

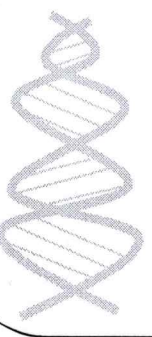
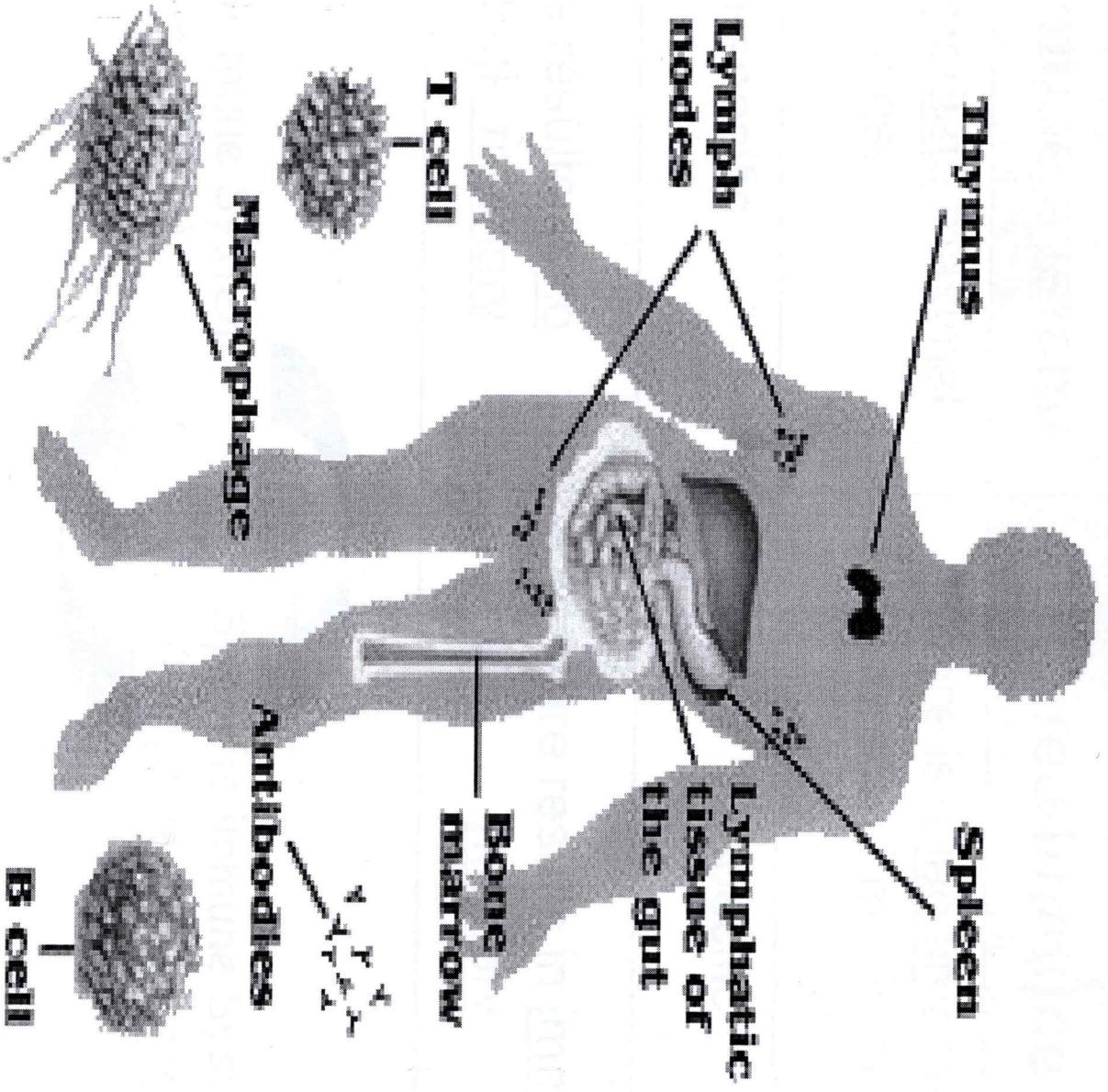
# What is immunity?

