

## **HUMAN DIGESTIVE SYSTEM**

- The digestive system is responsible for taking whole foods and turning them into energy and nutrients to allow the body to function, grow, and repair itself

### **Digestive systems**

- Ingestion of food
- Digestion of food
- Absorption of nutrients (chemical energy, carbohydrates, proteins, lipids, vitamins (cant make by itself), minerals)
- Elimination of waste

**Mouth** – start of the process, food is partly broken down by the process of chewing (**teeth**, bite of food) & by the chemical action of salivary enzymes

- Enzymes released into the mouth start the process of digestion.

### **Oral cavity**

#### **Teeth**

**Tongue** – muscular organ

- Speech
- Manipulates food, initiates swallowing

**Salivary glands** – produces saliva

- **Saliva**: hold lump of food together, lubricate lump of food, enzymes for digestion, starting digestion

### **Pharynx**

- Responsible for the passing of masses of chewed food from the mouth to the esophagus

**Glottis** – don't want food to down their causes choking, (goes to lungs)

**Esophagus** – food goes to stomach

**Epiglottis** – door, close glottis off

- Prevents food from going to lungs
- Smooth muscles (wave like) between esophagus (peristalsis)
- Relaxed muscles, contracted muscles, relaxed

**Stomach** – folds of epithelial tissue

- Expands
- Digest food
- Stores food
- Kills bacteria
- The stomach also contains hydrochloric acid and digestive enzymes that continue the digestion of food that began in the mouth.

**Gastric gland** – release enzyme

- HCl
- Mucus (slimy material)

### **Sphincter**

- Closes tube at the end of the esophagus

- Stops (trap) the food in stomach

**Pancreas** – releases pancreatic juice into small intestine

- Pancreatic juice has bicarbonate (neutralizes acid)
- Enzymes

**Liver** – largest internal organ

- Produces bile (not a digestive enzyme) very slowly, emulsifies fats (letting fat mix with water)
- Storing energy and helping the body get rid of toxins

**Gall bladder** – stores bile (help digest fats in the food you eat)

- The gallbladder is used to store and recycle excess bile from the small intestine so that it can be reused for the digestion of subsequent meals.

**Small intestine** – produces enzymes that will finish the process of digestion

- Peristalsis
- Highly folds
- Villi (has epithelial cells, microvilli)

Functions: digestion of food, absorb nutrients

- These folds are used to maximize the digestion of food and absorption of nutrients.
- By the time food leaves the small intestine, around 90% of all nutrients have been extracted from the food that entered it.

**Large intestine** –absorb water (water lost in food) & minerals

## Appendix

**Rectum** – storage of waste

**Anus** – has 2 sphincters

- Waste exits body

## HUMAN RESPIRATORY SYSTEM

- Air goes through the **nostrils**

**Nasal cavity** – sense of smell

**Pharynx** – connects to oral cavity

**Larynx** – stays open all the time

- Voice/speech

**Epiglottis** – closes

**Trachea** – stay open to allow air passage

**Bronchus** –

**Bronchial tree** –

**Bronchiole** –

**Alveoli** – high concentration of O<sub>2</sub> & low concentration of CO<sub>2</sub>

**Diaphragm** - main respiratory muscle that contracts and relaxes to allow air into the lungs.

- When you breathe in, the diaphragm contracts downward, creating a vacuum that causes a rush of fresh air into the lungs.
- The opposite occurs with exhalation, where the diaphragm relaxes upwards, pushing on the lungs, allowing them to deflate.

### Chest wall

**Lung** – typical volume of air in lungs

- Expand and contract, supplying life-sustaining oxygen to your body and removing from it, a waste product called carbon dioxide.
- They're responsible for providing oxygen to capillaries and exhaling carbon dioxide.
- Breathing starts at the **nose** and **mouth**.
- You inhale air into your nose or mouth, and it travels down the back of your throat and into your windpipe, or **trachea**.
- Your trachea then divides into air passages called bronchial tubes.
- As the **bronchial tubes** pass through the lungs, they divide into smaller air passages called **bronchioles**.
- The bronchioles end in tiny balloon-like air sacs called **alveoli**.
- The alveoli are surrounded by a mesh of tiny blood vessels called **capillaries**. Here, oxygen from the inhaled air passes through the alveoli walls and into the blood.
- After absorbing oxygen, the blood leaves the lungs and is carried to your heart.
- Your heart then pumps it through your body to provide oxygen to the cells of your tissues and organs.
- As the cells use the oxygen, carbon dioxide is produced and absorbed into the blood. Your blood then carries the carbon dioxide back to your lungs, where it is removed from the body when you exhale.



## **HUMAN CIRCULATORY SYSTEM**

- Transports materials around the body to and from the cells.
- The system is responsible for the flow of blood, nutrients, oxygen and other gases, and as well as hormones to and from cells.
- Humans have a **closed** circulatory system: This means that the blood is always contained in tubes and vessels.
- 

**Right ventricle** – muscular chamber that pumps blood to lungs

**Pulmonary artery** – carries blood to lungs

**Arteries** - Carry oxygen-rich blood away from the heart and where it needs to go

- Contain layers of connective, and smooth muscle tissues
- Arteries divide to form very small arteries called *arterioles*.

**Veins** – returns blood to the heart

- Veins carry deoxygenated blood to the lungs where they receive oxygen.
- Veins divide to become *venules*.

