphoid tissues
  - T and B cells come in contact with their antigens and complete their development as mature immune cells
- As an adult
  - With old age immune system deteriorates, more susceptible to infections, cancer, and other diseases
- The ability of our adaptive immune system to recognize foreign substances is determined by genetics

# Recognition and Response

- Animals use receptors from the innate and acquired immunity to detect foreign cells
- The immune system tags the antigens so the body can recognize what is a foreign invader and what is not
- As discussed in the next couple of slides, the process of the immune system relies heavily on the tagging of the invaders as to destroy later by other cells

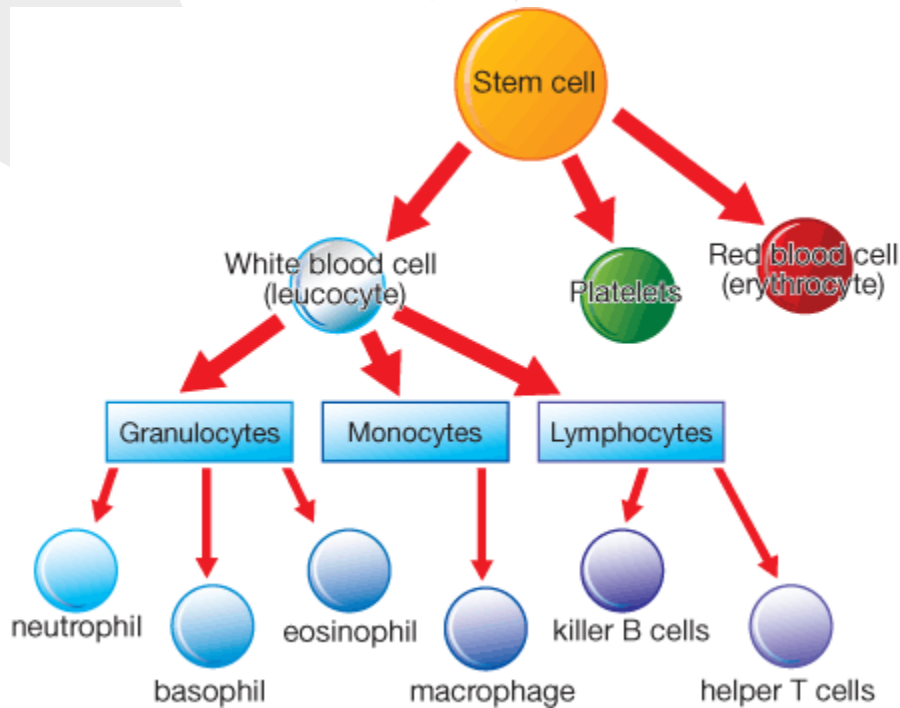


# The cells involved with the immune system



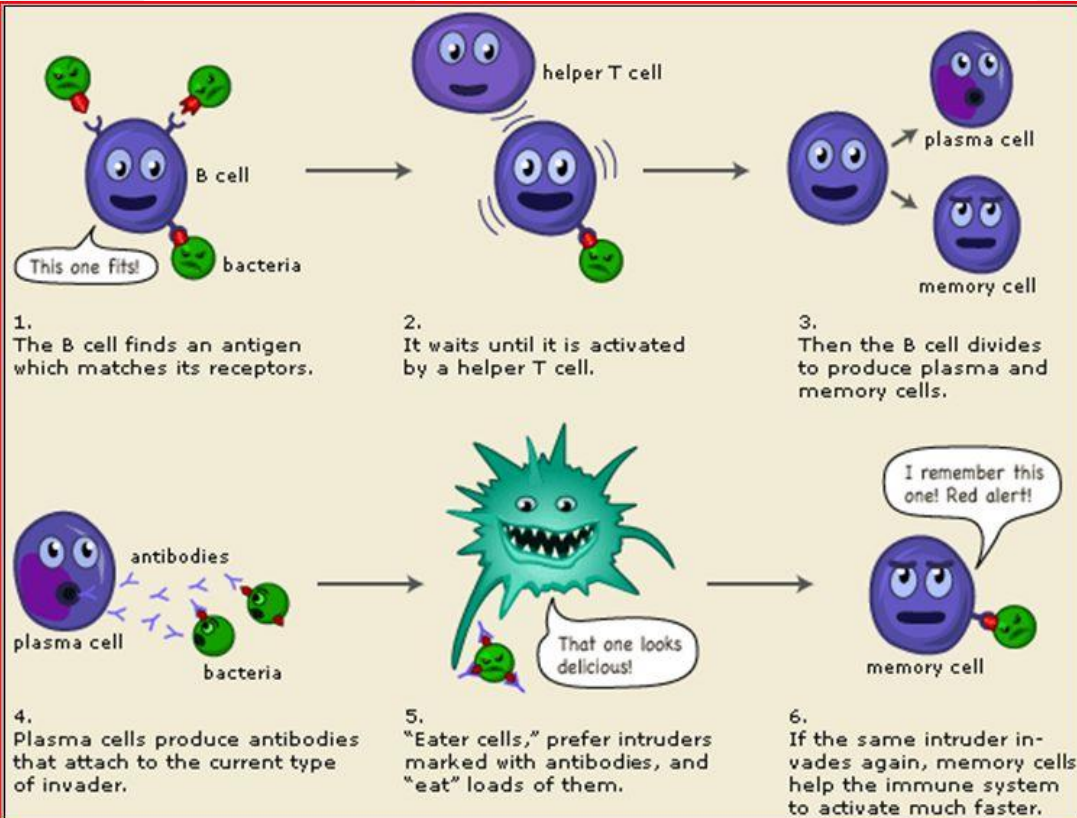
All of the cells involved come from the spleen, thymus, or lymphoid organs. All of the cells have a very distinct purpose in hoping to stop the attack of foreign invaders or infection

