Topics

- **Principals of immunization**
- **Vaccines**
- **Immunizations**

17-1

Principals of immunization

- **Active immunity**
- **Passive immunity**

17-2

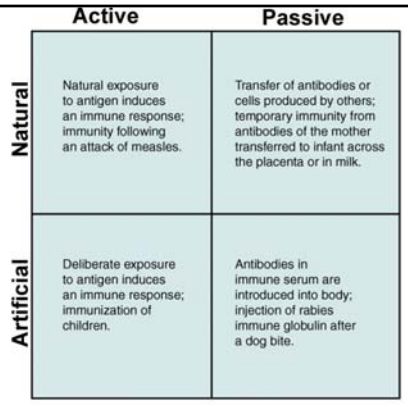

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Figure 17.1 Active and passive immunity

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

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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*

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Vaccines

- **Attenuated**
- **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"*

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Table 17.1 Some Important Immunizing Agents for Humans

Disease	Type of Vaccine	Persons Who Should Receive the Vaccine
Anthrax	Acellular	People in occupations that put them at risk of exposure, such as military personne
Diphtheria	Toxoid	Children; adults receive a booster every 10 years
Haemophilus influenzae type b infections	Polysaccharide-protein conjugate	Children
Hepatitis A	Inactivated virus	Children who live in selected regions, people traveling to certain parts of the worl
Hepatitis B	Protein subunit is produced by genetically engineered *Saccharomyces cerevisiae* and purified	Children, adults in high-risk groups such as IV drug abusers, health care workers who might be exposed to infected blood, and contacts of infected people, homosexual men, and people who have multiple sexual partners
Influenza	Inactivated virus, usually given by injection in the United States, but as a nasal spray in parts of Europe	Adults over age 50, medical personnel, and people at increased risk for complications; given yearly, as the antigens of the virus change frequently
Measles	Attenuated virus	Children, people entering college, adults born after 1956 who have not been immunized, travelers to foreign countries, and HIV-infected people without severe immunosuppression
Meningococcal disease	Purified polysaccharide (4 serotypes)	Children and adults with certain conditions that put them at greater risk (for example, those without a spleen or who have certain complement system defects); people traveling to sub-Saharan Africa

Table 17.1 - Vaccines

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Table 17.1 Some Important Immunizing Agents for Humans

Disease	Type of Vaccine	Persons Who Should Receive the Vaccine
Mumps	Attenuated virus	Same as measles
Pertussis (whooping cough)	Acellular vaccine given together with diphtheria and tetanus toxoids (DTaP)	Children
Pneumococcal infection	Two forms—purified polysaccharide (PPV) and polysaccharide-protein conjugate (PCV)	Children should receive PCV; adults over 65, people with certain chronic infections, and others in high-risk groups should receive PPV
Rabies	Inactivated virus grown in human or rhesus monkey cells	People exposed to the virus, people at high risk for exposure, such as veterinarians and other animal handlers
Rubella (German measles)	Attenuated virus	Children, adults (particularly women) who are susceptible, health care workers who are at high risk of exposure
Tetanus	Toxoid	Children; adults receive a booster every 10 years
Tuberculosis	Attenuated BCG strain of tuberculosis bacteria	Used only in special circumstances in the United States; widely used in other countries
Typhoid fever	Two forms—attenuated bacteria (taken orally) and purified polysaccharide	People traveling to certain parts of the world
Varicella-zoster (chickenpox)	Attenuated virus	Children; may also be given to susceptible adults
Yellow fever	Attenuated virus	Travelers to affected areas

Table 17.2 - Vaccines

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Immunizations

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

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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*

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Table 17.3 The Effectiveness of Universal Immunization in the United States

Disease	Cases per Year Before Immunization	Decrease After Immunization
Smallpox	48,164 (1900–1904)	100%
Diphtheria	175,885 (1920–1922)	Nearly 100%
Pertussis (whooping cough)	147,271 (1922–1925)	95.7%
Tetanus	1,314 (1922–1926)	97.4%
Paralytic poliomyelitis	16,316 (1951–1954)	100%
Measles	503,282 (1958–1962)	Nearly 100%
Mumps	152,209 (1968)	99.6%
Rubella (congenital syndrome)	823 (estimated)	99.4%
Haemophilus influenzae type b infections	20,000 (estimated)	99.7%

Table 17.3 - Effectiveness of immunizations

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Table 17.4 Recommended Childhood Immunization Schedule in the United States (2002)

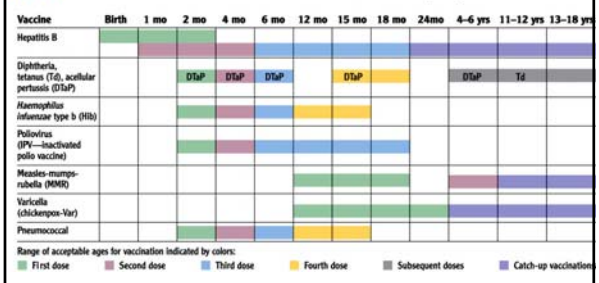

Table 17.4 - Recommended immunizations

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Table 17.5 Some Diseases for Which New or Improved Vaccines Are Sought

Disease	Estimated Impact
HIV/AIDS	40 million infected worldwide, with approximately 14,000 new infections daily
Malaria	300–500 million cases/yr and up to 3 million deaths/yr worldwide
Influenza	30–50 million cases/yr worldwide; 10,000–40,000 deaths/yr in the United States
Strep throat	20 million cases/yr in the United States
Genital herpes	45 million infected and 500,000 new infections/yr in the United States
Hepatitis C	170 million infected worldwide
Cancer	1 in 3 in the United States may get cancer, resulting in 560,000 deaths/yr

Table 17.5 - Future immunizations

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