**Capillaries** - Allows material and gas exchange between the body cells and the blood.

**Capillaries in lungs**

**Alveoli**

**Pulmonary veins** – bring blood to the heart from the lungs

**Left ventricle** – most muscular part of the heart

- Pumps blood out of heart to the body

**Aorta** – Large artery that carries blood away from the heart and to all parts of the body.

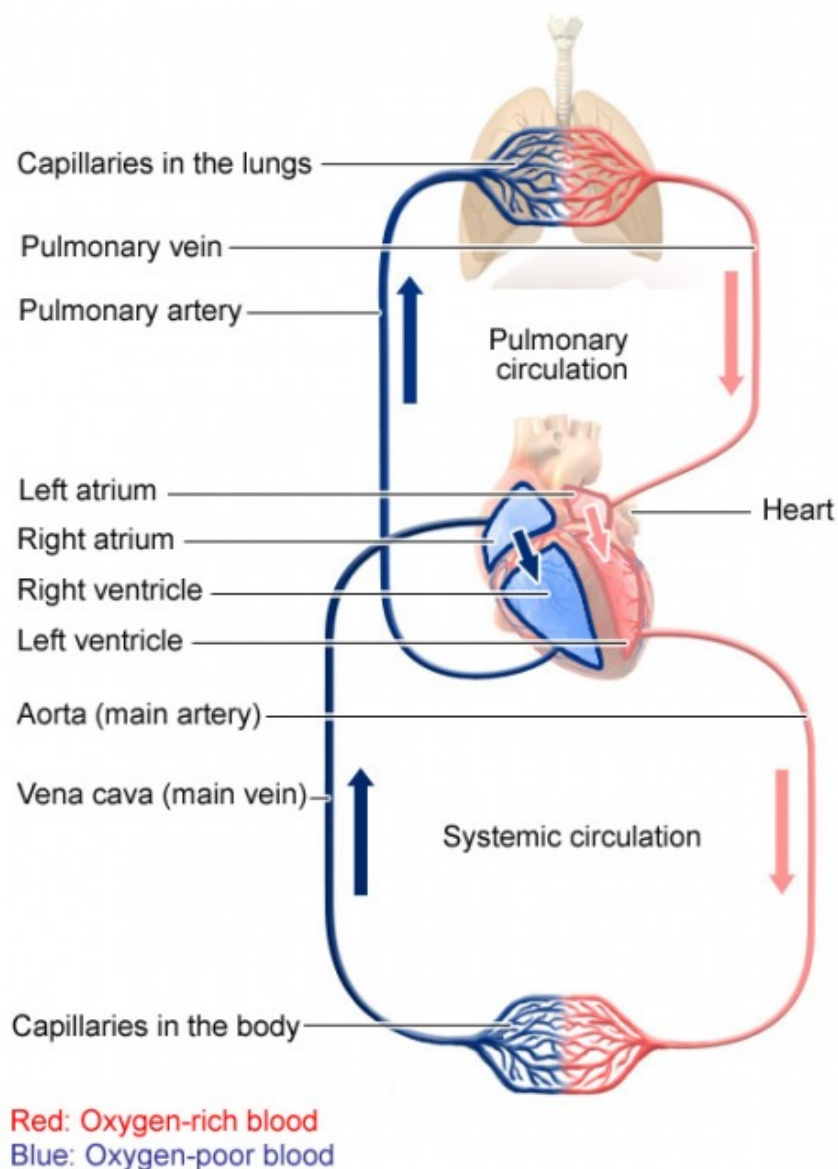
**Capillaries of abdominal organs & hind limbs**

**Vena cava** – major vein that brings back blood to heart right atrium

**Heart** – 4 chambered

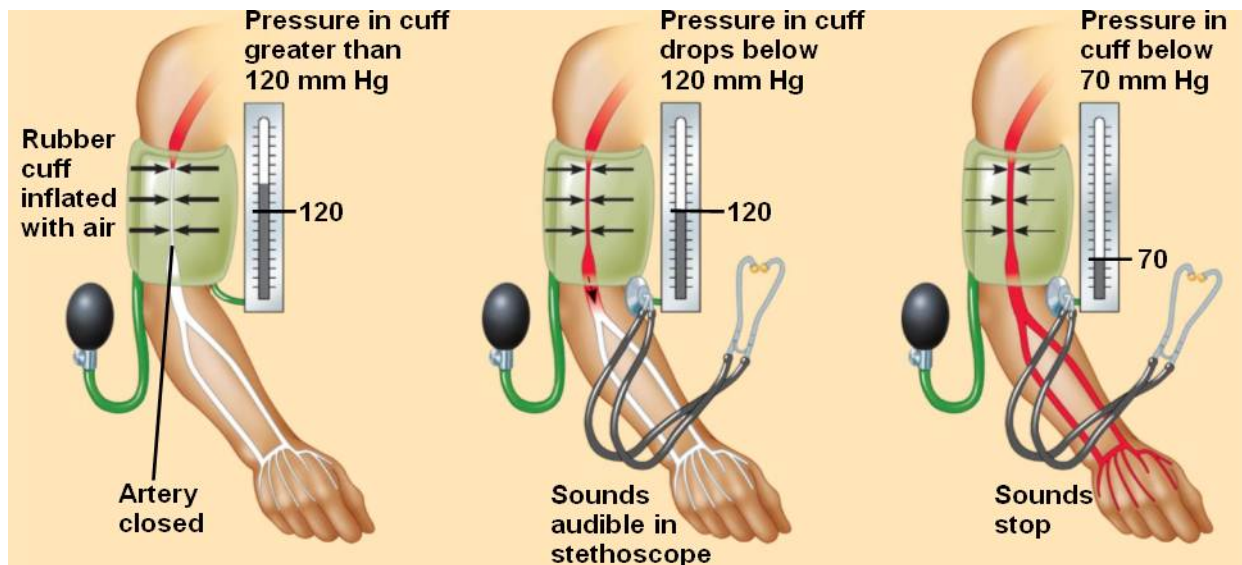
- Made of *Cardiac muscle*
- Pump blood around the body supplying the cells with nutrients and removing wastes (CO<sub>2</sub>) from the cells