# Process of stopping foreign invaders



- White blood cells are the main part of the immune system:
- 5 types of white blood cells present:
  - a. Phagocytes: cells that destroy invading organisms
    - i. Neutrophil is the most common type: fights bacteria and is the first cell to arrive at the site of infection
    - ii. Macrophages: type of neutrophil that acts as a scavenger to worn out cells
  - b. Basophils: defend against parasites
  - c. Eosinophil: defend against parasites
  - d. Mast cells: regulate the inflammatory response
  - e. Natural Killer Cells: attack and destroy tumors
- Antibodies help the adaptive immune system so to prevent the same invader from attacking again

# Process of immune system



- Process by which foreign invaders are eliminated and prevents future attack
- This is why you only get sick from the same virus/bacteria once, because of the antibodies produced from the immune system
- However, there are so many bacteria viruses that are unfamiliar to your body- you can always get sick.

# Interdependence between other systems

- If damage is done to another body system caused by harmful actions, the immune system is greatly affected.
  - Ex: Smoking causes damage to lungs, but also destroys the macrophages of the immune system that act as scavengers
- Immune system contains many cells that need to be transported to the site of infection rapidly through the bloodstream (circulatory system)
  - Without this ability, the immune system would be unable to stop foreign invaders from spreading
- The immune system fights infection through its own cells but it is very reliant on other body systems to properly function.

# Disorders (Problems)

1. Immunodeficiency Disorder- part of the immune system does not work properly
  - a. Can be by birth (primary) or actions (acquired)
2. Autoimmune Disorder- body's immune system attacks its own tissue or cells
3. Allergic Disorder- Overreaction to exposure to antigens in the environment
4. Cancers- cells of the immune system grow uncontrollably

# Treatments

- Many specific treatments depending on the disorder or allergy
- Immunodeficiency
  - Antibiotics and Antibody replacement
- Autoimmune
  - Immunosuppressive medicines
- Allergies
  - Avoidance
  - Nasal sprays
  - Eye drops
  - EpiPen
- Cancer
  - Radiation- uses high energy waves to kill cancer cells
  - Chemotherapy- uses medications and drugs to treat
  - Surgery- removing the cancerous cells through an operation

# Hepatitis

hepatitis is inflammation of the liver and is most often caused by a virus

Causes:

Hepatitis A - ingestion of fecal matter or contaminated food or drinks

Hepatitis B - Infectious blood, semen, other fluids from sex, and dirty needles

Hepatitis C - Infectious blood normally through needles used for drugs

Hepatitis D - Infectious blood similar to HBV

Hepatitis E - Ingestion of fecal matter normally through water supplies

Symptoms- Diarrhea, fatigue, loss of appetite, vomiting, weight loss

Treatment- Hepatitis b, c, d, and e can be treated by a doctor, Hepatitis A has no treatment but will normally go away fairly quickly

# Syphilis

Syphilis is a bacterial infection usually spread by sexual contact

Primary syphilis- a small sore that will heal in 6 weeks

Secondary syphilis- After the sore some get a rash

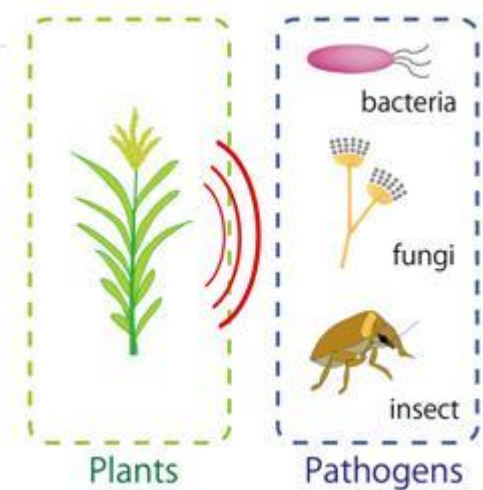
Latent syphilis- if not treated symptoms will go away in the latent stage leading to the tertiary stage

Tertiary syphilis- Disease may cause damage to brain, eyes, or other organs after the years in the latent stage



# Immunity in Plants

- No circulatory system to carry cells to the site of infection
  - cells must be able to independently respond
- May respond to pathogens by cell wall thickening or host cell death
  - Many pathogens feed on living tissue
- Plants have no adaptive immunity
  - Immune System is in their genes, if the plant does not have resistance mechanisms against a pathogen, it will



# Citation Page

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