- We are surrounded by bacteria, viruses, and fungi, swarms on our skin and invades our inner passageways!!!
- **Immunity:** is the ability of organism to resist infection by any foreign (non-self) invaders
- Function of immune system
- Defends body against these small foreign invaders
- To distinguish between self (normal component of the body) and non-self (foreign component)s

# The Immune System

- The immune system is the body's defense against infectious organisms and other invaders.
- Each exposure (to the same pathogen) increases the effectivity of the response
- **Primary Lymphoid organs of the immune system**
  - I. Thymus
  - II. Bone marrow
- **Secondary lymphoid organs**
  - I. Lymph nodes
  - II. Spleen
  - III. Skin
  - IV. liver
  - V. Tonsils
  - VI. Small intestine

# The Immune System

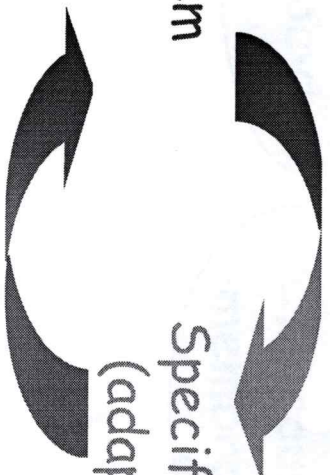




Immune system is divided into:

<b>innate Immune system</b>	<b>Acquired Immune system</b>
There is <u>immediate</u> maximal response	There is a <u>lag time</u> between exposure and maximal response
Non-specific	specific
Exposure results in <u>no immunologic memory</u>	Exposure results in <u>immunologic memory</u>

Non-specific immune System  
(innate or natural)



Specific immune System  
(adaptive or acquired)



**Immune system**

**Acquired immune system**

**Innate immune system**

**Humoral (antibody mediated) immune response**

**Cellular (Cell mediated) immune response**

**1<sup>st</sup> line of defense**

**2<sup>nd</sup> line of defense**

**B-lymphocytes**

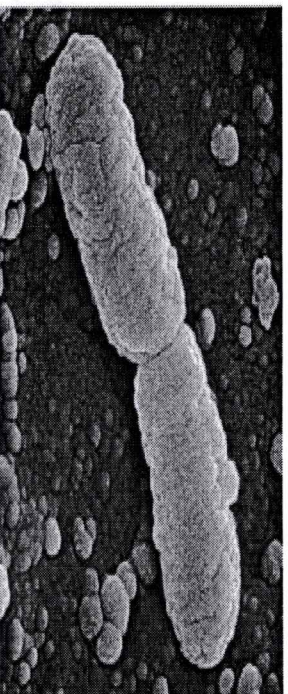
**T-lymphocytes**

**Skin  
Mucous membrane**

**Inflammation  
Phagocytosis  
Natural killers  
Complement  
Cytokines**



# Defense Against Disease



**Nonspecific External Barriers**  
skin, mucous membranes

If these barriers are penetrated,  
the body responds with

**Innate Immune Response**  
phagocytic and natural killer cells,  
inflammation, fever

If the innate immune response is insufficient,  
the body responds with

**Adaptive Immune Response**



# INNATE IMMUN SYSTEM

- Innate immunity refers to nonspecific defense mechanisms that come into play immediately or within hours of an antigen's appearance in the body.
- These mechanisms include physical barriers

## Is consists of:

- Anatomic Barriers (skin and mucous membrane)
- Stomach acid and enzymes (lysozymes)
- Tear & saliva
- Phagocytosis (phagocytes) Interferon
- Complement system
- NK (natural killer)
- mast cells
- Inflammatory reaction
- innate immune System (Natural)