- Deoxygenated blood from the body enters the **right Atrium**
- Here the blood is passed through the tricuspid valve to the **right ventricle**.
- The right ventricle contracts and forces blood up through the Semilunar valves and out through the **left and right pulmonary arteries**. This brings blood to the **lungs** to be oxygenated.
- Oxygenated blood from the lungs returns to the heart via the left and right **pulmonary veins** to the **left atrium**.
- The blood is passed to the **left ventricle** through the bicuspid valve.
- The left ventricle contracts and pushes blood through the Semilunar valves and out through the **aorta** to the body.



## Measurement of Blood Pressure

### Blood pressure –



## Blood

### (1) Plasma (55%)

- Mostly made up of water
- Allows things to dissolve
- Variety of ions (osmotic balance)
- Proteins (osmotic balance)

### (2) Cellular elements (45%)

- **Erythrocytes** (red blood cells)
  - Transport oxygen & help transport CO<sub>2</sub>
  - Hemoglobin (oxygen transporting substance in blood)
    - a protein found in the blood that is made up of iron & it carries oxygen to the cells and removes CO<sub>2</sub>
- **Leukocytes** (white blood cells)
  - Defense & immunity (fight foreign invaders and infections)
- Platelets (thrombocyte)
  - Blood particle involved in clotting
  - Fragment of cell sacks
- Blood cells generated in bone marrow
- A lot of blood proteins come from liver

## Substances transported by blood

- Nutrients
- Waste
- Respiratory gases
- Hormones

## HUMAN LYMPHATIC SYSTEM

**Lymphatic system** – is an extension of the circulatory system

**Lymph** – fluid, watery,

- Instead of returning to the heart through blood veins, the lymph enters a series of one-way lymphatic vessels

-

**Lymphatic vessels** (capillaries) – return lymph (fluid) to the circulatory system

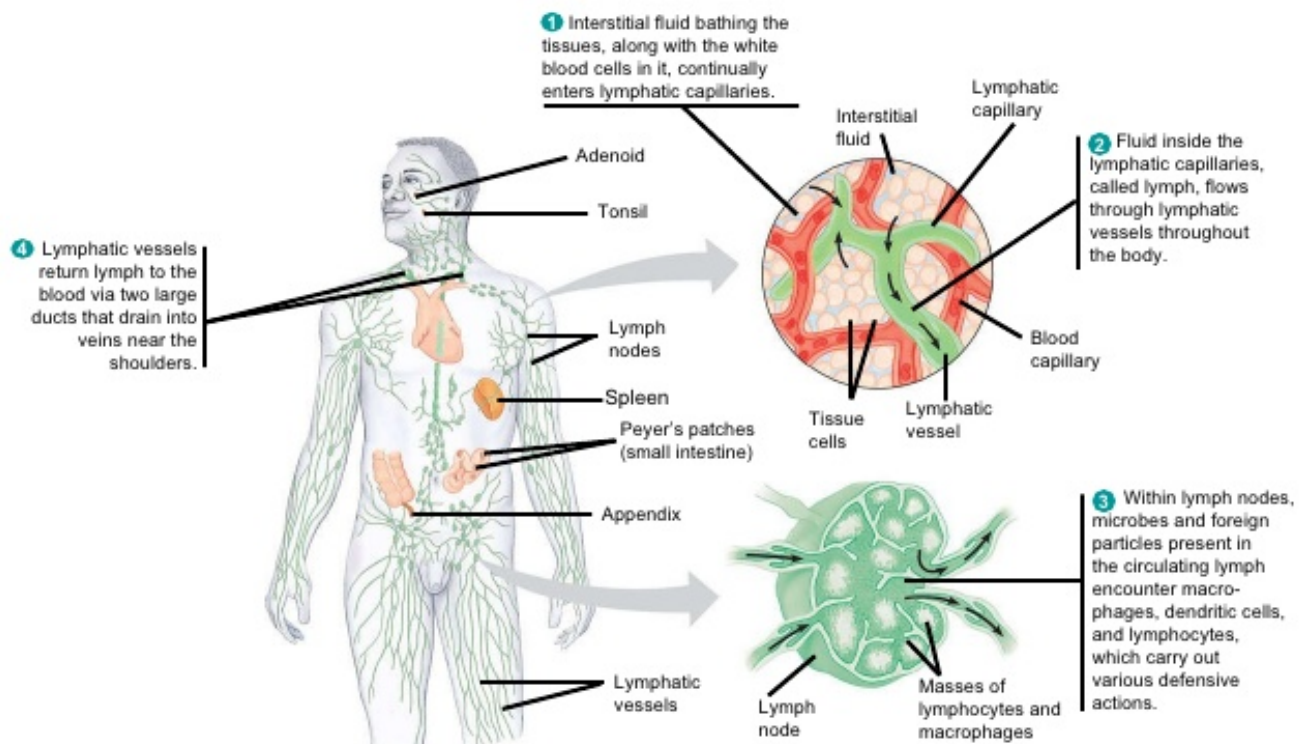
**Lymph nodes (size of a pea)** – packed with white blood cells (**lymphocytes**)

