VACCINES PART 2

E module

Submitted By

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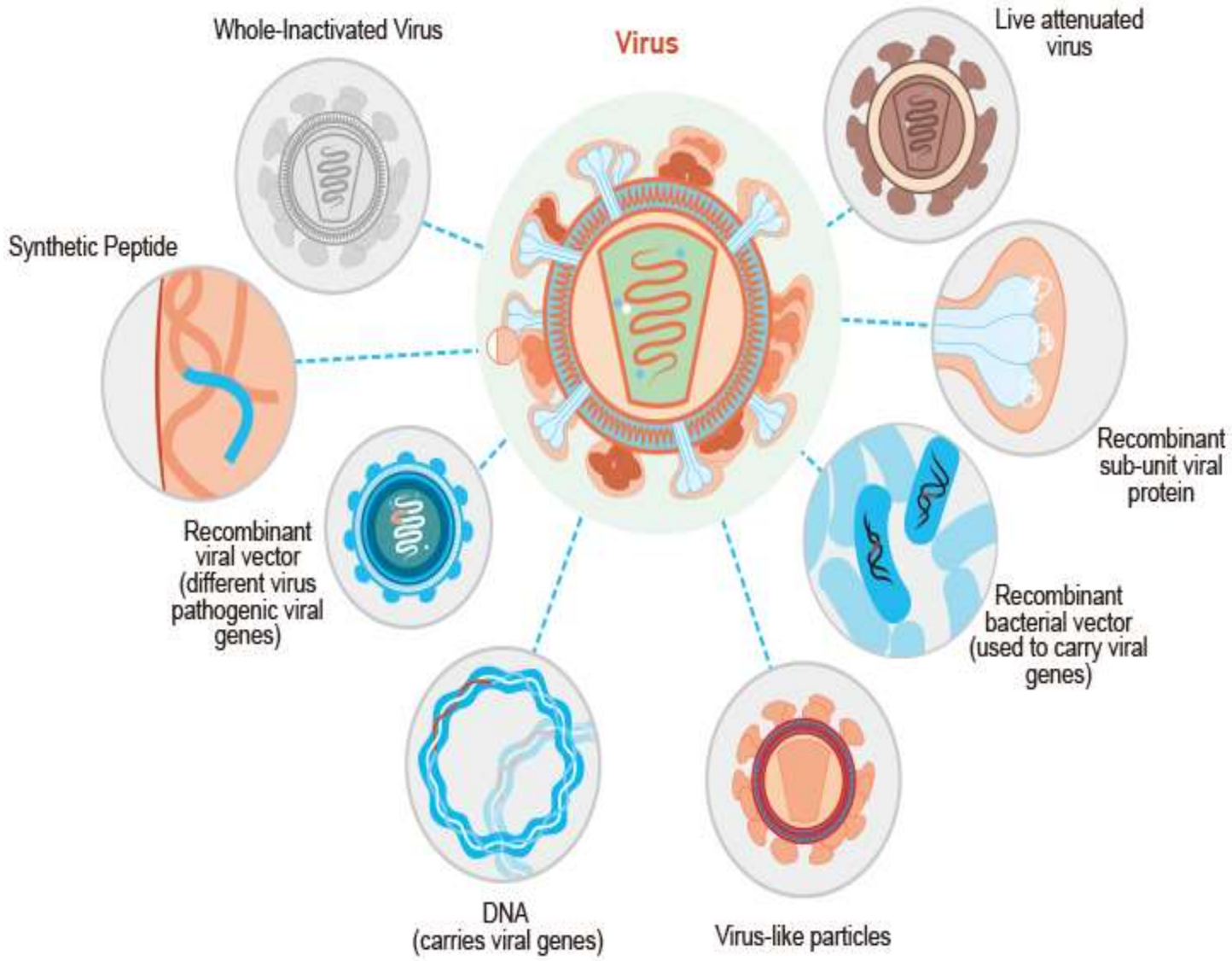
ZOOLOGY DEPTT.

