Antigens

- Immunogen – a molecule that specifically interacts with an antibody or lymphocyte and elicits an immune response
- Antigenic determinants (epitopes)

Figure 16.3 – Antibodies and Antigens

Antibodies

- Structure
- Protective outcomes
- Immunoglobulin classes
Structure

- Antigen – binding (Fab) site
- Fc region
- Heavy chains and light chains
- Variable region (Fab)
- Constant region (Fc)

Figure 16.4 Antibody structure

Figure 16.5 – Model of an IgG Molecule
Protective outcomes

- Neutralization
- Immobilization and prevention of adherence
- Agglutination and precipitation
- Opsonization
- Complement activation
- Antibody – dependent cellular cytotoxicity (ADCC)

Immunoglobulin classes

- IgM (pentamer) – first class produced
- IgG (monomer) – 80-85% total serum Ig; secondary response
- IgA (dimer in secretions) – secreted Ab; mucosal immunity
- IgD (monomer) – minor Ab involved in development
- IgE (monomer) – bound to basophils and mast cells, important in elimination of parasites, allergies
Table 16.1 Classes of immunoglobulins

<table>
<thead>
<tr>
<th>Name</th>
<th>M Leucine Residues</th>
<th>Structure</th>
<th>Half-life in serum</th>
<th>Properties</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>IgM</td>
<td>248-250</td>
<td>M type</td>
<td>&gt;10 days</td>
<td>Specific attachment to phagocytes; complement fixation; ability to fix plasma</td>
<td>Agglutination; precipitation; opsonization; ABC; complement activation</td>
</tr>
<tr>
<td>IgG</td>
<td>441-450</td>
<td>G type</td>
<td>21 days</td>
<td>Complement fixation; first antibody produced during primary immune response; binds to E.coli lipopolysaccharide</td>
<td>Agglutination; precipitation; complement activation</td>
</tr>
<tr>
<td>IgA</td>
<td>466-475</td>
<td>A type</td>
<td>18-21 days</td>
<td>Secreted into saliva, milk, tears, and other secretions, resistance to proteolytic degradation</td>
<td>Protection of mucous membranes from entry of pathogens (resistance immunity)</td>
</tr>
<tr>
<td>IgE</td>
<td>370-380</td>
<td>E type</td>
<td>&lt;7 hrs</td>
<td>Involved in development and regulation of the adaptive immune response; involved in allergic reactions</td>
<td>Involved in many allergic reactions; functions in ADCC, antigen presentation</td>
</tr>
</tbody>
</table>

Figure 16.7 – Immunoglobulin G Levels in the Fetus and Infant

Names for antibodies based on protective outcome:

- **agglutinin** – IgG antibody that agglutinates antigen
- **precipitin** – IgG antibody that precipitates antigen
- **opsonin** – IgG that coats antigen to promote phagocytosis
- **complement fixing antibody** – leads to complement lysis
- **antitoxin** – neutralizes antigen
- **neutralizing antibody** – neutralizes ability of virus to infect
Clonal selection

- Specific response of a lymphocyte to an antigen
- Lymphocytes
  - Immature
  - Naïve
  - Activated
  - Effector
  - Memory

B-lymphocytes

- Response to T-dependent antigens
- Response to T-independent antigens

Figure 16.8 Clonal selection
Response to T–dependent antigens

- B cells present antigen (usually protein) to effector T cells
- B cell clonal expansion – affinity maturation, class switching and memory
- Primary and secondary response

Figure 16.9
B cell and T cell interaction

Figure 16.10 – Lymphocytes and plasma cells
Figure 16.12
Affinity maturation
in B cells

Figure 16.13 – Class switching in B cells and plasma cells

Figure 16.11 – Primary and secondary response
Response to T – independent antigens

- Polysaccharides – trigger B cell response
- No T – helper cells are involved

Figure 16.14 - T – independent antigens