

# Study Outline Chapter 18

## Vaccines (pp. 485- 490)

- Edward Jenner developed the modern practice of vaccination when he inoculated people with cowpox virus to protect them against smallpox.

### Principles and Effects of Vaccination (p. 486)

- Herd immunity results when most of a population is immune to a disease.

### Types of Vaccines and Their Characteristics (pp. 488- 490)

- Attenuated whole-agent vaccines consist of attenuated (weakened) microorganisms; attenuated virus vaccines generally provide lifelong immunity.
- Inactivated whole-agent vaccines consist of killed bacteria or viruses.
- Toxoids are inactivated toxins.
- Subunit vaccines consist of antigenic fragments of a microorganism; these include recombinant vaccines and acellular vaccines.
- Conjugated vaccines combine the desired antigen with a protein that boosts the immune response.
- Nucleic acid vaccines, or DNA vaccines, are being developed. These cause the recipient to make the antigenic protein associated with class I MHC.

### The Development of Vaccines (p. 490)

- Viruses for vaccines may be grown in animals, cell cultures, or chick embryos.
- Recombinant vaccines and nucleic acid vaccines do not need to be grown in cells or animals.

## Diagnostic Immunology (pp. 490- 500)

- Many tests based on the interactions of antibodies and antigens have been developed to determine the presence of antibodies or antigens in a patient.

### Precipitation Reactions (pp. 490- 491)

- The interaction of soluble antigens with IgG or IgM antibodies leads to precipitation reactions.
- Precipitation reactions depend on the formation of lattices and occur best when antigen and antibody are present in optimal proportions. Excesses of either component decrease lattice formation and subsequent precipitation.
- The precipitin ring test is performed in a small tube.
- Immunodiffusion procedures are precipitation reactions carried out in an agar gel medium.
- Immunoelectrophoresis combines electrophoresis with immunodiffusion for the analysis of serum proteins.

### Agglutination Reactions (pp. 491- 492)

- The interaction of particulate antigens (cells that carry antigens) with antibodies leads to agglutination reactions.
- Diseases may be diagnosed by combining the patient' s serum with a known antigen.
- Diseases can be diagnosed by a rising titer or seroconversion (from no antibodies to the presence of antibodies).

- Direct agglutination reactions can be used to determine antibody titer.
- Antibodies cause visible agglutination of soluble antigens affixed to latex spheres in indirect or passive agglutination tests.
- Hemagglutination reactions involve agglutination reactions using red blood cells. Hemagglutination reactions are used in blood typing, the diagnosis of certain diseases, and the identification of viruses.

#### Neutralization Reactions (pp. 492- 495)

- In these reactions, the harmful effects of a bacterial exotoxin or virus are eliminated by a specific antibody.
- An antitoxin is an antibody produced in response to a bacterial exotoxin or a toxoid that neutralizes the exotoxin.
- In a virus neutralization test, the presence of antibodies against a virus can be detected by the antibodies' ability to prevent cytopathic effects of viruses in cell cultures.
- Antibodies against certain viruses can be detected by their ability to interfere with viral hemagglutination in viral hemagglutination inhibition tests.

#### Complement-Fixation Reactions (p. 495)

- Complement-fixation reactions are serological tests based on the depletion of a fixed amount of complement in the presence of an antigen- antibody reaction.

#### Fluorescent-Antibody Techniques (pp. 495- 497)

- Fluorescent-antibody techniques use antibodies labeled with fluorescent dyes.
- Direct fluorescent-antibody tests are used to identify specific microorganisms.
- Indirect fluorescent-antibody tests are used to demonstrate the presence of antibody in serum.
- A fluorescence-activated cell sorter can be used to detect and count cells labeled with fluorescent antibodies.

#### Enzyme-Linked Immunosorbent Assay (ELISA) (pp. 497- 500)

- ELISA techniques use antibodies linked to an enzyme such as horseradish peroxidase or alkaline phosphatase.
- Antigen-antibody reactions are detected by enzyme activity. If the indicator enzyme is present in the test well, an antigen-antibody reaction has occurred.
- The direct ELISA is used to detect antigens against a specific antibody bound in a test well.
- The indirect ELISA is used to detect antibodies against an antigen bound in a test well.

#### Radioimmunoassay (p. 500)

- In RIA, antibodies against the compound are combined with a radioactivity labeled antigen and a sample containing an unknown amount of antigen.
- Analysis of radioactivity in the resulting antigen-antibody complexes indicates the amount of antigen in the sample.

#### **The Future of Diagnostic Immunology (p. 501)**

- The use of monoclonal antibodies will continue to make new diagnostic tests possible.