TYPES OF VACCINES



VACCINES

- Smallpox vaccines produced and successfully used during the intensified eradication program are called **first generation vaccines,**In contrast to smallpox vaccines developed at the end of the eradication phase or thereafter and produced by modern cell culture techniques.
- **Second generation smallpox vaccines** use the same smallpox vaccine strains employed for manufacture of first generation vaccines or clonal virus variants plaque purified from traditional vaccine stocks.
- Whereas **Third generation smallpox** vaccines represent more attenuated vaccine strains specifically developed as safer vaccines at the end of the eradication phase by further passage in cell culture or animals.
- Second and third generation vaccines are produced using modern cell culture techniques and current standards of Good Manufacturing Practices

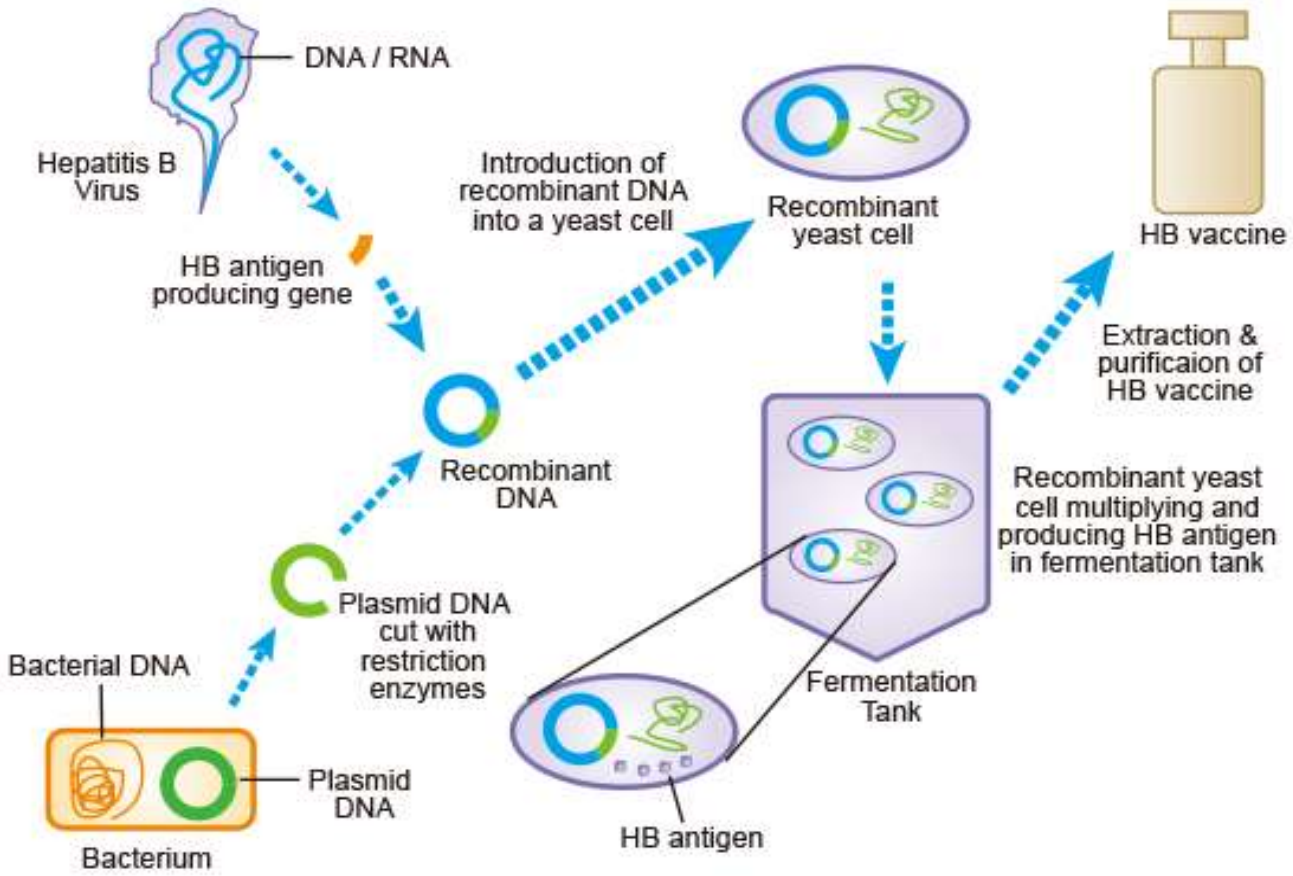
TYPES $1^{ST}/2^{ND}$ AND 3^{RD} GENERATION VACCINES

