



Cell and Molecular Immunology

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MSc Microbiology/

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IMMUNOLOGY AND THE IMMUNE SYSTEM

- * **Immunology**

- * Study of the components and function of the immune system

- * **Immune Response:** A physiological reaction which occurs within an organism for the purpose of defending

- * **Immune System**

- * Molecules, cells, tissues and organs which provide non-specific and specific protection against
 - * Microorganisms
 - * Microbial toxins
 - * Tumor cells

THE IMMUNE RESPONSE AND IMMUNITY

- * **Immune response**
 - * Innate (non-specific)
 - * Adaptive (specific)
 - * Primary
 - * Secondary
- * **Immunity (Immunis L- Exempt from tax/ free)**
 - * State of non-specific and specific protection
- * **Acquisition of Immunity**
 - * Natural
 - * Artificial

Humans have three types of immunity — innate, adaptive, and passive:

- * **Innate immunity:** Everyone is born with innate (or natural) immunity, a type of general protection. For example, the skin acts as a barrier to block germs from entering the body. And the immune system recognizes when certain invaders are foreign and could be dangerous.
- * **Adaptive immunity:** Adaptive (or active) immunity develops throughout our lives. We develop adaptive immunity when we're exposed to diseases or when we're immunized against them with vaccines.
- * **Passive immunity:** Passive immunity is "borrowed" from another source and it lasts for a short time. For example, antibodies in a mother's breast milk give a baby temporary immunity to diseases the mother has been exposed to.

NATURALLY ACQUIRED IMMUNITY

- * Active

- * Antigens enter body naturally with response of
 - * Innate and adaptive immune systems
- * Provides long term protection

- * Passive

- * Antibodies pass from mother to
 - * Fetus across placenta
 - * Infant in breast milk
- * Provides immediate short term protection

ARTIFICIALLY ACQUIRED IMMUNITY

- * Active

- * Antigens enter body through vaccination with response of
 - * Innate and adaptive immune systems
- * Provides long term protection

- * Passive

- * Antibodies from immune individuals injected into body
 - * Referred to as
 - * Immune serum globulins (ISG)
 - * Immune globulins (IG)
 - * Gamma globulins
- * Provides immediate short term protection

PRINCIPAL FUNCTION OF THE IMMUNE SYSTEM

- * To protect humans from pathogenic microorganisms
- * Pathogenic microorganisms (Pathogens)
 - * Microorganisms capable of causing infection and/or disease
- * Infection
 - * Ability of pathogen to enter host, multiply and stimulate an immune response
- * Disease
 - * Clinical manifestations associated with infection

FUNCTIONAL IMPORTANCE OF IMMUNE SYSTEM

Role of the immune system	Implications
Defense against infections	Deficient immunity results in increased susceptibility to infections; exemplified by AIDS Vaccination boosts immune defenses and protects against infections
Defense against tumors	Potential for immunotherapy of cancer
Clearance of dead cells and tissue repair	Deficient immunity can lead to secondary infections after injury, and excessive immune responses can lead to fibrosis and organ dysfunction
The immune system can injure cells and induce pathologic inflammation	Immune responses are the cause of allergic, autoimmune, and other inflammatory diseases
The immune system recognizes and responds to tissue grafts and newly introduced proteins	Immune responses are barriers to transplantation and gene therapy

Difference between Innate and Acquired Immunity

Innate	Acquired
Present from birth/innate	Develops during life time
Inheritable by genetic constituents and physiology of host	Cannot be passed except briefly to neonates
Remains through the life	Maybe short lived or long lived
Contact/exposure to antigen not essential	Contact/exposure to antigen essential
Generate a non-specific response	Generates a Specific Immune response
Rapid response	Delayed 5-6 days
No memory	Memory
Less Diversity	High Diversity
Less potent	High potency
3 lines –physical, chemical and cellular	Humoral and Cellular components
Eg Inflammation- redness caused by WBC to wound	Vaccination, Hypersensitivity

Properties of Acquired Immune Response

- * **Self/ Non Self Discrimination- Tolerance**
- * **Specificity- antigen recognition**
- * **Diversity/Versality- various types of antigen recognized
by lymphocytes (T and B cells)**
- * **Memory- Clonal Selection**

Principal Mechanisms

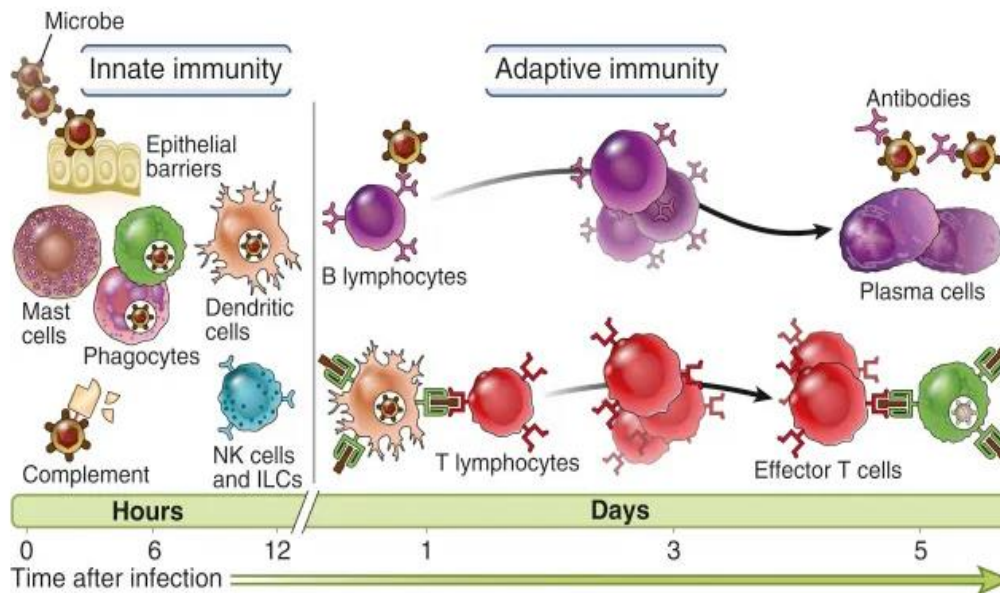


Fig. 1.3

Principal mechanisms of innate and adaptive immunity.

The mechanisms of innate immunity provide the initial defense against infections. Some mechanisms (e.g., epithelial barriers) prevent infections, and other mechanisms (e.g., phagocytes, natural killer [NK] cells and other innate lymphoid cells [ILCs], the complement system) eliminate microbes. Adaptive immune responses develop later and are mediated by lymphocytes and their products. Antibodies block infections and eliminate microbes, and T lymphocytes eradicate intracellular microbes. The kinetics of the innate and adaptive immune responses are approximations and may vary in different infections.