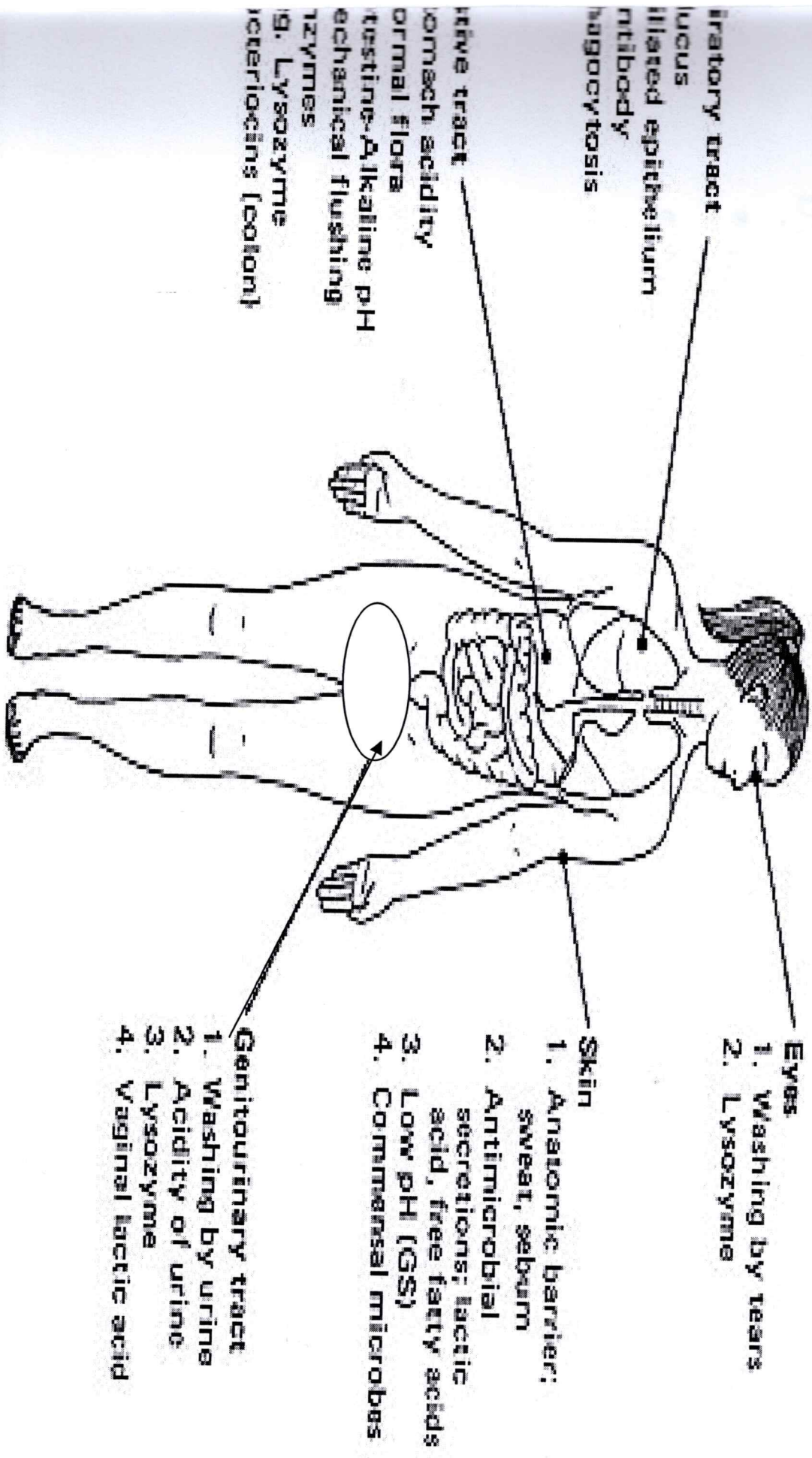
# First lines of defense (Anatomical barriers):

## The natural barriers

### the skin

### 2- mucous membranes

protect organ system open to the external environment such as the digestive, respiratory, reproductive system and lymph system



