

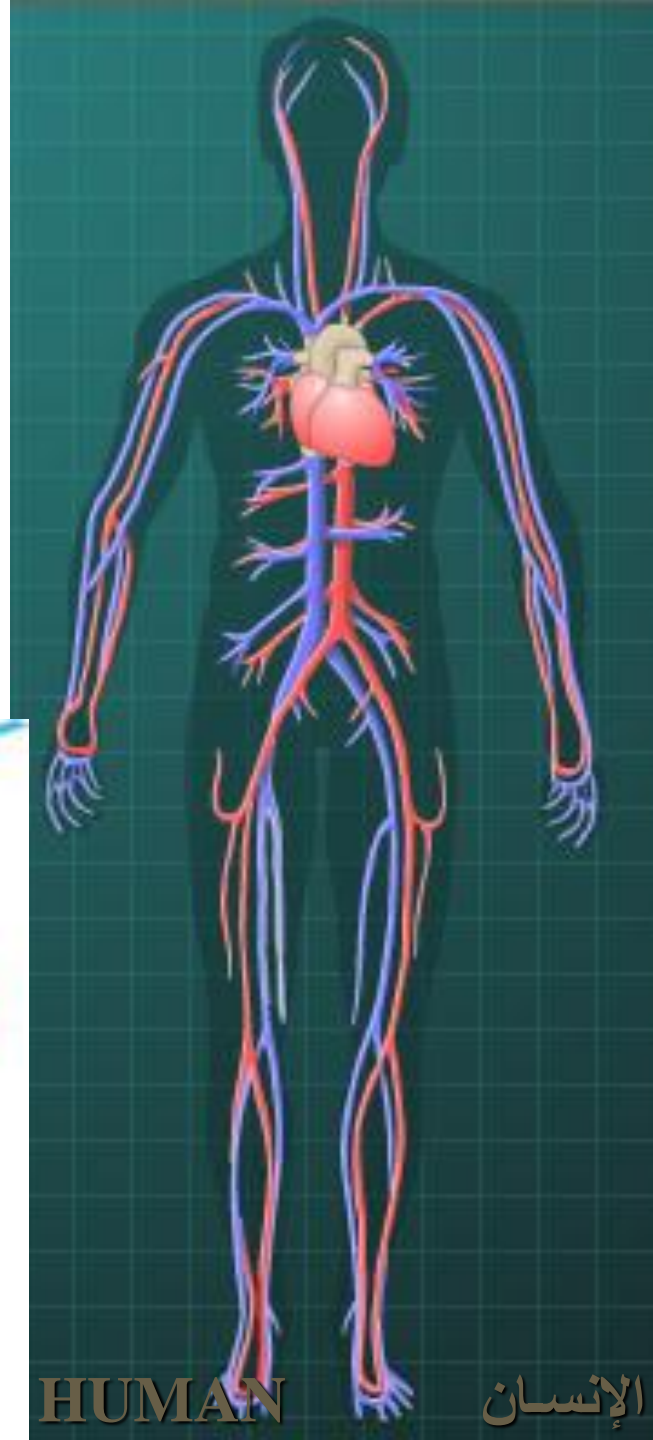
# The Immunology

**Lecture 1**

**By: Dr. Ghasoun M.A. Wadai**

# Human Organ Systems

- Respiratory system
- Cardiovascular system
- Digestive system
- Renal system
- Reproductive system
- Musculo-skeletal system
- Nervous system
- Endocrine system
- Immune system

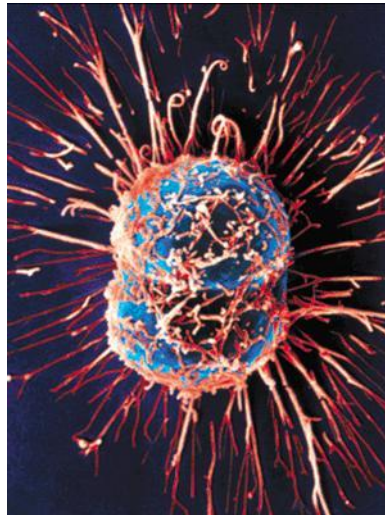
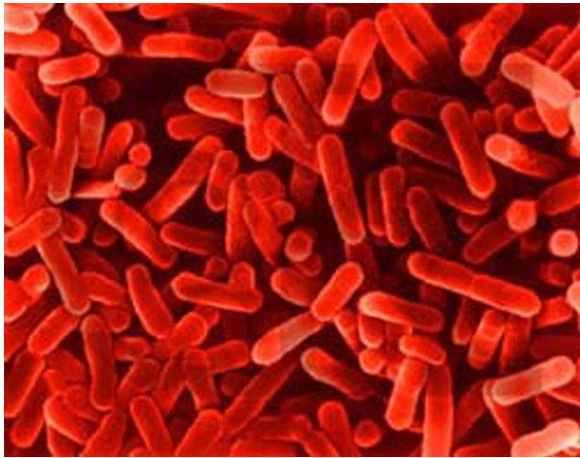


HUMAN

الإنسان

# What is the immune system?

- The body's defense against disease causing organisms, malfunctioning cells, and foreign particles



# IMMUNITY

The term Immunity is derived from the Latin word Immunitae, which referred to the protection from the legal prosecution offered to Roman Senators during their tenure in office.