- Masses of lymphocytes & macrophages
- Lymph returned to blood

**Spleen** – like a giant lymph node, but for blood

- Removes old erythrocytes from the blood
- Contains white blood cells

- The lymphatic system plays an active role in defending the body from pathogens



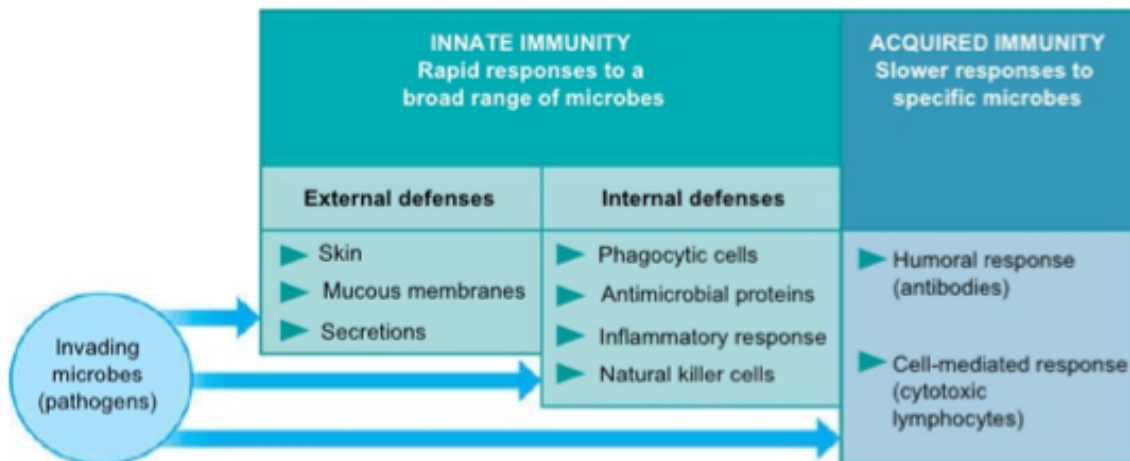
# HUMAN IMMUNE SYSTEM

## Defense against attack

- Unicellular organisms may produce chemicals that are toxic to other organisms to protect them from any attack

## Immune system – defense against infection

- Returning fluid to blood
- Invading microbes (pathogens), such as bacteria, viruses, & fungi that cause disease



**Innate Immunity** – rapid responses to broad ranges of microbes, active immediately upon exposure to pathogens

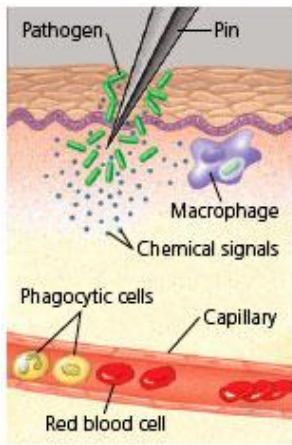
Two levels:

### (1) External Defenses (physical)

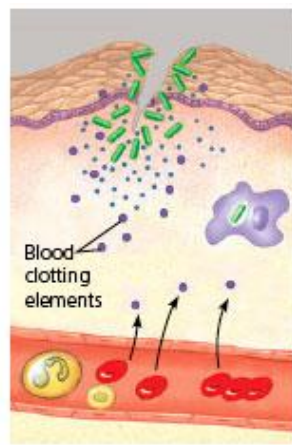
- Skin (provides physical barrier)
- Mucous membranes
- Secretions (provide an environment that is often hostile to microbes)

### (2) Internal Defenses (cellular)

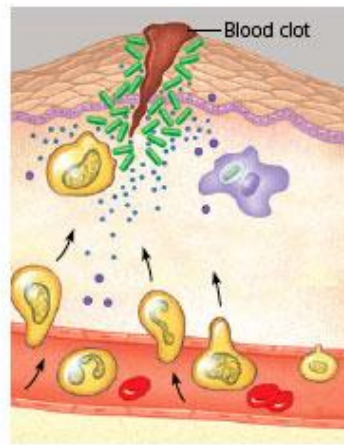
- Phagocytosis cells (**phagocytes**) – types of white blood cells
  - ingest invading microorganisms
  - initiate the inflammatory response → **mast cells** (part of connective tissue)
  - Protect the body by engulfing and digesting foreign invaders (pathogens)
- **Macrophages** – specific type of phagocyte
  - can be found migrating through the body, in various organs of the lymphatic system
- **Inflammatory Response** – release histamine
  - Increased blood flow in capillaries
  - Increased permeability (more leaky)
  - Redness
  - Heat
  - Swelling



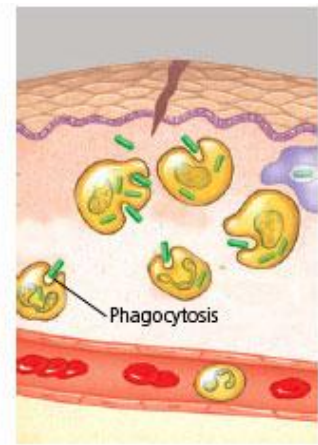
1 Chemical signals released by activated macrophages and mast cells at the injury site cause nearby capillaries to widen and become more permeable.