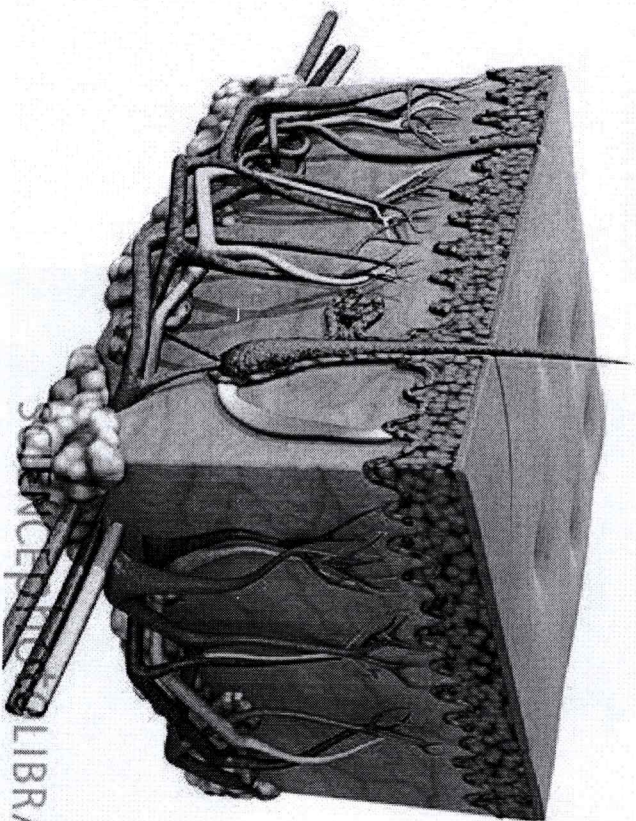


# First line of defense

- Non-specific defenses are designed to prevent infections by viruses and bacteria. These include:
  - Intact skin
  - Mucus and Cilia

# Role of skin

- 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.



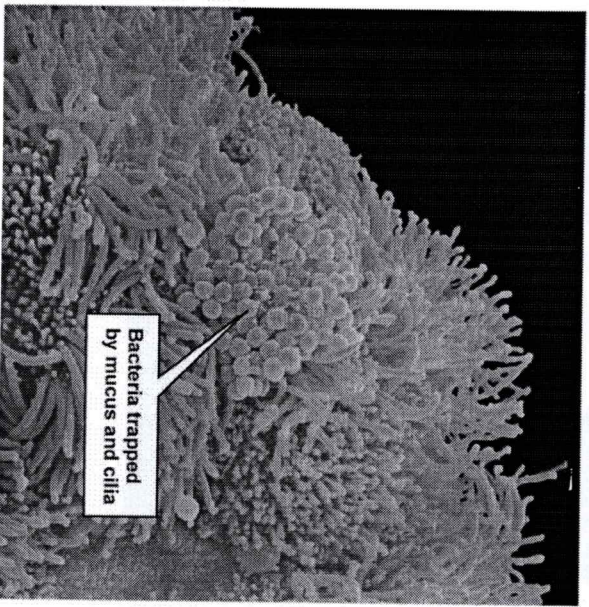
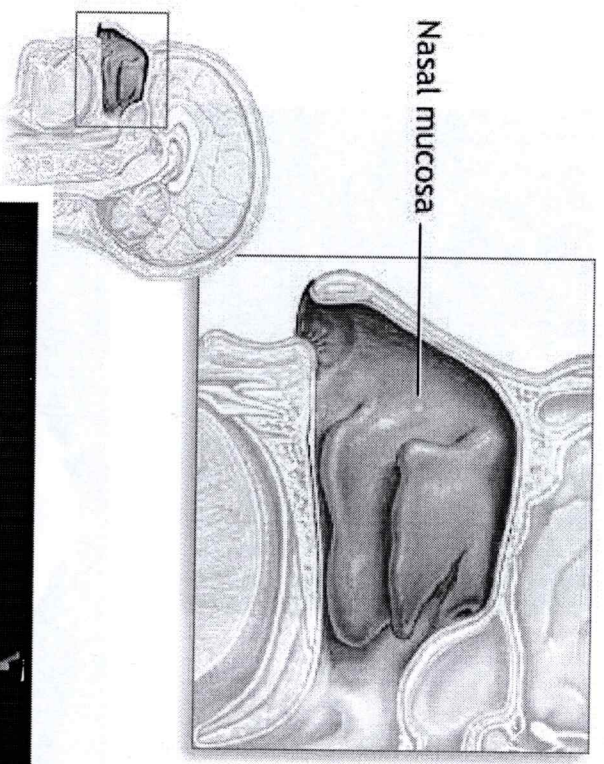


# Role of mucus and cilia

Mucus contains lysozymes, enzymes that destroy bacterial cell walls.