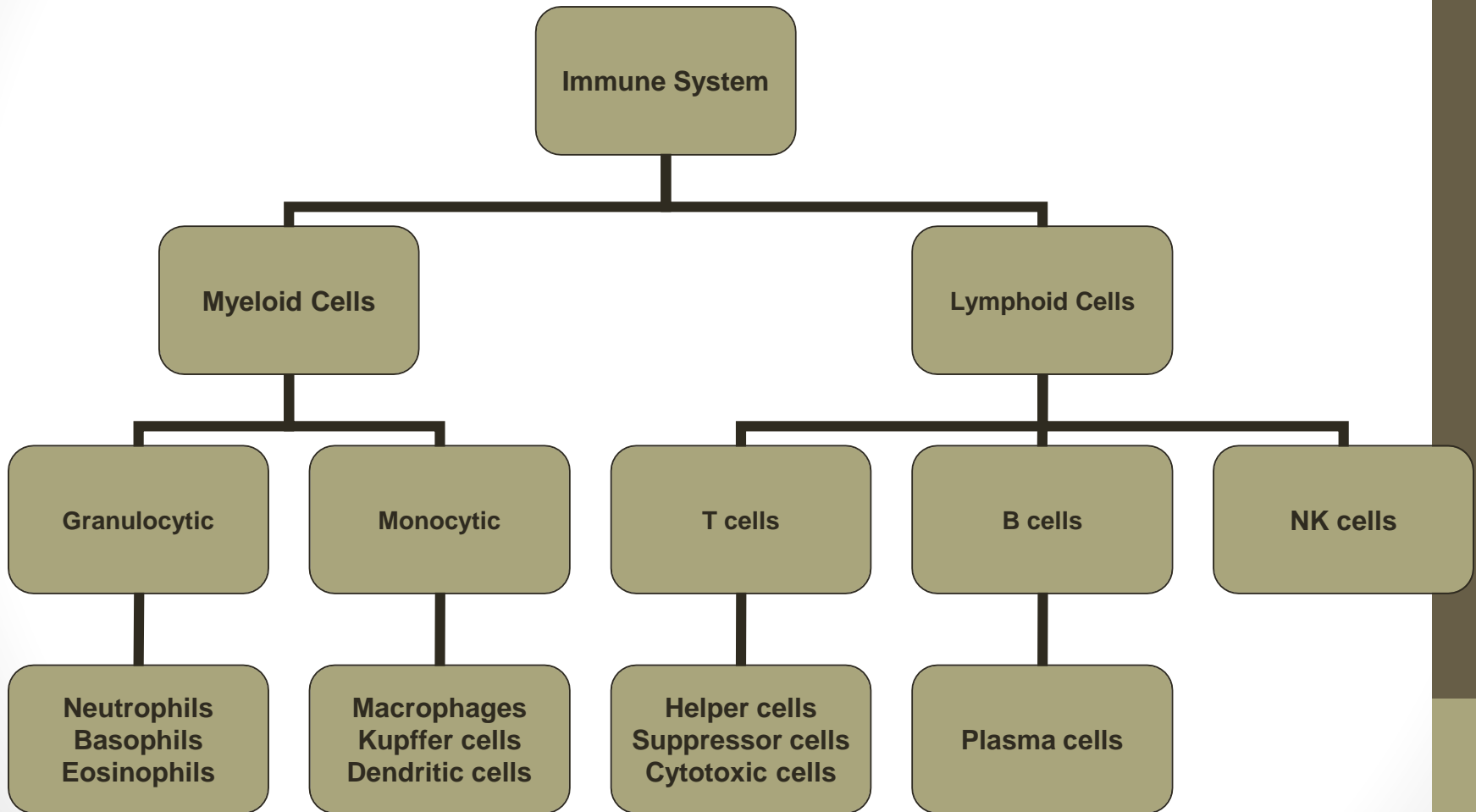
Refers to the resistance exhibited by the host towards injury caused by microorganisms and their products.

- ⇒ Protection against infectious diseases
- ⇒ Distinguishes self from non-self
- ⇒ Eliminate potentially destructive foreign substances from body

