VACCINES PART 1

E module

Submitted By

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ZOOLOGY DEPTT.

VACCINES

- A **vaccine** is a biological preparation that provides **active acquired immunity** to a particular infectious disease.
- A **vaccine** typically contains an agent that resembles a disease-causing microorganism and is often made from weakened or killed forms of the microbe, its toxins, or one of its surface proteins.

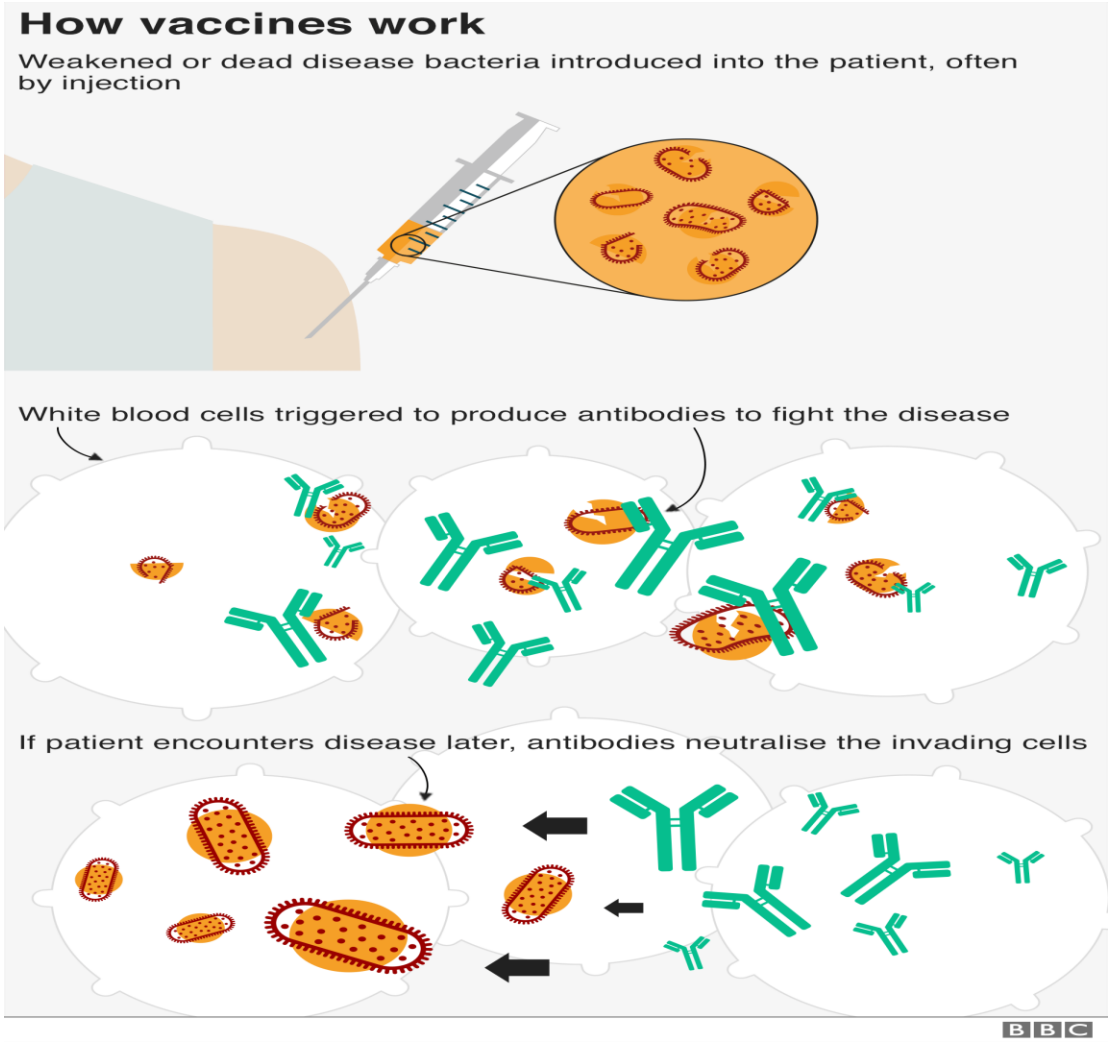
VACCINES

- A vaccine is defined as prepration of bacterial,viral or other pathogenic agents or their isolated antigens and is administered to stimulate protective immunity.
- After primary exposure of antigen to immunocompenent lymphocytes,primary immune response is generated.
- Subsequent infection with same antigen, stimulates secondary immune response and memory cells are formed.

