WHAT IS IMMUNITY?

- **Immunity** is a state in which the body has sufficient defenses to fight infection, disease or invasion by pathogens.

- **Non-Specific Immunity** refers to the defenses that are in place at all times and are not specific to the pathogen to which the system is responding.

- Your 1st line of Defense: Skin, mucous membranes, hairs in nose and ears, enzymes in mouth and tears in eyes.

THE IMMUNE SYSTEM

- The immune system’s function is to protect the body from foreign invaders.

- Your immune system has specialized cells that react when faced with these invaders called **pathogens**.

- A **pathogen** is a bacterium, virus, or other microorganism that invades your body and can cause disease.

DISEASE

- **Disease** results when the body is unable to maintain homeostasis.

LINES OF DEFENSE

1st line: **Barriers**
- Broad, external defense
- "Walls & moats"
- Skin & mucus membranes

2nd line: **Non-specific patrol**
- Broad, internal defense
- "Patrolling soldiers"
- Phagocyte (eating) WBCs

3rd line: **Immune system**
- Specific, acquired immunity
- "Elite trained units"

- Lymphocyte WBCs & antibodies
- B & T cells

IMMUNE SYSTEM

- When pathogens (any foreign invaders/substances) enter the body, their outer coating contains **antigens**.

- Once this occurs, an immune response is activated and your body will begin to produce antibodies.

- Antibodies are special proteins produced by white blood cells (lymphocytes) that recognize, tag, and destroy pathogens.
WHITE BLOOD CELLS

- White blood cells play specialized roles in an immune response.
- Lymphocytes: B-cells and T-cells
  - Each target pathogens and have specific roles

WHITE BLOOD CELLS

- Phagocytes (macrophages)
  - Engulf or “eat” the foreign invaders

ANTIBODIES

- Antibodies are special proteins that recognize and defeat invading pathogens.
- Antibodies are made by the B-cells, a type of white blood cell.
- Once a pathogen is encountered by the B-cells it memorizes it and next time it encounters the pathogen it will have antibodies ready to fight the pathogen.

VOCABULARY CHECKPOINT:

- Antibody: a protein produced by the human immune system to tag and destroy invasive microbes/pathogens.
- Antigen: any foreign substance that causes the immune system to produce antibodies
- Pathogen: any foreign invader that can cause disease; bacteria, virus, microorganism

INFLAMMATORY RESPONSE

- Inflammation is common after a cut/injury because the cells release chemical signals called histamines.
- This is why the area feels warm and swollen.
- Blood flow increases
- White blood cells rush to the site to fight bacteria
- Red blood cells and clotting factors repair

ANTIBODIES

- Antibodies bind to the receptors of an antigen and flag them for destruction!
- White-blood cells called phagocytes usually destroy the pathogen by engulfing the invader.
- Sometimes, “killer” T-cells are needed to assist in “eating” the antigen.
- B-cells will remember them if they ever invade again...
FEVER
- When a local response is not enough, a fever is a full body response to an infection.
- Higher body temperature:
  - Slows germ growth
  - Helps macrophages
  - Speeds body tissue repair

VACCINATIONS
- A vaccination will expose the body to a weakened pathogen. This will stimulate the immune system to produce antibodies to the invader.
- Most vaccines contain a little bit of a disease germ that is weak or dead. Vaccines do NOT contain the type of germ that makes you sick.
- Having this little bit of the germ inside your body makes your body's immune system build antibodies to it.
- Vaccines can be administered by a needle, mouth and some through a nasal spray.
- In the US children are vaccinated before they can enter school for: Measles, Mumps, Rubella, Pertussis, Hepatitis B, Diphtheria, and Tetanus

CURING YOU OF DISEASE
Antibiotics = medicine
- advantage
  - kill bacteria that have successfully invaded you
  - make you well after being sick
- disadvantage
  - use only after sick
  - only good against bacteria
  - possible development of resistance by bacteria (if don't use correctly)
  - can get sick again

*DON'T CONFUSE WITH ANTIBODIES

IMMUNE SYSTEM MALFUNCTIONS
Auto-immune diseases
- Rheumatoid Arthritis
  - antibodies causing damage to cartilage & bone
- AIDS (Acquired Immune Deficiency Syndrome) is caused by an infection by the HIV (Human Immunodeficiency Virus), which attacks and destroys T-helper cells. Because it attacks the immune system directly, finding a vaccine has been difficult. Some drugs can slow down HIV reproduction, but no cure exists yet. Prevention is still the best “cure.”

IMMUNE SYSTEM MALFUNCTIONS
Allergies
- over-reaction to harmless compounds called allergens
  - proteins on pollen
  - proteins from dust mites
  - proteins in animal saliva
  - body mistakenly thinks they are attackers
  - Your body releases histamines, which can produce an inflammatory response.

ORGAN TRANSPLANTS - MALFUNCTIONS
- Organ transplant rejection occurs when the body recognizes the organ as foreign and initiates an immune response against it.
- Immunosuppressant drugs – suppress the immune system so it does not attack the transplanted organ.
- Patients must be very careful while on these drugs because they are at risk for becoming very sick if exposed to any diseases or infections.
- The best match for an organ donor would be an identical twin (if available) because their DNA would be an exact match.
REGENTS PRACTICE QUESTION 1
Vaccines play an important role in the ability of the body to resist certain diseases.

• Describe the contents of a vaccine
• Identify the system in the body that is most directly affected by a vaccination.
• Explain how a vaccination results in the long-term ability of the body to resist disease.

REGENTS PRACTICE QUESTION 2
Many people become infected with the chicken pox virus during childhood. After recovering from chicken pox, these people are usually immune to the disease for the rest of their lives. However, they may still be infected by viruses that cause other diseases, such as measles. Discuss the immune response to the chicken pox virus. In your answer, be sure to include:
• the role of antigens in the immune response [1]
• the role of white blood cells in the body’s response to the virus [1]
• an explanation of why recovery from an infection with the chicken pox virus will not protect a person from getting a different disease, such as measles [1]
• an explanation of why a chicken pox vaccination usually does not cause a person to become ill with chicken pox [1]

REGENTS PRACTICE QUESTION 3
Many people have a sensitivity to peanuts. The symptoms can include watery, itchy eyes and difficulty breathing. This allergic reaction can be mild, severe, or fatal.
Discuss why an individual can have a sensitivity to peanuts. In your answer, be sure to:
• identify the human system that is responsible for this sensitivity to peanuts
• identify the specific type of molecule that triggers an allergic reaction
• state one reason why a person could be allergic to peanuts, but not be allergic to walnuts
• describe how this reaction is similar to the rejection of a transplanted organ

VOCABULARY REVIEW
Immunity: a state in which the body has defenses to fight infections, diseases, and pathogens
Pathogen: a bacterium, virus, or other microorganism that invades your body and can cause disease
Disease: results when the body is unable to maintain homeostasis
Antibodies: are special proteins produced by white blood cells that recognize, tag, and destroy pathogens
Antigen: any foreign substance that causes the immune system to produce antibodies
Vaccination: exposure to a weakened or dead pathogen to stimulate the immune system to produce antibodies
Antibiotics: medicine taken to kill bacteria
Histamines: chemical signals produced by the body that cause an inflammatory response
Allergies: the immune system’s over-reaction to harmless compounds called allergens
Allergens: harmless compounds which the immune system mistakenly perceives as a threat (ex: pollen)
Immunosuppressant: a drug which weakens the immune system usually taken after an organ transplant to lessen the chance of rejection