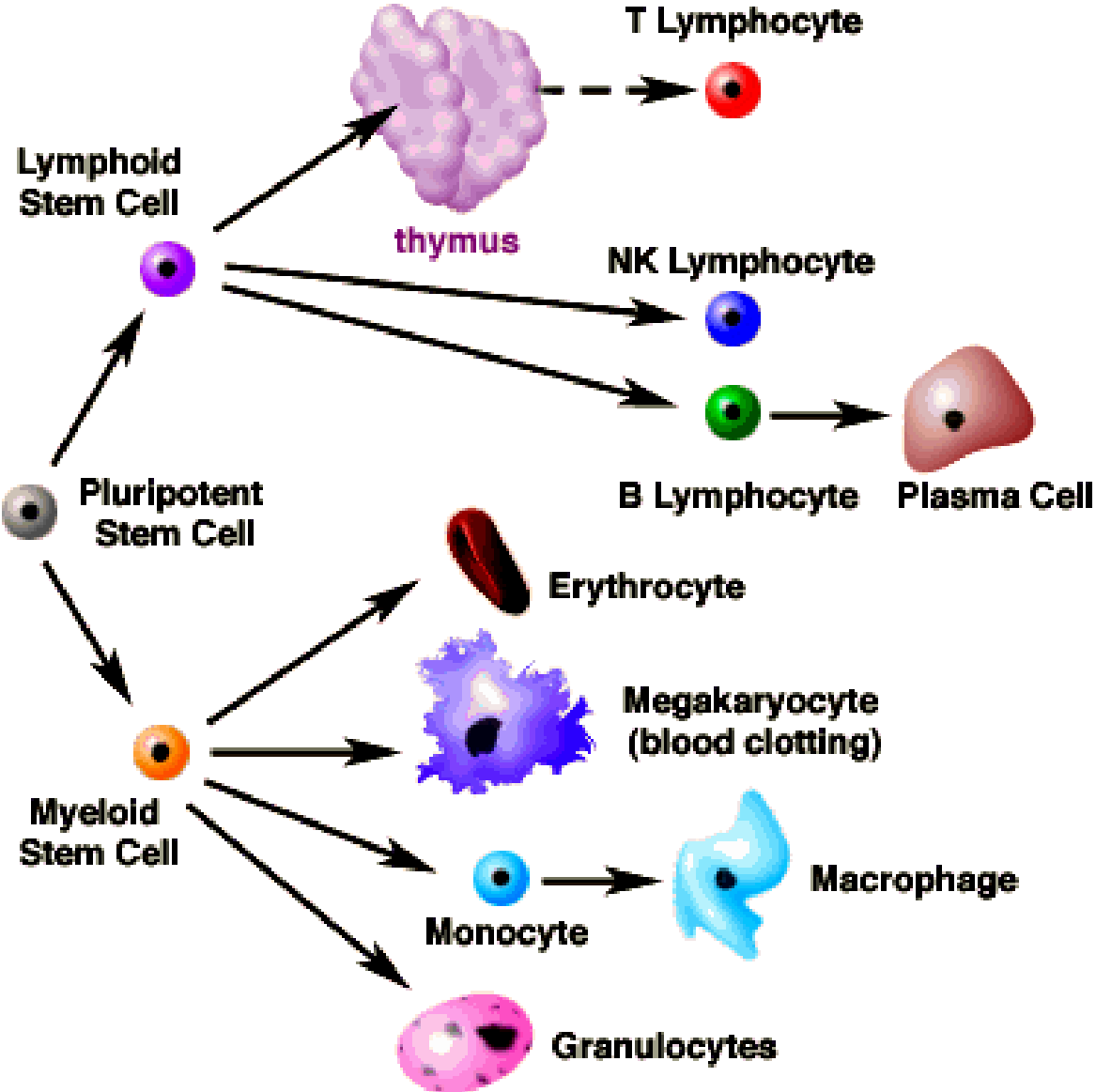
# IMMUNE SYSTEM

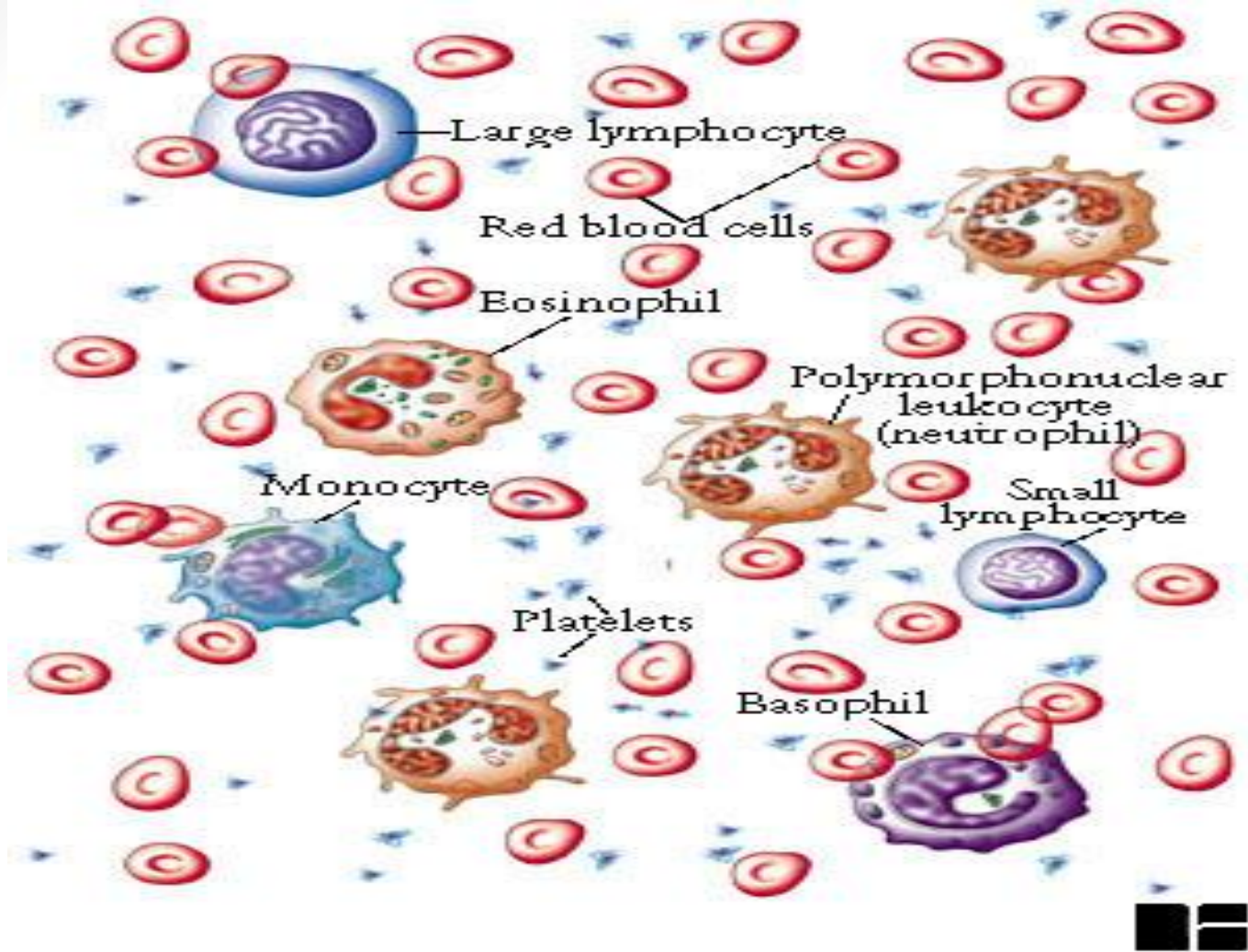
- is a system of biological structures and processes within an organism that protects against disease.
- To function properly, an immune system must detect a wide variety of agents, from viruses to parasitic worms, and distinguish them from the organism's own healthy tissue.
- The immune system recognizes foreign bodies and responds with the production of immune cells and proteins
- Barriers help an organism to defend itself from the many dangerous pathogens it may encounter

