Topics

- Principals of immunization
- Vaccines
- Immunizations

Principals of immunization

- Active immunity
- Passive immunity

Vaccines

- Attenuated (weakened form of the disease-causing agent)
  
  Agent replicates, may cause mild disease
  Mimics wild type strain, controls infection
  Longer antigen exposure than inactivated vaccines
  Can cause disease in immunocompromised people
  eg Sabin polio vaccine

- Inactivated (unable to replicate; retains immunogenicity)
  
  Cannot cause infections or revert to dangerous form
  No amplification of dose in vivo; boosters required
  Inactivated whole agent vaccines – killed microorganisms
  Toxoids – inactivated toxins
  Protein subunit vaccines (and recombinant vaccines)
  Contain key protein antigens
  Reduced unwanted side effects
  Polysaccharide vaccines – T-independent antigens
  Conjugate vaccine – polysaccharide plus protein = T-dependent vaccine
  Adjuvant – enhances immune response to antigens, provide "danger signals"

Antitoxin – antibody preparation against a specific toxin

Antiserum – a preparation of serum containing protective antibodies

Immune serum globulin – passive immune preparation containing IgG (gamma globulin)
  Pooled blood serum from many donors
  Variety of Abs
  Given to travelers and immunosuppressed individuals

Hyperimmune globulin – sera from donors with high levels of specific Abs
  eg anti tetanus, rabies, hepatitis A and hepatitis B
  Given during disease incubation period to prevent disease development

Herd immunity – inability of a pathogen to spread; no hosts

Figure 17.1 Active and passive immunity
Table 17.1 - Vaccines

<table>
<thead>
<tr>
<th>Disease</th>
<th>Type of Vaccine</th>
<th>Persons Who Should Receive the Vaccine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polio</td>
<td>Oral polio vaccine</td>
<td>Children, adults to receive every 10 years</td>
</tr>
<tr>
<td>Influenza</td>
<td>Inactivated vaccine</td>
<td>Children, adults to receive annually</td>
</tr>
<tr>
<td>Measles</td>
<td>Live measles vaccine</td>
<td>Children, adults to receive annually</td>
</tr>
</tbody>
</table>

Immunizations

- Paralytic poliomyelitis
- Effectiveness of immunizations
- Recommended immunizations
- Future immunizations

Paralytic poliomyelitis

- 1950 – Salk vaccine (inactivated virus)
- 1960 – Sabin vaccine (attenuated virus)
- Salk vaccine is safe (but virus can replicate and spread)
- Sabin vaccine provides herd immunity
  
given orally, induces mucosal immunity
  can cause vaccine-related polio in some individuals

Table 17.3 - Effectiveness of immunizations

<table>
<thead>
<tr>
<th>Disease</th>
<th>Cases per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphtheria</td>
<td>4.3 (1923-1926)</td>
</tr>
<tr>
<td>Tetanus</td>
<td>0.15 (1891-1925)</td>
</tr>
<tr>
<td>Measles</td>
<td>1.8 (1921-1925)</td>
</tr>
<tr>
<td>Paralytic polio</td>
<td>0.001 (1921-1925)</td>
</tr>
<tr>
<td>Mumps</td>
<td>0.001 (1921-1925)</td>
</tr>
<tr>
<td>Rabies</td>
<td>0.001 (1921-1925)</td>
</tr>
<tr>
<td>Hemophilus influenzae type B</td>
<td>0.001 (1921-1925)</td>
</tr>
</tbody>
</table>

Table 17.4 - Recommended immunizations
### Table 17.5 - Some Diseases for Which New or Improved Vaccines Are Sought

<table>
<thead>
<tr>
<th>Disease</th>
<th>Estimated Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles</td>
<td>40 million cases worldwide; with approximately 33,000 new infections daily</td>
</tr>
<tr>
<td>Influenza</td>
<td>20-30 million cases worldwide; 12,000-41,000 deaths in the United States</td>
</tr>
<tr>
<td>Shigella</td>
<td>50 million cases/year in the United States</td>
</tr>
<tr>
<td>Malaria</td>
<td>45 million infections and 500,000 new deaths/year in the United States</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>300,000 deaths worldwide</td>
</tr>
<tr>
<td>Cancer</td>
<td>1 in 3 in the United States may get cancer, resulting in 560,000 deaths/year</td>
</tr>
</tbody>
</table>

Table 17.5 - Future immunizations