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

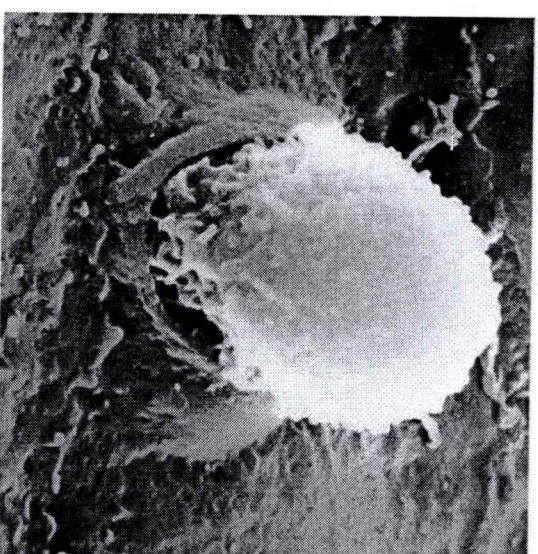
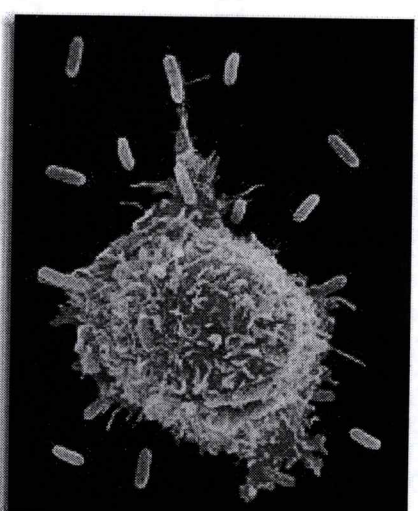
Cilia in the respiratory tract move mucus out of the lungs to keep bacteria and viruses out.



# Second Line defences

## 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.



**Complement is not a cell but a group of proteins**

set of about 30 different kinds of proteins that circulate in an inactive form in the blood  
These proteins can act together (in complement) with other defense mechanisms made in the liver

Activated by infection,

activated complements:

- help to recruit phagocytes to site of inflammation and activate them
- bind to receptors on phagocytes, helping to remove agent of infection
- form pores in the invader or infected cell's membrane (like the NKs do)
- activate mast cells to release histamine and other factors
- Certain complement proteins also help trigger the inflammatory responses

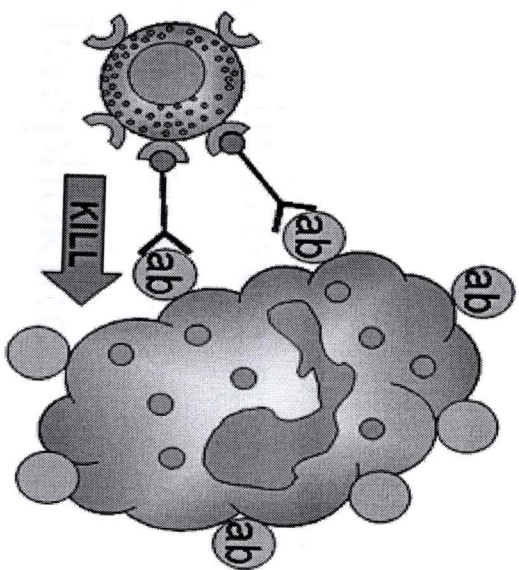
## tural killer cells (NK cells)

Cells, known as Natural Killer Cells, target virus infections and tumors. They usually take 3 days to become active. When active they will destroy the infected cells.

Instead of attacking the invaders, they attack the body's own cells that have become infected by viruses

They also attack potential cancer cells, often before they form tumors

They bind to cells using an antibody "bridge", then kill it by secreting a chemical (perforin) that makes holes in the cell membrane of the target cell. With enough holes, the cell will die.