- First generation vaccine are prepared by conventional methods using whole organisms but these vaccines have many side effects and no uniform quality.
- Second generation vaccines are vaccines produced by Recombinant DNA technology.These have less side effects anduniform in quality.e.g Hepatitis,Herpes virus etc.
- Third generation are Synthetic vaccines and have been produced againstdiptheria,Leukemia etc.These vaccines have high purity.s

RECOMBINANT VACCINES

- Recombinant DNA technology in recent years has become a boon to produce new generation vaccines. By this approach, some of the limitations (listed above) of traditional vaccine production could be overcome.
- In addition, several new strategies, involving gene manipulation are being tried to create novel recombinant vaccines.

RECOMBINANT VACCINE



TYPES OF RECOMBINANT VACCINES

- **1. Subunit recombinant vaccines:**

These are the components of the pathogenic organisms. Subunit vaccines include proteins, peptides and DNA.

- **2. Attenuated recombinant vaccines:**

These are the genetically modified pathogenic organisms (bacteria or viruses) that are made non-pathogenic and used as vaccines.

3. Vector recombinant vaccines:

These are the genetically modified viral vectors that can be used as vaccines against certain pathogens.

SUBUNIT VACCINES

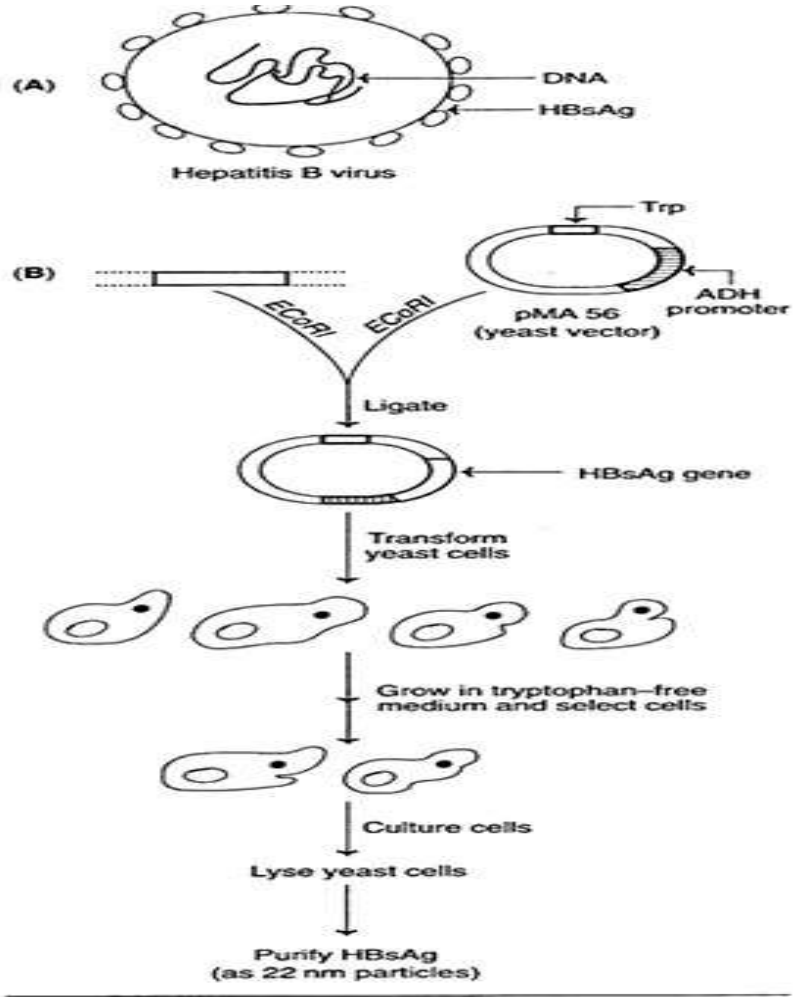
Instead of the entire pathogen, subunit vaccines include only the components, or antigens, that best stimulate the immune system. Although this design can make vaccines safer and easier to produce, it often requires the incorporation of adjuvants to elicit a strong protective immune response because the antigens alone are not sufficient to induce adequate long-term immunity