2 Fluid, antimicrobial proteins, and clotting elements move from the blood to the site. Clotting begins.



3 Chemokines released by various kinds of cells attract more phagocytic cells from the blood to the injury site.



4 Neutrophils and macrophages phagocytose pathogens and cell debris at the site, and the tissue heals.

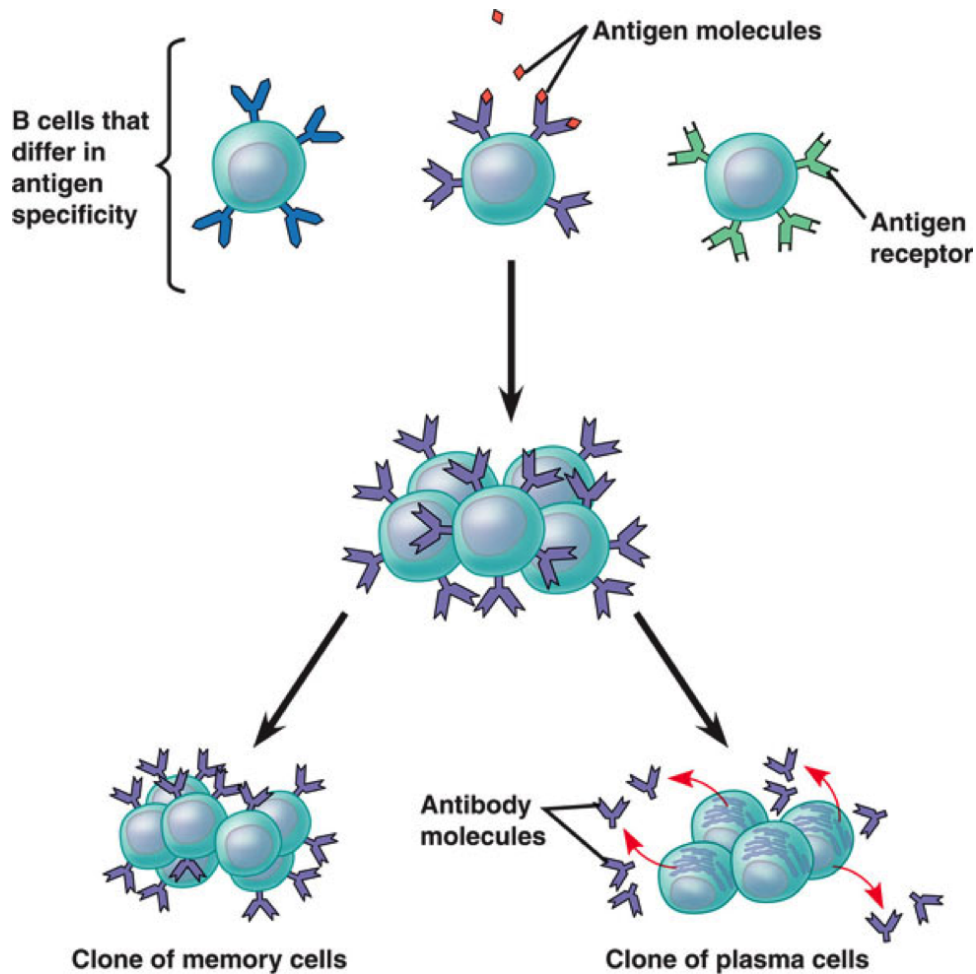
**Acquired Immunity** – slower response to specific microbes

**(1) Humoral immune response** – involves the activation & clonal selection of B cells, resulting in the production of antibodies

- **B cells** – found in lymph nodes,
- Produces different antigen binding site

**Antigen** – is any substance that causes your immune system to produce antibodies against it

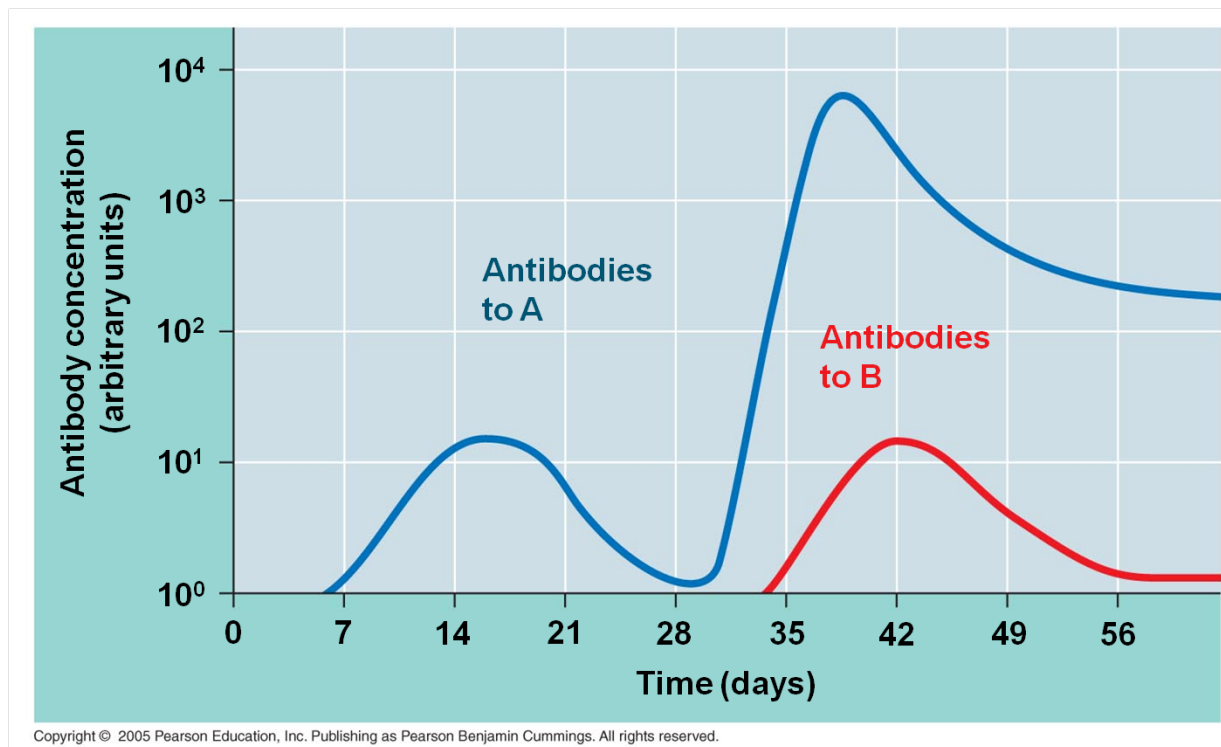
- May be any foreign substance from the environment such as chemicals, viruses, bacteria or pollen
- May be formed inside body, as with bacterial toxins or tissue cells



