Fundamentals of Immunology

By

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Fundamentals of immunology

What is immunity

You can not prosecute diplomats
   – they have immunity

“I have diplomatic immunity!”
Fundamentals of immunology

Immunity – is the ability of host to defense itself from foreign harmful organisms

Not all defense mechanisms constitute immunity
Immunity – is the ability of host to defend itself from invading foreign harmful organisms and altered self proteins or cells
Types of immunity

**Immunity**

**Innate / inborn**
- Non-specific
  - Physical barriers
    - Skin, Saliva, Mucous, Stomach acid, Tears
  - 1st line of defense
  - Phagocytosis (PAMP – PRR)
    - Antimicrobial proteins
      - Defisins
  - 2nd Line of defense

**Acquired / adaptive**
- Specific
  - 3rd line of defense
  - Passive
    - Natural (Placental transfer)
  - Active
    - Natural (infections)
    - Artificial (Vaccination)
# Types of immunity

<table>
<thead>
<tr>
<th>Innate immunity</th>
<th>Adaptive immunity</th>
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<tbody>
<tr>
<td>• Skin, Saliva, tears mucous</td>
<td>• Have specialized cell</td>
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<tr>
<td>• Non-specific</td>
<td>- T cells, B cells</td>
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<tr>
<td>• Recognize molecular patterns not common in host</td>
<td>• Specific to particular antigen</td>
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<tr>
<td>• Immediate maximal response</td>
<td>• Time lag between exposure and maximal response</td>
</tr>
<tr>
<td>• No immunological memory</td>
<td>• Immunological memory</td>
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- Innate immunity is non-specific.
- It recognizes molecular patterns not common in the host.
- It provides an immediate maximal response.
- It lacks immunological memory.

- Adaptive immunity has specialized cells such as T cells and B cells.
- It is specific to particular antigens.
- It has a time lag between exposure and maximal response.
- It possesses immunological memory.
# Types of immunity

<table>
<thead>
<tr>
<th></th>
<th>Specific</th>
<th>Non Specific</th>
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<tbody>
<tr>
<td><strong>3rd line of defense</strong></td>
<td><strong>2nd line of defense</strong></td>
<td><strong>1st line of defense</strong></td>
</tr>
<tr>
<td>T cells</td>
<td>Phagocytes</td>
<td>Skin</td>
</tr>
<tr>
<td>B cell</td>
<td>Pore forming anti microbial proteins</td>
<td>Secretions</td>
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<tr>
<td>Antibodies</td>
<td>Inflammatory response</td>
<td>Mucous membranes</td>
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Basic terms of immunology

- **Antigen** – A molecule that stimulates immune response (generally proteins)
- **Hapten** – Small portion of antigen which by itself cannot elicit an immune reaction
- **Epitope** – Part of Antigen recognized by the immune system
- **Antibody** – Protein (globulin) which is reactive against specific antigen
- **Paratope** – Part of antibody which recognizes the antigen
Basic terms of immunology

- **Cytokines** – are proteins used for intercellular communication and intracellular signalling pathways
- Interleukins are kind of cytokines
- **Immunization** – is the means of providing specific protection against a damaging pathogen
- **Tolerance** – refers to an antigen induced specific unresponsiveness
Basic terms of immunology

- **Autoimmunity** – failure of immune system to develop tolerance for self proteins and starting immune response
- **Immunological memory** – capacity of immune system to remember a antigen and react more vigorously upon re-exposure of the same antigen
  - Involves B cells and T cells
Immunological memory

- Upon secondary exposure there will be boost of immunity
Basic terms of immunology

- **Inflammation** – a set of physiological reactions to damage of tissue integrity, leading to protection against infection, localization and restriction of damaged site and finally to healing
  - Reddening (rubor)
  - Swelling (tumor)
  - Pain (dolar)
  - Increased temperature (calor)
Inflammation

Steps of the Inflammatory Response

The inflammatory response is a body's second line of defense against invasion by pathogens. Why is it important that clotting factors from the circulatory system have access to the injured area?

1. Damaged tissues release histamines, increasing blood flow to the area.
2. Histamines cause capillaries to leak, releasing phagocytes and clotting factors into the wound.
3. Phagocytes engulf bacteria, dead cells, and cellular debris.
4. Platelets move out of the capillary to seal the wounded area.
Several chemokines will also be released.
Organs of immune system

- Bone marrow
- Spleen
- Thymus
- Lymphatic system
Main organs of immune system

- Bone marrow
  - Source of stem cells
  - Maturing site for B cells

- In Birds B cells mature in Bursa of Fabricius
Main organs of immune system

- **Spleen**
  - Effective against blood born pathogens
  - Replaces old RBC
  - Produces complement components
  - Have macrophages
Main organs of immune system

- **Thymus**
  - Development and differentiation of T cells
  - Where T cell education happens
  - Self and non self discrimination
Development and selection of T cells in thymus

Nature Reviews | Immunology
Main organs of immune system

Lymphatic system

Janeway's Immunobiology 8th edition
Cells of immune system

Cells of the Immune System

- Stem Cell
  - Lymphoid Stem Cell
    - Lymphocytes
      - B Cell Progenitor
      - T Cell Progenitor
        - Natural Killer Cell
        - Tc Cell
          - Th Cell
            - Memory Cell
            - Plasma Cell
  - Myeloid Progenitor
    - Granulocytes
      - Neutrophil
      - Eosinophil
      - Basophil
        - Mast Cell
        - Monocyte
        - Dendritic Cell
        - Macrophage