A brief discussion on passive and active (esp., vaccines) immunity

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Active VS Passive immunity

• Active immunity is protection that is produced by the person’s own immune system. This type of immunity usually lasts for many years, often during a lifetime.

• Passive immunity is protection by products produced by an animal or human and transferred to another human, usually by injection. Passive immunity often provides effective protection, but this protection wanes (disappears) with time, usually within a few weeks or months.
Passive immunity

• The transfer of antibody produced by one human or other animal to another

• This protection is temporary. The antibodies will degrade during a period of weeks to months, and the recipient will no longer be protected

• The most common form of passive immunity is that which an infant receives from its mother

• These antibodies will protect the infant from certain diseases for up to a year. Protection is better against some diseases (e.g., measles, rubella, tetanus) than others (e.g., polio, pertussis)
Active immunity

• Active immunity usually lasts for many years, often for a lifetime

• The persistence of protection for many years after the infection is known as immunologic memory

• Vaccination is the most important example of active immunity

• The most effective immune responses are generally produced in response to a live antigen
Vaccines

1-Live attenuated:
A-Bacterial
B-Viral

2-Inactivated
A-Whole viruses or bacteria
B-Fractional:
   a-protein-based:
      • Toxoid
      • Subunit
   b-Polysaccharide-based
      • Pure
      • Conjugate
• General Rule: The more similar a vaccine is to the disease-causing form of the organism, the better the immune response to the vaccine
Live Attenuated Vaccines

• Attenuated (weakened) form of the “wild” virus or bacterium

• Must replicate to produce an immune response

• Immune response virtually identical to natural infection

• Usually produce immunity with one dose (except those administered orally)

• Severe reactions possible
Live Attenuated Vaccines, examples

• Viral: measles, mumps, rubella, vaccinia, varicella, yellow fever, rotavirus, intranasal influenza, oral polio

• Bacterial: BCG
Live Attenuated Vaccines, cont’d

• Although live attenuated vaccines replicate, they usually do not cause disease such as may occur with the “wild” form of the organism. ...but it can cause adverse reactions

• Live attenuated vaccines may cause severe or fatal reactions as a result of uncontrolled replication (growth) of the vaccine virus. This only occurs in persons with immunodeficiency (e.g., from leukemia, treatment with certain drugs, or human immunodeficiency virus [HIV] infection)
Inactivated vaccines, examples

- **Whole-cell vaccines:**
  - Viral: polio, rabies, influenza
  - Bacterial: pertussis

- **Fractional vaccines:**
  1. Protein-based:
     - Subunits: hepatitis B, influenza, acellular pertussis, human papillomavirus
     - Toxoids: diphtheria, tetanus
  2. Polysaccharide-based
Inactivated vaccines, cont’d

• Protein-based vaccines include toxoids (inactivated bacterial toxin) and subunit or subvirion products

• Most polysaccharide-based vaccines are composed of pure cell wall polysaccharide from bacteria

• Conjugate polysaccharide vaccines contain polysaccharide that is chemically linked to a protein. This linkage makes the polysaccharide a more potent vaccine
Inactivated vaccines, cont’d

• Inactivated vaccines always require multiple doses. In general, the first dose does not produce protective immunity, but “primes” the immune system. A protective immune response develops after the second or third dose.

• Antibody titers against inactivated antigens diminish with time. As a result, some inactivated vaccines may require periodic supplemental doses to increase, or “boost,” antibody titers.

• In contrast to live vaccines, in which the immune response closely resembles natural infection, the immune response to an inactivated vaccine is mostly humoral. Little or no cellular immunity results.
Polysaccharide-based fractional inactivated vaccines, examples (may be purely polysaccharide or conjugated with protein)

• Pneumococcal disease

• Meningococcal disease

• *Haemophilus influenzae* type b (Hib)
Recombinant Vaccines

• Vaccine antigens may also be produced by genetic engineering technology
Thank You