# Cells of the Immune System



# The Immune System

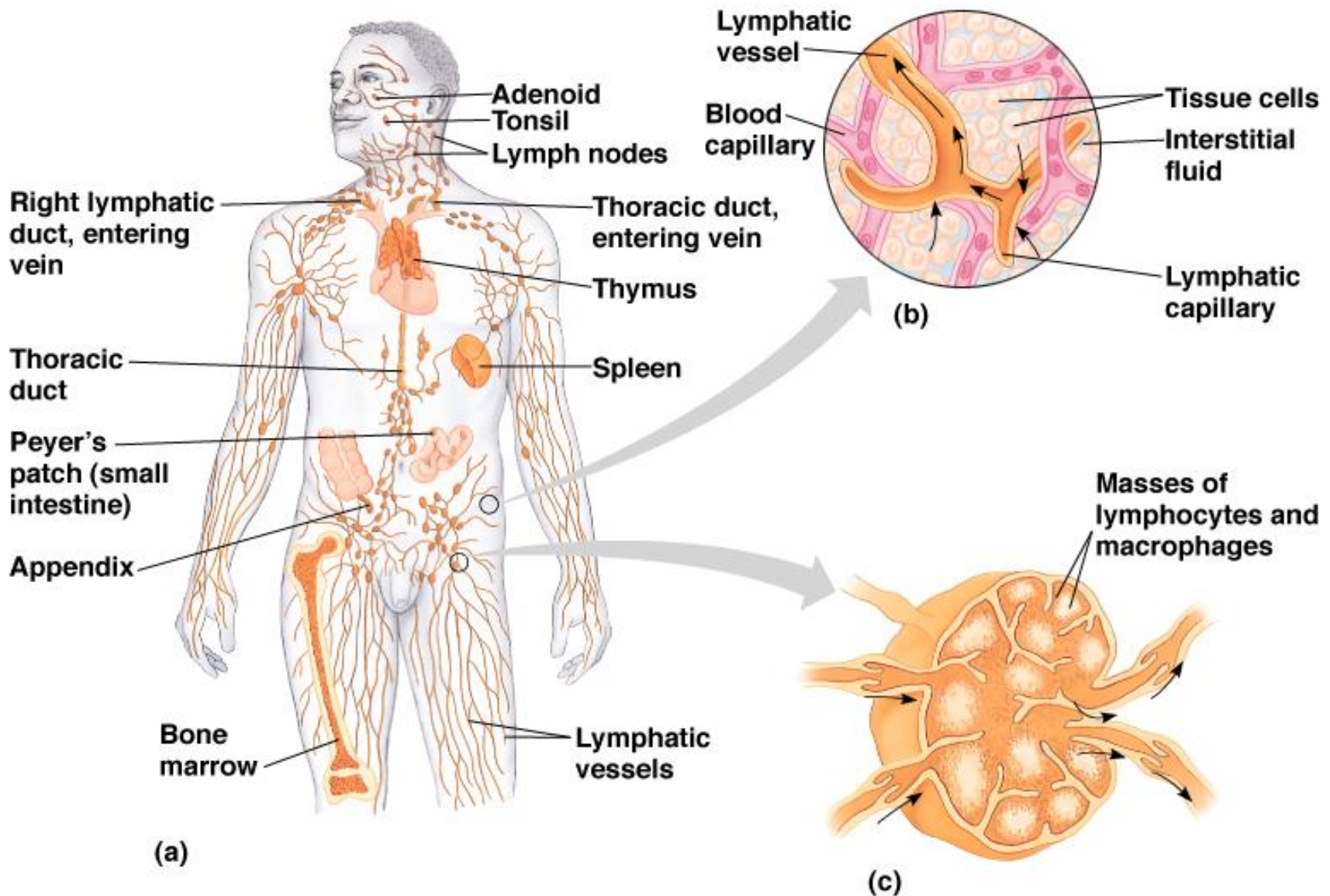




# Cells of immune system

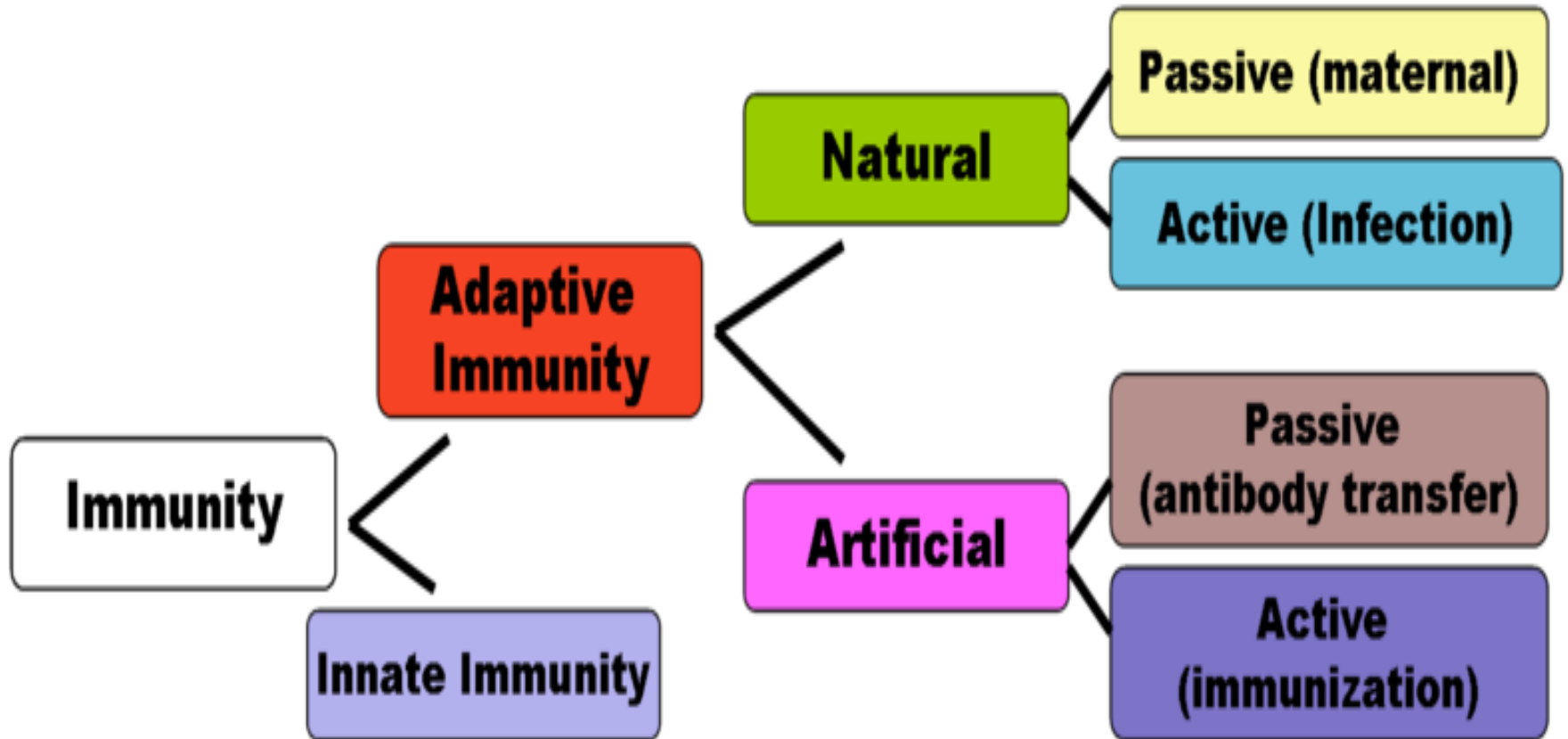


# Components of Human Immune System



# **Components of Immune System**

# CLASSIFICATION



## **INNATE IMMUNITY**

- 1. Resistance to infection which individual possesses by virtue of his genetic and constitutional make up.**
- 2. Early defense response against microbes.**
- 3. Immune response Non specific.**
- 4. Innate response do not alter on repeated exposure.**
- 5. Memory effect absent.**
- 6. Not affected by immunisation or prior contact**

## **ACQUIRED IMMUNITY**

- 1. The resistance that an individual acquires during life.**
- 2. Later defense response .**
- 3. Immune response is highly specific .**
- 4. Adaptive response improves with each successive encounter with same pathogen**
- 5. Memory effect present**
- 6. Is improved by immunisation**

# *Immune system*

The human body has  
Two type of immunity

**Innate :**

a **general** response  
to all pathogens

**does not** improve with  
subsequent infections

**Acquired :**

a response **targeted**  
against pathogens

**does** improve with  
subsequent infections

# BARRIER DEFENSES

- Barrier defenses include the skin and mucous membranes of the respiratory, urinary, and reproductive tracts
- Mucus traps and allows for the removal of microbes
- Many body fluids including saliva, mucus, and tears are hostile to microbes
- The low pH of skin and the digestive system prevents growth of microbes

# INNATE IMMUNITY

- nonspecific immunity
- is the natural resistances with which a person is born.
- It provides resistances through several physical, chemical and cellular approaches.
- Microbes first encounter the epithelial layers, physical barriers that line skin and mucous membranes.
- Subsequent general defenses include secreted chemical signals (cytokines), antimicrobial substances, fever, and phagocytic activity associated with the inflammatory responses.
- The phagocytes express cell surface receptors that can bind and respond to common molecular patterns expressed on the surface of invading microbes.
- Through these approaches, innate immunity can prevent the colonization, entry and spread of microbes.

