



## Immune System - Solutions

Mammals are constantly exposed to pathogens (typically microorganisms) which cause disease. For protection from these pathogens, the immune system evolved to constantly monitor the body and combat disease.

### Innate Vs. Adaptive Immune System

	<b>Innate</b>	<b>Adaptive</b>
<b>Specificity</b>	Nonspecific – same response applies to many different agents	Highly specific – response is generated against one agent
<b>Speed</b>	Immediate	Takes days to weeks
<b>Memory</b>	No memory – multiple exposures will produce the same response	Memory is present – prompts an amplified response upon re-exposure
<b>Response</b>	<ul style="list-style-type: none"> <li>- Physical and chemical barriers such as skin and mucous membranes</li> <li>- Inflammation, phagocytosis, cytokine release, complement system, natural killer cells</li> </ul>	<ul style="list-style-type: none"> <li>- Cell-mediated immune response (Helper and Cytotoxic T-cells)</li> <li>- Humoral (antibody-mediated) immune response (B-cells and antibodies)</li> </ul>



## B-cells Vs. T-cells

	<b>B-cells</b>	<b>T-cells</b>
<b>Origin</b>	Bone marrow	Bone marrow
<b>Maturation</b>	Bone marrow	Thymus (which is why they are also known as thymocytes)
<b>Types</b>	Plasma Memory	Cytotoxic Helper Memory
<b>Relationship to Antibodies</b>	Secrete antibodies when activated	Present antigen receptors on membrane

## Types of T-cells

	<b>Helper T-cells</b>	<b>Cytotoxic T-cells</b>
<b>Marker</b>	Expresses CD4+ receptors	Expresses CD8+ receptors
<b>Function</b>	Assists or induces immune response	Induces apoptosis in other cells
<b>MHC</b>	Antigen recognition via class II MHC	Antigen recognition via class I MHC
<b>Mechanism</b>	Secrete signalling molecules (e.g. cytokines) in order to assist other cells	Directly destroys infected or tumor cells



**Antibodies** are Y-shaped proteins that are produced by plasma cells and form the foundation of humoral immunity. They can be present in blood, gastric and mucous secretions, and breast milk.

## Functions of Antibodies

<b>Neutralization</b>	Antibodies prevent the agent from binding to its intended target
<b>Opsonization</b>	Antibodies tag the agent for phagocytosis by a macrophage or neutrophil
<b>Complement Activation</b>	Antibodies bound to agent's cell surface trigger the complement system
<b>Agglutination/Aggregation</b>	Antibodies bind to multiple cells simultaneously, forming aggregates that can be filtered from the blood
<b>Immobilization</b>	Antibodies prevent locomotion of motile bacteria/protozoans by binding to flagella/cilia