SUBUNIT VACCINES

1. Subunit Vaccines:

- As already stated, subunit recombinant vaccines are the components (proteins, peptides, DNAs) of the pathogenic organisms.
- The advantages of these vaccines include their purity in preparation, stability and safe use. The disadvantages are — high cost factor and possible alteration in native conformation

SUBUNIT VACCINE



SUBUNIT VACCINE

- The gene encoding for hepatitis B surface antigen (HBsAg) has been identified. Recombinant hepatitis B vaccine as a subunit vaccine, is produced by cloning HbsAg gene in yeast cells. The gene for HBsAg is inserted and these plasmids are then transferred and cultured.
- The cells grown in medium are selected and cloned. The yeast cells are cultured. The HBsAg gene is expressed to produce particles similar to those found in patients infected with hepatitis B. The subunit HBsAg particles can be isolated and used to immunize individuals against hepatitis.

Hepatitis B vaccine-the first synthetic vaccine:

- In 1987, the recombinant vaccine for hepatitis B (i.e. HBsAg) became the first synthetic vaccine for public use.
- Hepatitis B vaccine is safe to use, very effective and produces no allergic reactions

This recombinant vaccine has been in use since 1987.

PEPTIDE VACCINE

- It is expected that only small portions of a given protein (i.e., domains) are immunogenic and bind to antibodies. So, it is possible to use short peptides that are immunogenic as vaccines. These are referred to as peptide vaccines.

Peptide vaccines for foot and mouth disease

- Each one of these short peptides (domains) was bound to the surface of a carrier protein and used as a vaccine. Among the peptides used, the one corresponding to amino acids 141 to 160 was found to be effective in immunizing guinea pigs against FMD.
- In addition, when two peptides were joined together they served as more efficient recombinant vaccines.

Attenuated Recombinant Vaccines

In the early years of vaccine research, attenuated strains of some pathogenic organisms were prepared by prolonged cultivation i.e weeks, months or even years.

Although the reasons are not known, the infectious organism would lose its ability to cause disease but retains its capability to act as an immunizing agent

. This type of approach is almost outdated now.

ATTENUATED RECOMBINANT VACCINE

- It is now possible to genetically engineer the organisms (bacteria or viruses) and use them as live vaccines, and such vaccines are referred to as attenuated recombinant vaccines. The genetic manipulations for the production of these vaccines are broadly of two types:
- 1. Deletion or modification of virulence genes of pathogenic organisms.
- 2. Genetic manipulation of non-pathogenic organisms to carry and express antigen determinants from pathogenic organisms.

ATTENUATED RECOMBINANT VACCINE

- The advantage with attenuated vaccines is that the native conformation of the immunogenic determinants is preserved; hence the immune response is substantially high.
- This is in contrast to purified antigens which often elicit poor immunological response.

ATTENUATED RECOMBINANT VACCINE AGAINST CHOLERA

- By genetic engineering, it was possible to delete the required DNA sequence and create a new strain of V. cholera which is non-pathogenic, since it cannot produce enterotoxin.
- The genetically engineered V. cholera is a good candidate to serve as an attenuated vaccine.

REFERENCES:

- Kuby Immunology
  By J.Kindt, A. Goldsby, A.Osborne
- The Elements of Immunology
  By Fahim Halim Khan
- Textbook of Zoology
  By P.S Dhami,J.K Dhami
- Google