- A white blood cell engulfs a microbe, then fuses with a lysosome to destroy the microbe
- There are different types of phagocytic cells:
- Neutrophils engulf and destroy microbes
- Macrophages are part of the lymphatic system and are found throughout the body
- Eosinophils discharge destructive enzymes
- Dendritic cells stimulate development of acquired immunity



# The innate immune system

## 1\_Physicochemical barriers

- Skin
- Mucous membranes
- Mucous

provides a physical barrier preventing microbial access

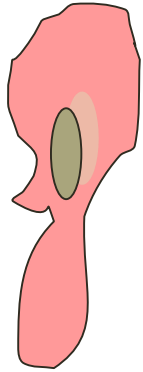
## 2\_Physiological variables

- pH of our environment
- temperature of our environment

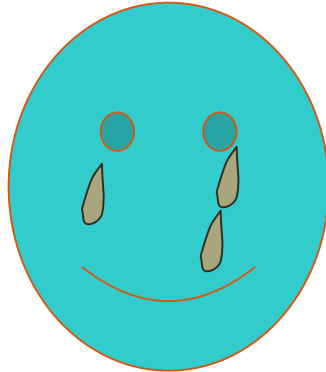
## 3\_chemical defenses

- nitric oxide, enzymes, proteins, complement
- **Secreted agents** : Lysozyme, saliva, urine

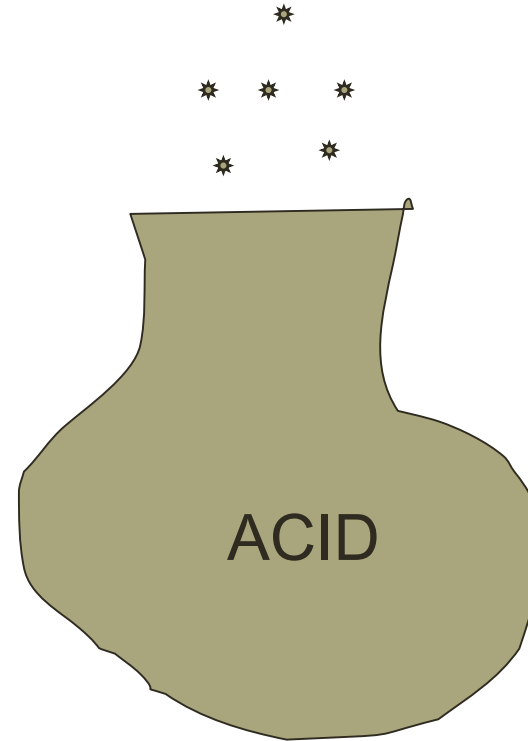
# Examples of Innate Immunity



Ear wax



Tears



Acidity of Stomach



Sweat

# Innate Immunity

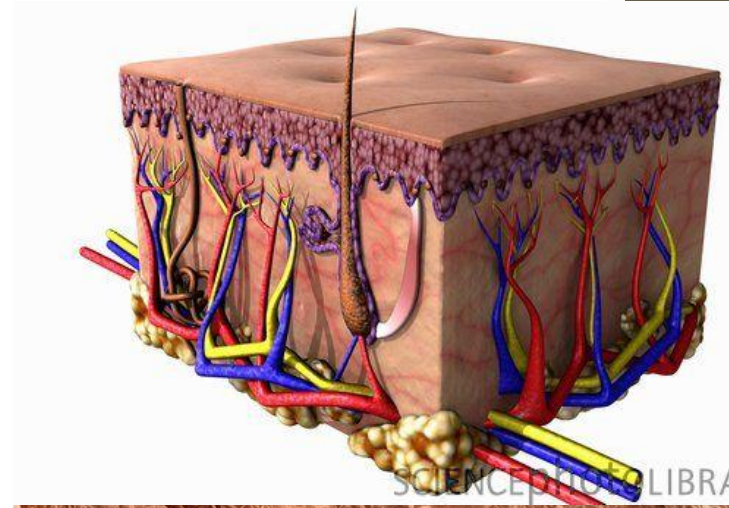
- **Protection by Skin and Mucous Membranes**
- **Phagocytic Cells**
  - Remove debris (garbage men)
  - Macrophages, Neutrophils, Monocytes
- **Natural Killer Cells**
  - Lymphocytes that kill virally infected cells and tumours
- **Complement System**
  - “complements antibody in the killing of bacteria”
  - A group of >30 proteins found in the blood

# The First Line of Defense

# 1-Skin

## Role of skin

- The dead, outer layer of skin, known as the **epidermis**, forms a shield against invaders and secretes chemicals that kill potential invaders
  - Dead skin cells are constantly sloughed off, making it hard for invading bacteria to colonize.
  - Sweat and oils contain anti-microbial chemicals, including some antibiotics.



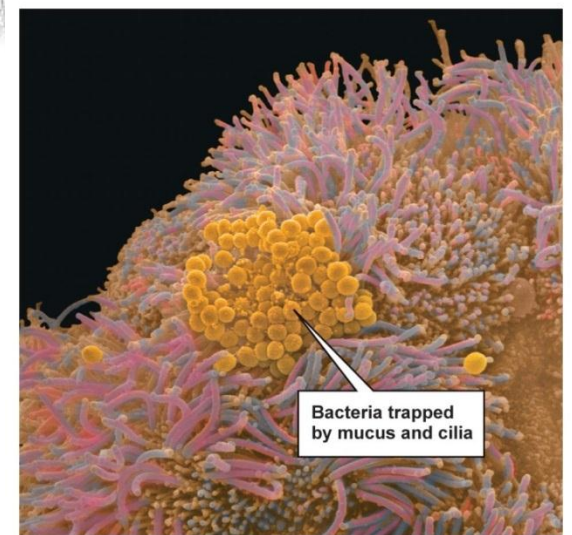
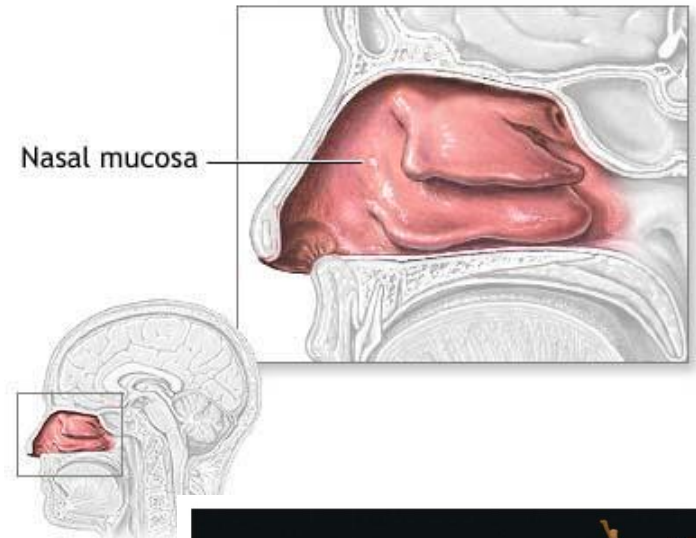
# 2-Mucus and Cilia

