

Chapter 18
Practical Applications of Immunology

Overview

History of Vaccines

Measles

Vaccines used to prevent bacterial diseases

Types of vaccines

Developing new vaccines

Safety of vaccines

Diagnostic immunology

Monoclonal antibodies

History of Vaccines

- Variolation: Inoculation of smallpox into skin (18th century)
- Vaccination:
 - Inoculation of cowpox virus into skin (Jenner)
 - Inoculation with rabies virus (Pasteur)

Measles Worldwide

- Kills 600 children per day

Vaccines Used to Prevent Bacterial Diseases

Vaccines for Persons Aged 0–6 Years

- Hepatitis B
- Rotavirus
- DTP
- Haemophilus influenzae b
- Pneumococcal
- Inactivated poliovirus
- Influenza
- MMR
- Varicella
- Hepatitis A
- Meningococcal

Types of Vaccines

- Attenuated whole-agent vaccines
 - MMR
- Inactivated whole-agent vaccines
 - Salk polio
- Toxoids
 - Tetanus
- Subunit vaccines
 - Acellular pertussis
 - Recombinant hepatitis B

- Nucleic acid (DNA) vaccines
 - West Nile (for horses)

The Development of New Vaccines

- Culture pathogen
- rDNA techniques
- In plants
- Adjuvants
- Deliver in combination

Safety of Vaccines

- Therapeutic index =
 - Risk vs. benefit

Diagnostic Immunology

- Sensitivity: Probability that the test is reactive if the specimen is a true positive
- Specificity: Probability that a positive test will not be reactive if a specimen is a true negative
- Koch's experiment
 - Guinea pigs with TB injected with Mycobacterium tuberculosis: Site became red and slightly swollen

Monoclonal Antibodies (Mabs)

- Hybridoma: "Immortal" cancerous B cell fused with an antibody-producing normal B cell, produces
- Monoclonal antibodies: A single kind of antibody produced from a clonal cell culture
- Muromonab-CD3: For kidney transplant
- Infliximab: For Crohn's disease
- Ibritumomab + rituximab: For non-Hodgkin's lymphoma
- Trastuzumab: Herceptin for breast cancer
- Chimeric Mabs: Genetically modified mice that produce Ab with a human constant region
- Humanized Mabs: Mabs that are mostly human, except for mouse antigen-binding
- Fully human antibodies: Mabs produced from a human gene on a mouse