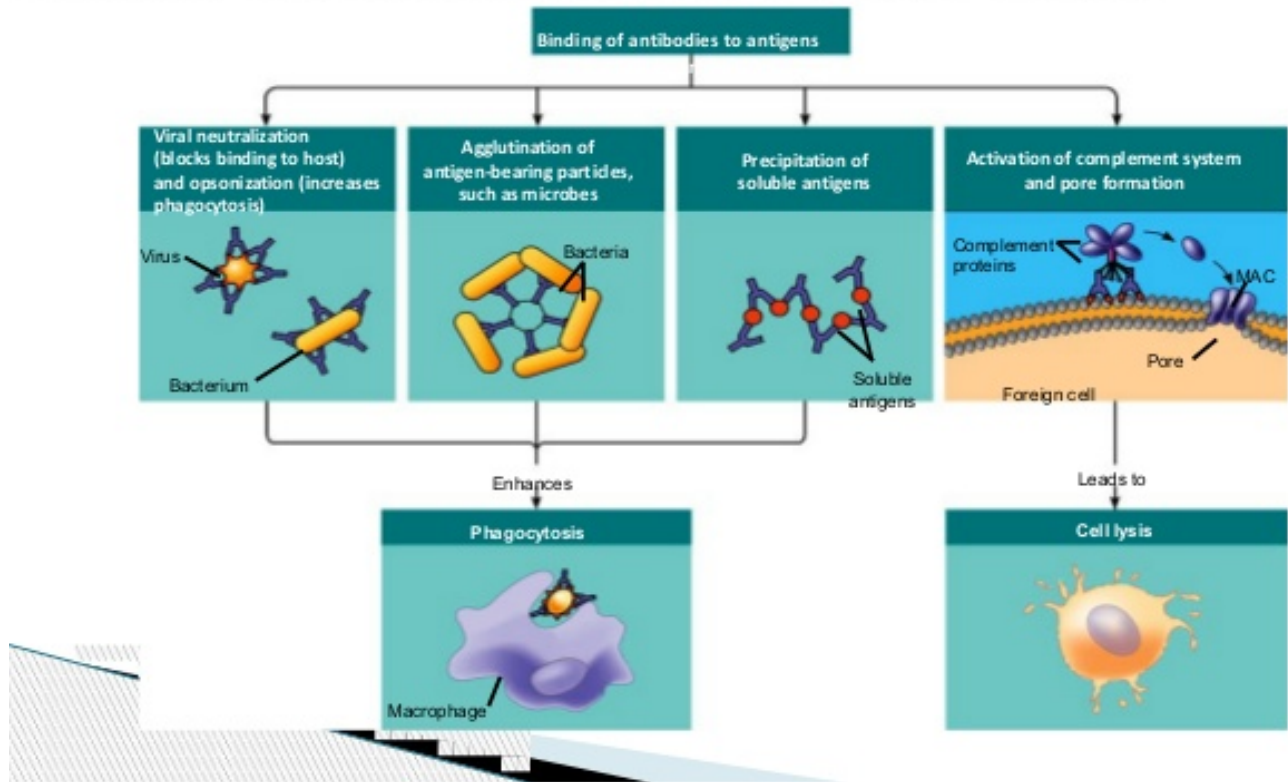
Clone Plasma Cells

## Clone Memory Cells

- **Memory cells** facilitate a faster, more efficient response
- Day 1: First exposure to antigen A
- **Primary response** to antigen A produces antibodies A
- Day 28: Second exposure to antigen A; first exposure to antigen B
- **Secondary response** to antigen A produces antibodies to A; **primary response** to antigen B produces antibodies to B
  
- Exposed to virus second time, memory cells respond very quickly, destroys virus before it releases any symptoms
  