## Role of mucus and cilia

Mucus contains lysozymes, enzymes that destroy bacterial cell walls.

The normal flow of mucus washes bacteria and viruses off of mucus membranes.

Cilia in the respiratory tract move mucus out of the lungs to keep bacteria and viruses out.



What's the first thing you do when  
you cut your finger?



- The most  
typical  
survival  
however

- Swallowed bacteria are broken down by incredibly strong acids in the stomach that break down your food
- The stomach must produce a coating of special mucus or this acid would eat through the stomach!





# Think of the human body as a hollow plastic tube...

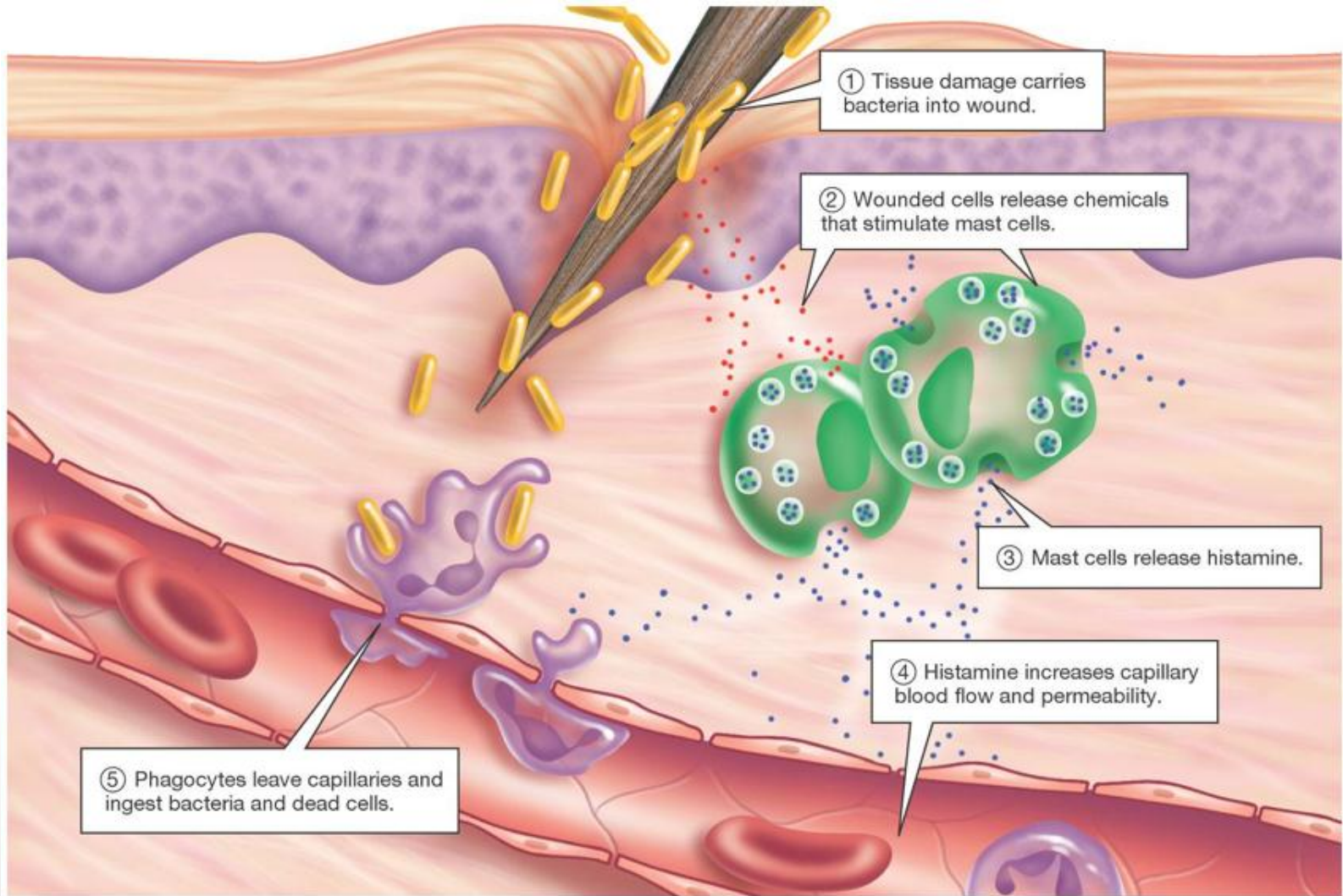


The food is digested within the hole in the tube, but it never actually enters into the solid plastic material.