NK cell

Target cell



# cytokines

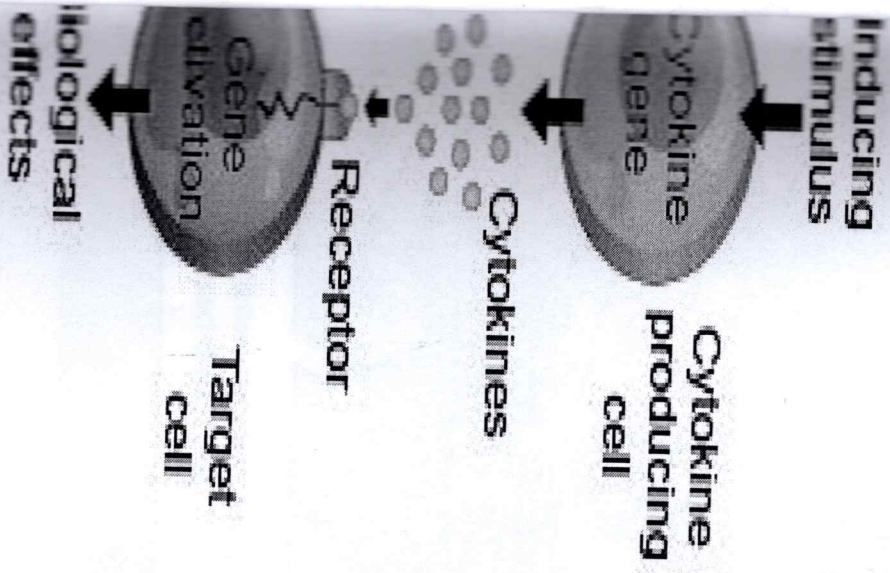
Chemical messengers

Cytokines are small secreted proteins released by cells that have a specific effect on the interactions and communications between cells.

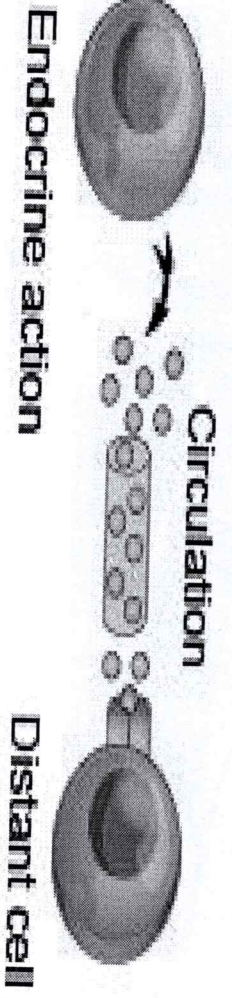
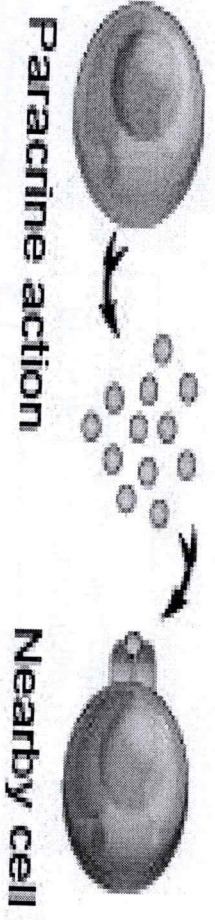
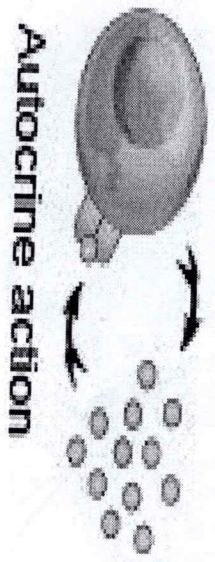
Cytokine is a general name; other names include lymphokine (cytokines made by lymphocytes), monokine (cytokines made by monocytes), chemokine (cytokines with chemotactic activities), and interleukin (cytokines made by one leukocyte and acting on other leukocytes).

