Vertebrate Immune System Single goal:

Distinguish self from non-self

Protect from microorganisms, viruses, bacteria, and parasites

Two hallmarks:

Specificity

Memory

Two related strategies:

Humoral immune response

Cellular immune response
Antigens:

- foreign macromolecule capable of eliciting an immune response

- antibody specificity is not for an entire antigen

- antigenic determinant called an epitope

- small foreign molecules may elicit an immune response if attached to a macromolecule e.g DNP-BSA

![Diagram of DNP-BSA](image)

Figure 14-2
Dinitrophenylated bovine serum albumin (DNP-BSA) is an effective immunogen.

- macromolecule (carrier) & small molecule (haptenic determinant)
Antibodies:

- recognition elements of humoral immune response

- secreted from plasma cells derived from B-lymphocytes

- are immunoglobulin (Ig) proteins

-five classes of antibodies formed (IgG, IgM, IgA, IgD and IgE)

-formed by the combination of heavy, and light Ig chains
Five classes of antibodies:

<table>
<thead>
<tr>
<th>Class</th>
<th>Serum (Mg/mL)</th>
<th>Mass (kDa)</th>
<th>Chain Structure</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>IgG</td>
<td>12</td>
<td>150</td>
<td>$\kappa\gamma_2 / \lambda\gamma_2$</td>
<td>Principle in serum</td>
</tr>
<tr>
<td>IgA</td>
<td>3</td>
<td>180-500</td>
<td>$\kappa\gamma_2 / \lambda\gamma_2$</td>
<td>Primarily in external secretion</td>
</tr>
<tr>
<td>IgM</td>
<td>1</td>
<td>950</td>
<td>$\kappa\gamma_2 / \lambda\gamma_2$</td>
<td>First formed following immune challenge</td>
</tr>
<tr>
<td>IgD</td>
<td>0.1</td>
<td>175</td>
<td>$\kappa\gamma_2 / \lambda\gamma_2$</td>
<td>Unknown</td>
</tr>
<tr>
<td>IgE</td>
<td>0.001</td>
<td>200</td>
<td>$\kappa\gamma_2 / \lambda\gamma_2$</td>
<td>Parasites / allergic reactions</td>
</tr>
</tbody>
</table>
Immunoglobulin G (IgG)

- Subunit structure: light (L) and heavy (H) chains

- IgG L2H2 homodimer

- L chain 25 kDa, H chain 50 kDa connected by disulfide bond

- variable (N-terminal ~108 residues) and constant regions (C-terminal)

- antigen-binding sites formed by three hypervariable regions (complementarity determining regions CDRs) in both L and H chains
IgG consists of homologous domains.
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3D structure of an IgG molecule