- Exposed to new virus, have to go through initial process again

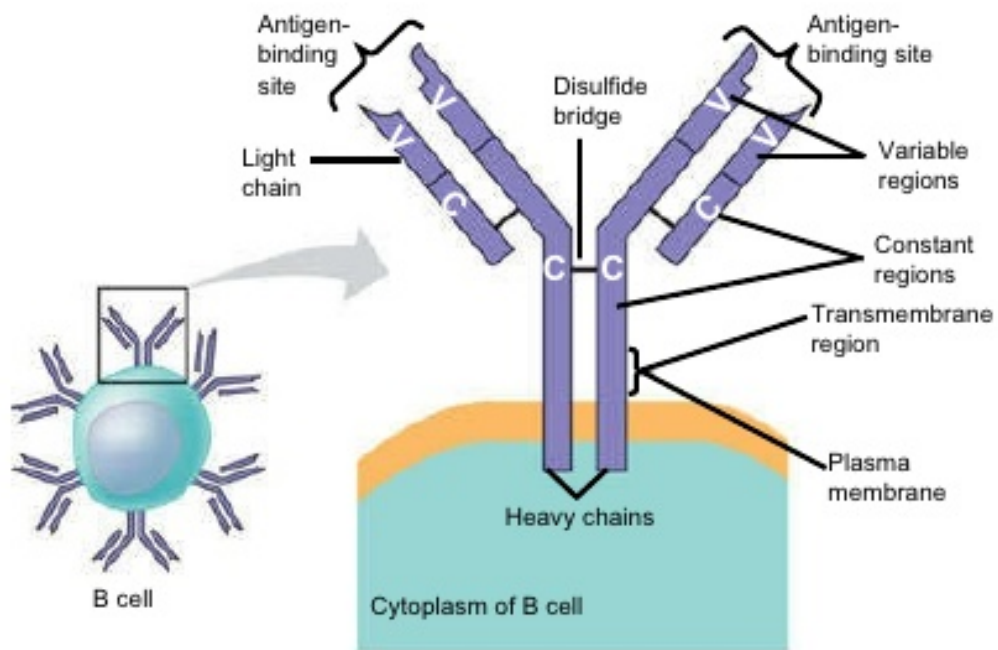


# Antibody-mediated mechanisms of antigen disposal



The binding of antibodies to antigens

- Basis of several antigen disposal mechanisms
- Leads to elimination of microbes by phagocytosis & complement-mediated lysis

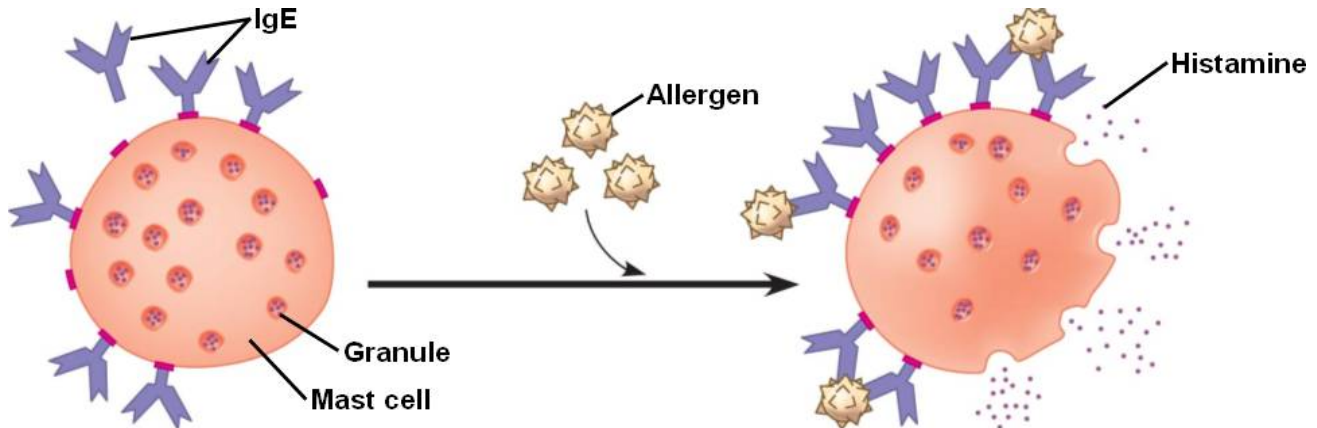


(a) A B cell receptor consists of two identical heavy chains and two identical light chains linked by several disulfide bridges.

## Immune System

**Allergy** – exaggerated response to a certain antigen called allergens

- Antibodies produced after first exposure to an allergen attach to receptors on mast cells
- Next time allergen enters the body it binds to mast cells
- **Mast cells** then release histamine that causes vascular changes & typical symptoms