# Cytokines

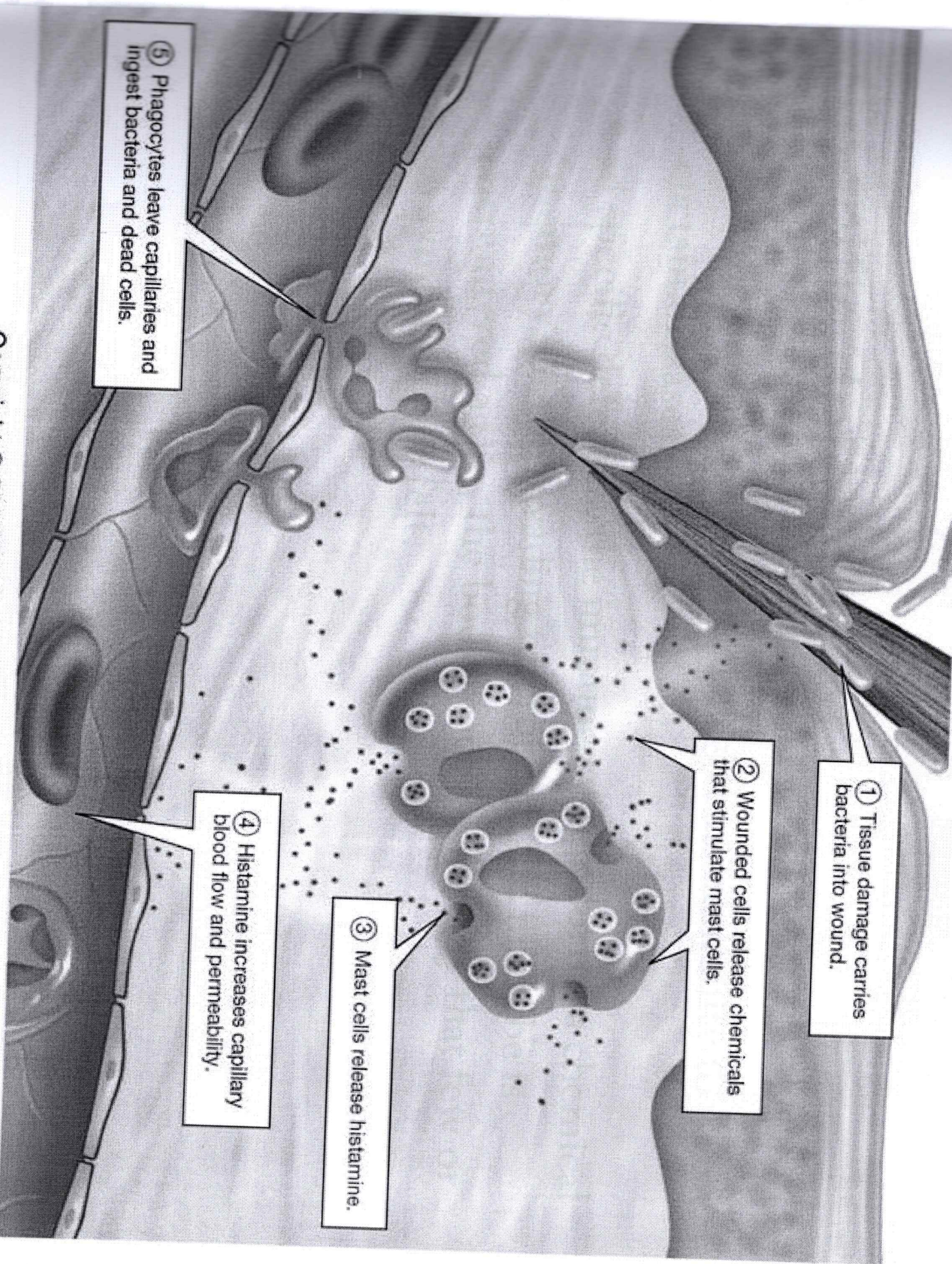
- Cytokines may act on the cells that secrete them (autocrine action), on nearby cells (paracrine action), or in some instances on distant cells (endocrine action)



**b**







① Tissue damage carries bacteria into wound.

② Wounded cells release chemicals that stimulate mast cells.

③ Mast cells release histamine.

④ Histamine increases capillary blood flow and permeability.

⑤ Phagocytes leave capillaries and ingest bacteria and dead cells.



# Specific defenses

- Specific defenses are those that give us immunity to certain diseases.
- In specific defenses, the immune system forms a chemical “memory” of the invading microbe. If the microbe is encountered again, the body reacts so quickly that few or no symptoms are felt.