VACCINES

- Secondary response occurs within 2-3 days and results in rapid and more effective immune response.
- Vaccine is basically an antigen that can induce secondary immune response and it prevents severe complications and brodans the immunological memory.

HOW VACCINES WORKS



VACCINES

- A vaccine can confer active immunity against a specific harmful agent by stimulating the immune system to attack the agent
- . Once stimulated by a vaccine, the antibody-producing cells, called B lymphocytes, remain sensitized and ready to respond to the agent should it ever gain entry to the body.

VACCINES

- A vaccine may also confer passive immunity by providing antibodies or lymphocytes already made by an animal or human donor.
- Vaccines are usually administered by injection

but some are given orally.

HISTORY OF VACCINES

- The first vaccine was introduced by British physician Edward Jenner, who in 1796 used the cowpox virus (vaccinia) to confer protection against smallpox, a related virus, in humans
- Jenner's contribution was to use a substance similar to, but safer than, smallpox to confer immunity.
- He thus exploited the relatively rare situation in which immunity to one virus confers protection against another viral disease.

HISTORY OF VACCINES

- In 1881 French microbiologist Louis Pasteur demonstrated immunization against Anthrax by injecting sheep with a preparation containing attenuated forms of the bacillus that causes the disease.
- Four years later he developed a protective suspension against Rabies.

HISTORY OF VACCINES

- After Pasteur's time, a widespread and intensive search for new vaccines was conducted, and vaccines against both bacteria and viruses were produced, as well as vaccines against venoms and other toxins.
- Through vaccination, smallpox was eradicated worldwide by 1980, and polio cases declined by 99 percent.

HISTORY OF VACCINES

- Other examples of diseases for which vaccines have been developed include mumps, measles, typhoid fever, cholera, plague, tuberculosis, tularemia, pneumococcal infection, tetanus, influenza, yellow fever, hepatitis A, hepatitis B, some types of encephalitis, and typhus—although some of those vaccines are less than 100 percent effective or are used only in populations at high risk.
- Vaccines against viruses provide especially important immune protection, since, unlike bacterial infections, viral infections do not respond to antibiotics.

HERD IMMUNITY

- In addition to the development of memory B cells, which are capable of triggering a secondary immune response upon exposure to the pathogen targeted by a vaccine, vaccination is also beneficial at the population level.
- When a sufficient number of individuals in a population are immune to a disease, as would occur if a large proportion of a population were vaccinated, herd immunity is achieved.
- That means that if there is random mixing of individuals within the population, then the pathogen cannot be spread throughout the population

HERD IMMUNITY

- Herd immunity acts by breaking the transmission of infection or by lessening the chances of susceptible individuals coming in contact with a person who is infectious.
- Herd immunity provides a measure of protection to individuals who are not personally immune to the disease—for instance, individuals who, because of their age or underlying medical conditions, cannot receive vaccines or individuals who received vaccines but remain susceptible.
- Herd immunity played an important role in the successful eradication of smallpox, and it is vital in preventing the spread of diseases such as polio and measles.

RISKS OF VACCINATION

- Vaccination carries some risk of reaction, though adverse effects are very rare and very mild.
- The most common reactions to vaccines include **redness and soreness** around the vaccination site.
- More severe adverse reactions, such as vomiting, high fever, seizure, brain damage, or death, are possible for some vaccine but such reactions are exceptionally rare.

WHOLE PATHOGEN VACCINE

- Traditional vaccines consist of entire pathogens that have been killed or weakened so that they cannot cause disease.
- Such whole-pathogen vaccines can elicit strong protective immune responses
- . Many of the vaccines in clinical use today fall into this category.
- However, not every disease-causing microbe can be effectively targeted with a whole-pathogen vaccine.

TYPES OF VACCINES

- Natural live vaccines
- Live attenuated vaccines
- Inactivated vaccines
- Toxoid vaccines
- Polysaccharide vaccine
- Recombinant vaccine
- Viral vector vaccine
- Bacterial vector vaccine
- DNA vaccines

NATURAL LIVE VACCINES

- It includes non pathogenic natural pathogenic organism but still induce specific immunity.Currently these type of vaccines are not used.e.g Cow pox virus.
- Disadvantage of this virus is their ability to mutate and convert into forms that could be pathogenic.