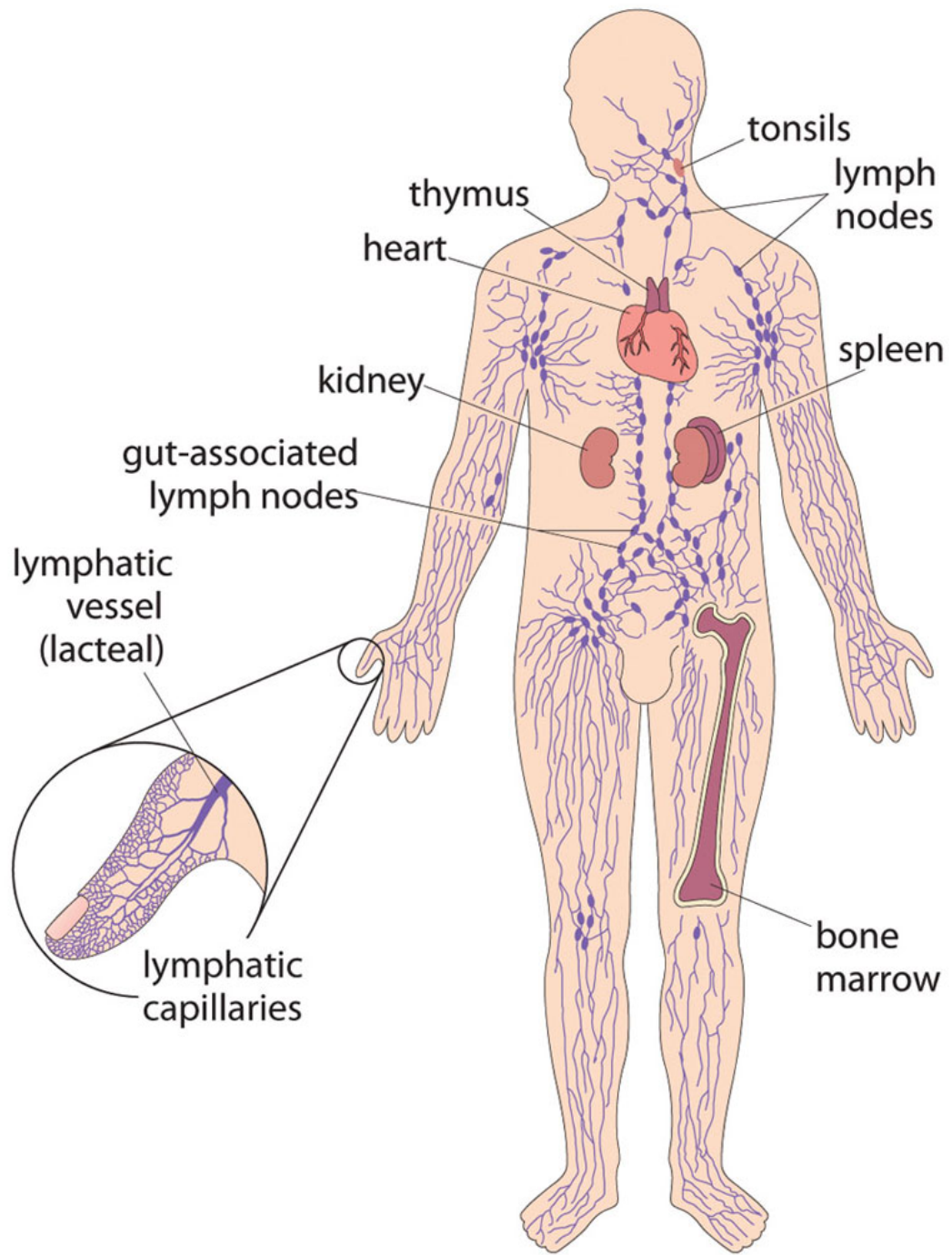
**Tissue rejection** – normal immune response to transplanted tissue

- The immune system's ability to distinguish self from non-self limits tissue transplantation
- The immune system can attack cells from other individuals
- Transplanted tissues are usually destroyed by the recipient's immune system

**Autoimmune system** – immune response to the body's own tissue

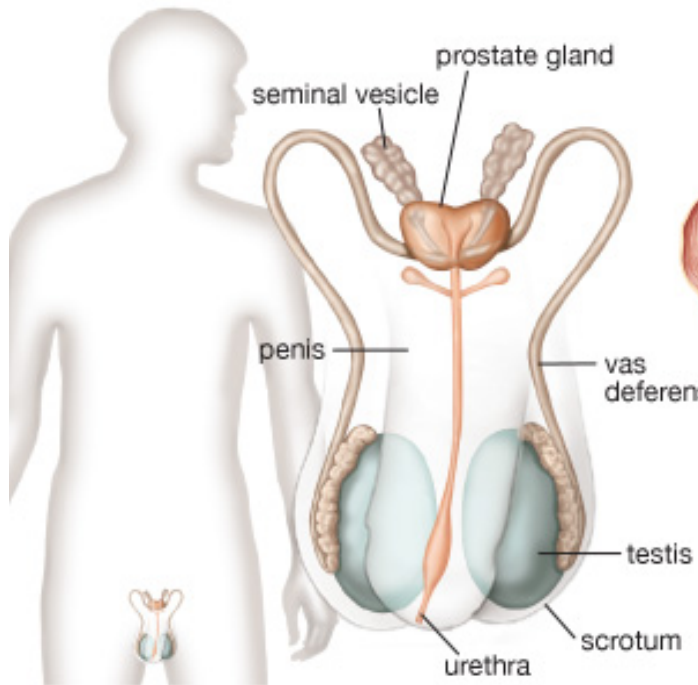
**Vaccine** – injection of an antigen

- Triggers the production of memory cells

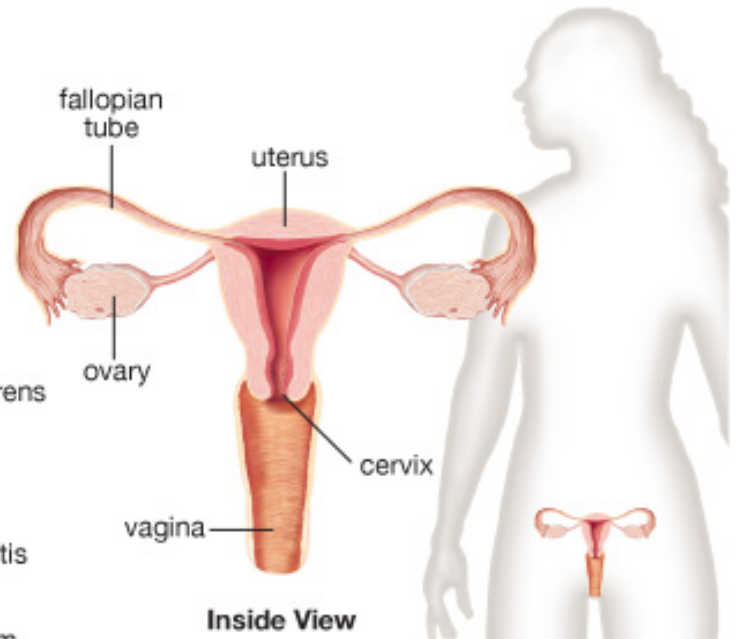


# HUMAN REPRODUCTIVE SYSTEM

## Male Reproductive System



## Female Reproductive System



© 2013 Encyclopædia Britannica, Inc.