**Innate defenses against infection**

<table>
<thead>
<tr>
<th>Innate immunity (24.1-3)</th>
<th>Acquired immunity (24.4-15)</th>
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<tbody>
<tr>
<td>Response is the same whether or not pathogen has been previously encountered</td>
<td>Found only in vertebrates; previous exposure to pathogen enhances immune response</td>
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<tr>
<th>External barriers</th>
<th>Internal defenses</th>
<th>Acquired immunity (24.4-15)</th>
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<tbody>
<tr>
<td>Skin/exoskeleton</td>
<td>Phagocytic cells</td>
<td>Antibodies (24.8-10)</td>
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<tr>
<td>Secretions</td>
<td>NK cells</td>
<td>Lymphocytes (24.11-14)</td>
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<td>Mucous membranes</td>
<td>Defensive proteins</td>
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<td>Inflammatory response (24.2)</td>
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The lymphatic system (24.3)
Diagram 1: The inflammatory response

1. Tissue injury; release of chemical signals such as histamine

2. Dilation and increased leakiness of local blood vessels; migration of phagocytes to the area

3. Phagocytes (macrophages and neutrophils) consume bacteria and cell debris; tissue heals
The Lymphatic System

Figure 1: The human lymphatic system
The Acquired Immune Response

Figure 2: A soldier receiving a smallpox vaccination
Lymphocytes mount a dual defense

**Figure 3**: The development of B cells and T cells
Antigens have specific regions where antibodies bind to them.

**Figure 4:** The binding of antibodies to antigenic determinants.
Diagram 2: Clonal selection of B cells in the primary immune response
Clonal Selection Musters Defensive Forces Against Specific Antigens (cont.)

**Diagram 3:** Clonal selection of B cells in the secondary immune responses

- **Second clone**
- **Plasma (effector) cells secreting antibodies**
- **Endoplasmic reticulum**
- **Antigen molecules**
  - 6. Second exposure to same antigen

Secondary immune response (May occur long after primary immune response.)
Antibodies are the weapons of the humoral immune response

**Figure 5:** Antibody structure with an antigen-binding site
Antibodies mark antigens for elimination

Diagram 4: Effector mechanisms of the humoral immune response
Monoclonal antibodies are powerful tools in the lab and clinic.

Figure 6: Monoclonal antibodies used in a home pregnancy test.
Helper T cells stimulate the humoral and cell-mediated immune responses

Diagram 6: The activation of a helper T cell and its roles in immunity
Cytotoxic T cells destroy infected body cells

Diagram 7: How a cytotoxic T cell kills an infected cell

1. Cytotoxic T cell binds to infected cell
2. Perforin makes holes in infected cell’s membrane and enzyme enters
3. Infected cell is destroyed
HIV destroys helper T cells, compromising the body’s defenses