Tube inside  
~Digestive system~

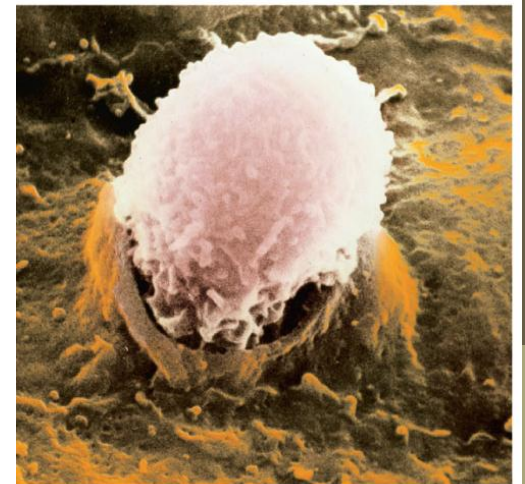
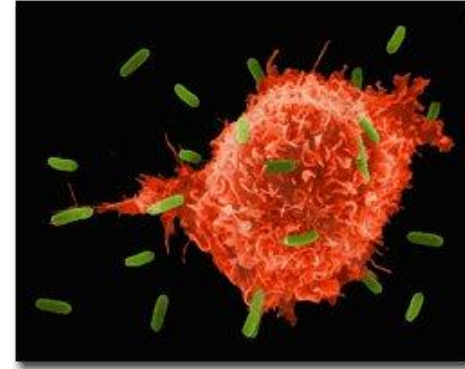
Anterior  
body~

!



# Role of phagocytes

- Phagocytes are several types of white blood cells (including macrophages and neutrophils) that seek and destroy invaders. Some also destroy damaged body cells.
- Phagocytes are attracted by an inflammatory response of damaged cells.



# Role of inflammation

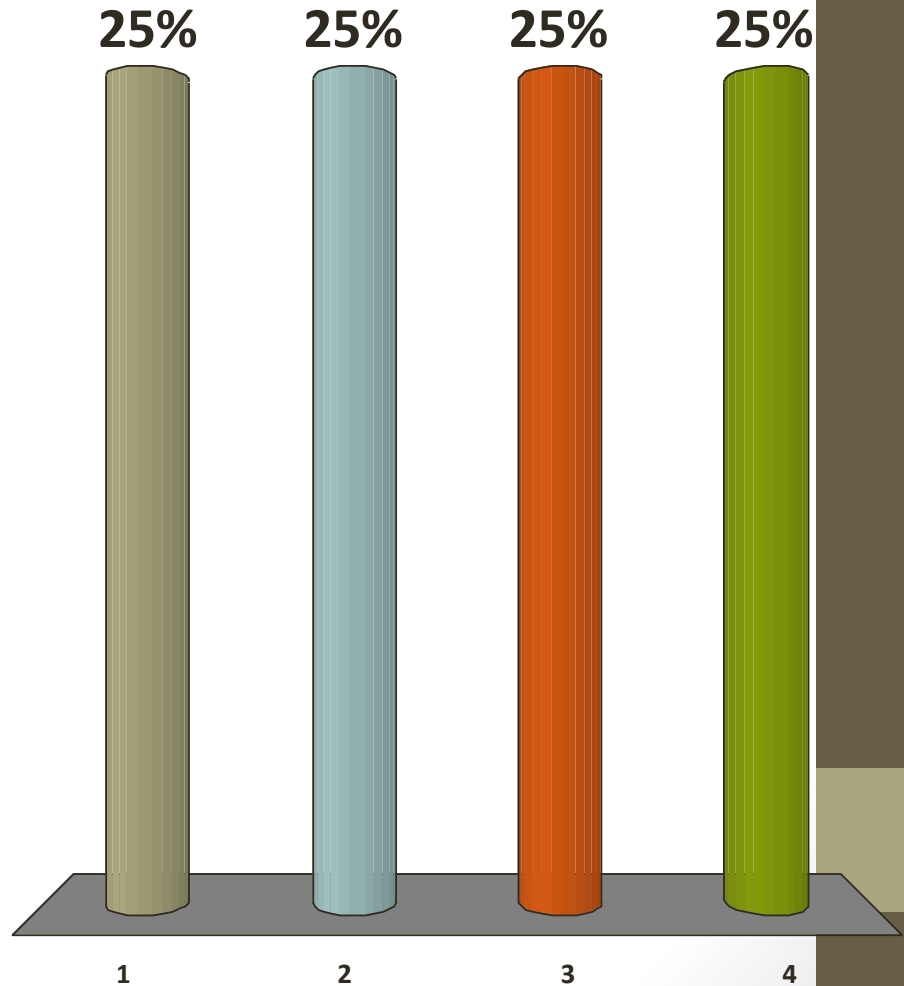
- Inflammation is signaled by mast cells, which release histamine.
- Histamine causes fluids to collect around an injury to dilute toxins. This causes swelling.
- The temperature of the tissues may rise, which can kill temperature-sensitive microbes.

# Role of fever

- Fever is a defense mechanism that can destroy many types of microbes.
- Fever also helps fight viral infections by increasing interferon production.
- While high fevers can be dangerous, some doctors recommend letting low fevers run their course without taking aspirin or ibuprofen.

# Fever is caused by:

1. Toxins on the surface of viruses.
2. Release of histamines by damaged cells.
3. Your own body's accumulated toxins.
4. Your body's pyrogens signaling the hypothalamus.



# **Determinants of innate immunity**

**I. Species and strains**

**II. Age**

**III. Hormonal Influences**

**IV. Nutrition**

# **MECHANISMS OF INNATE IMMUNITY**

## **I. Epithelial surfaces**

**Skin**

**Mucosa of the respiratory tract**

**Human eye.**

**Flushing action of urine**

## **II. Antibacterial substances in Blood and tissues**

## **III. Inflammation**

## **IV. Fever**

## **V. Cellular factors**