LIVE ATTENUATED VACCINES

- **Live-attenuated vaccines**
- Live vaccines use a weakened (or attenuated) form of the germ that causes a disease.
- Because these vaccines are so similar to the natural infection that they help prevent, they create a strong and long-lasting immune response.
- Just 1 or 2 doses of most live vaccines can give you a lifetime of protection against a germ and the disease it causes.

LIVE ATTENUATED VACCINES

- If administered to a person who has an impaired immune system response, e.g. they have leukaemia or HIV infection, or are taking immunosuppressing medications, administration of a live attenuated vaccine may cause severe disease as a result of uncontrolled replication (growth) of the vaccine virus.
- Rotavirus, chickenpox, and measles, mumps, and rubella vaccines are live attenuated vaccines.

LIVE ATTENUATED VACCINES

- Live vaccines are made using ‘wild’ viruses or bacteria that have been attenuated, or weakened, before being included in the vaccine.
- After immunisation, the weakened vaccine viruses or bacteria replicate (grow) in the vaccinated person. This means a relatively small dose of virus or bacteria can be given in order to stimulate an immune response.
- Live attenuated vaccines do not usually cause disease in vaccine recipients who have a healthy immune system. When a live attenuated vaccine does cause ‘disease’ , e.g. chickenpox vaccine, it is usually more mild than ’wild’ disease.
- Live attenuated vaccines given by injection are generally effective following one dose. However, those given orally usually require three doses.

LIVE VACCINE

- Live vaccines are used to protect against:
- Measles, mumps, rubella (MMR combined vaccine)
- Rotavirus
- Smallpox
- Chickenpox
- Yellow fever

LIVE ATTENUATED VACCINES

- ADVANTAGES
- Prolonged exposure of antigen to immune system and therefore production of large no of B , T cells and memory cells.
- No booster doses required and administred once in life time.
- e.g sabin polio vaccine which induces the production of IgA and IgG and antibodies serve as defence against naturally occuring poliovirus.

LIVE ATTENUATED VACCINES

- DISADVANTAGES
- Reversion to virulent form
- Cannot be given to patients with immunodeficiency diseases.
- Contaminted with other viruses.

INACTIVATED VACCINES

- Inactivated vaccines use the killed version of the germ that causes a disease.
- Inactivated vaccines usually don’t provide immunity (protection) that’s as strong as live vaccines. So you may need several doses over time (booster shots) in order to get ongoing immunity against diseases.
- **inactivated vaccines**, which are produced by killing the pathogen with chemicals, heat or radiation.

INACTIVATED VACCINES

Advantages	Disadvantages
No mutation or reversion to wild type forms since pathogenic organism is dead.	Weak cell-mediated responses.
Provides sufficient humoral immunity.	Requires booster stimulation since organism cannot replicate inside host.
Heat-stable.	Higher cost.
Can be used in immunodeficient patients	Inadequate killing of virulent organism can result in occurrence of the disease.

INACTIVATED VACCINES

- Inactivated vaccines are used to protect against:
- Hepatitis A
- Flu (shot only)
- Polio (shot only)
- Rabies

TOXOID VACCINES

- Toxoid vaccines use a toxin (harmful product) made by the bacteria that causes a disease. It means the immune response is targeted to the toxin instead of the whole germ.
- Like some other types of vaccines, booster doses are required to get ongoing protection against diseases.
- Toxoid vaccines are used to protect against:
- Diphtheria
- Tetanus

POLSACCHARIDE VACCINES

- **Polysaccharide vaccines**
- Polysaccharide (sugar) molecules are taken from the outside layer of encapsulated bacteria such as 23 *Streptococcus pneumoniae* (pneumococcal) serotypes for use in the Pneumovax 23 special groups Schedule vaccine.

CONJUGATE VACCINE

- Conjugate vaccines use polysaccharide (sugar) molecules are taken from the outside layer of encapsulated bacteria and join the molecules to carrier proteins. Polysaccharide molecules are taken from *Haemophilus influenzae* type b (Hib), 13 *Streptococcus pneumoniae* (pneumococcal) serotypes, and either one of four *Neisseria meningitidis* (meningococcal) serogroups and joined to carrier proteins for the Schedule vaccines Act-HIB, Prevenar 13, NeisVac-C and Menactra respectively.