

# Innate Immunity and Adaptive Immunity

Dr. Ahmed Hasan

# definitions

- Innate immunity consists of the defenses against infection that are ready for immediate action when a host is attacked by a pathogen (viruses, bacteria, fungi, or parasites).
- Adaptive immune responses, which take days to arise following exposure to antigens

- Physical barriers - the body's first line of defense - are the epithelial layers of the skin and of the mucosal and glandular tissue surfaces connected to the body's openings; these epithelial barriers prevent infection by blocking pathogens from entering the body.
- Chemical barriers at these surfaces include specialized soluble substances that possess antimicrobial activity as well as acid pH.
- The cellular innate immune responses to invasion by an infectious agent that overcomes the initial epithelial barriers are rapid, typically beginning within minutes of invasion.
- Macrophages and neutrophils do the phagocytosis.

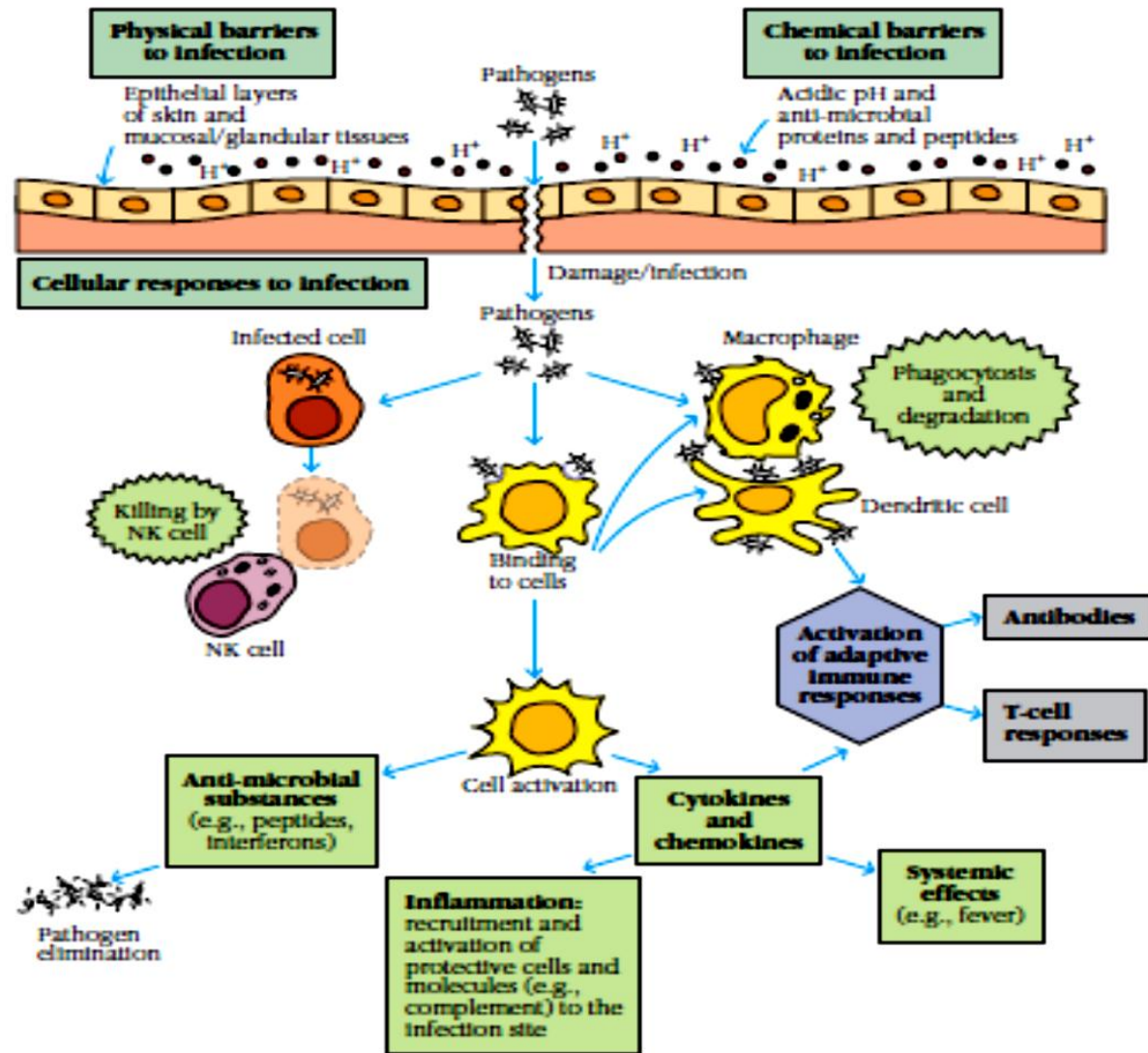
## **Inflammation:**

- 1. redness**
- 2. swelling**
- 3. pain**
- 4. fever**

<b>Attribute</b>	<b>Innate Immunity</b>	<b>Adaptive Immunity</b>
Response time	Minutes/hours	Days
Specificity	Specific for molecules and molecular patterns associated with pathogens and molecules produced by dead/damaged cells	Highly specific; discriminates between even minor differences in molecular structure of microbial or nonmicrobial molecules
Diversity	A limited number of conserved, germ line–encoded receptors	Highly diverse; a very large number of receptors arising from genetic recombination of receptor genes in each individual
Memory responses	Some (observed in invertebrate innate responses and mouse/human NK cells)	Persistent memory, with faster response of greater magnitude on subsequent exposure
Self/nonsel self discrimination	Perfect; no microbe-specific self/nonsel self patterns in host	Very good; occasional failures of discrimination result in autoimmune disease
Soluble components of blood	Many antimicrobial peptides, proteins, and other mediators	Antibodies and cytokines
Major cell types	Phagocytes (monocytes, macrophages, neutrophils), natural killer (NK) cells, other leukocytes, epithelial and endothelial cells	T cells, B cells, antigen-presenting cells



# Innate Immunity



# Antimicrobial Barriers

- Skin and other epithelia provide a kind of living “plastic wrap” that encases and protects the inner domains of the body from infection.
- The secretions of these tissues (mucus, urine, saliva, tears, and milk) wash away potential invaders.
- Mucus, the viscous fluid secreted by specialized cells of the mucosal epithelial layers, entraps foreign microorganisms.
- In the lower respiratory tract, **cilia**, hair like protrusions of the cell membrane, cover the epithelial cells. The synchronous movement of cilia propels mucus-entrapped microorganisms from these tracts.

- Coughing is a mechanical response that helps us get rid of excess mucus, with trapped microorganisms, that occurs in many respiratory infections.
- The flow of urine sweeps many bacteria from the urinary tract.
- With every meal, we ingest huge numbers of microorganisms, but they must run a challenge of defenses in the gastrointestinal tract that begins with the antimicrobial compounds in saliva and in the epithelia of the mouth and includes the hostile mix of digestive enzymes and acid found in the stomach.
- The acidic pH of vaginal secretions is important in providing protection against bacterial and fungal pathogens.



# Microbial defense mechanisms

- influenza virus has a surface molecule that enables it to attach firmly to cells in mucous membranes of the respiratory tract, preventing the virus from being swept out by the ciliated epithelial cells.
- *Neisseria gonorrhoeae*, the bacteria that causes gonorrhea, binds to epithelial cells in the mucous membrane of the urogenital tract. Adherence of these and other bacteria to mucous membranes is generally mediated by hair like protrusions on the bacteria called *fimbriae* or *pili* that have evolved the ability to bind to certain glycoproteins or glycolipids only expressed by epithelial cells of the mucous membrane of particular tissues.