



Microbial Production Of Vaccines


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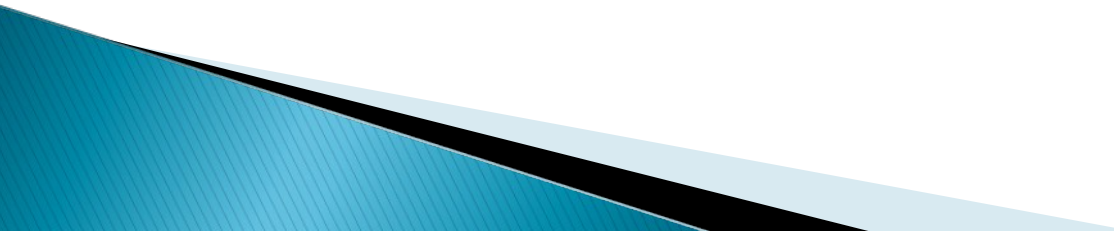


INTRODUCTION

- ▶ The word “vaccine” originates from the Latin Variolae vaccinae (cowpox), which Edward Jenner demonstrated in 1798 could prevent smallpox in humans.
 - ▶ Today the term ‘vaccine’ applies to all biological preparations, produced from living organisms, that enhance immunity against disease and either prevent (prophylactic vaccines) or, in some cases, treat disease (therapeutic vaccines).
- 



What vaccines do?

- ▶ When inactivated or weakened disease-causing microorganisms enter the body, they initiate an immune response.
 - ▶ This response mimics the body's natural response to infection.
 - ▶ These antigens trigger the production of “antibodies” by the immune system.
 - ▶ Antibodies bind to corresponding antigens and induce their destruction by other immune cells
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Types Of Vaccines

Types of
Vaccines

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graph TD; A[Types of Vaccines] --> B[Live]; A --> C[Dead]; A --> D[Subunit]; A --> E[Gentically engineered];
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Live

Dead

Subunit

Gentically
engineered

LIVE ATTENUATED VACCINE

- ▶ These vaccines are composed of live, attenuated microorganisms that cause a limited infection in their hosts sufficient to induce an immune response, but insufficient to cause disease.
- ▶ To make an attenuated vaccine, the pathogen is grown in foreign host such as animals, embryonated eggs or tissue culture, under conditions that make it less virulent.

LIVE ATTENUATED VACCINES



KILLED VACCINES

- ▶ When it is unsafe to use live microorganisms to prepare vaccines, they are killed or inactivated.
- ▶ These are preparations of the normal (wild type) infectious, pathogenic microorganisms that have been rendered nonpathogenic, usually by treatment with using heat so that they cannot replicate at all.



- ▶ **The Sabin (oral poliomyelitis)** vaccine consists of an aqueous suspension of poliomyelitis virus, usually grown in cultures of monkey kidney tissue.
- ▶ It contains approximately 1 million particles of poliomyelitis strains 1, 2 or 3 or a combination of all three strains.



SUBUNIT VACCINES

SUBUNIT VACCINES

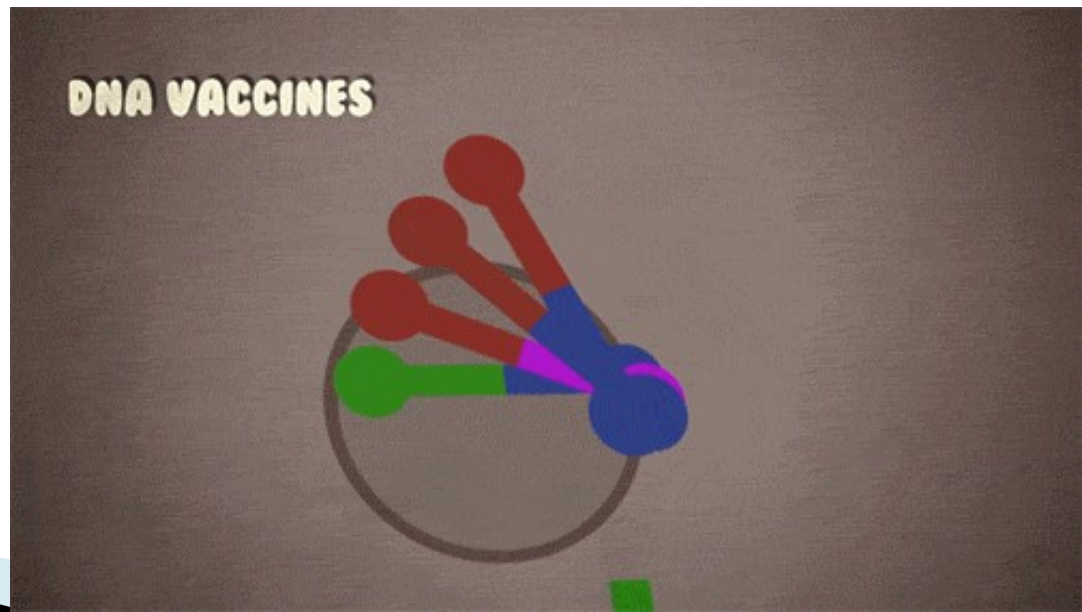


RECOMBINANT VACCINES

- ▶ The vaccines are produced using recombinant DNA technology or genetic engineering.
- ▶ Recombinant vaccines are those in which genes for desired antigens of a microbe are inserted into a vector.
- ▶ Different strategies are: Using the engineered vector that is expressing desired antigen as a vaccine The engineered vector (e.g., yeast) is made to express the antigen, such is vector is grown and the antigen is purified and injected as a subunit vaccine.

DNA VACCINES

- ▶ The DNA is injected into the muscle of the animal being vaccinated, usually with a "gene gun" that uses compressed gas to blow the DNA into the muscle cells.
- ▶ DNA can be introduced into tissues by bombarding the skin with DNA-coated gold particles. It is also possible to introduce DNA into nasal tissue in nose drops.
- ▶ DNA vaccines have induced both humoral and cellular immunity.




Cocktail Vaccines

- ▶ A cocktail vaccine is a mixture of different vaccines which is effective against more than one disease.
- ▶ For example- MMR vaccine is effective against Mumps, Measles and Rubella.
- ▶ MMR Vaccine was first developed by Maurice Hillemann.
- ▶ MMR vaccine consists of live attenuated virus of three diseases, administered via injection.



Production

- ▶ Vaccines are produced in large scale as they need to be administered to large populations of children and adults to be effective as a public health tool. This large scale production is often a challenge.
 - ▶ **Stages of vaccine production**
 - ▶ Vaccine production has several stages. Process of vaccine manufacture has the following steps:
 - ✓ Inactivation – This involves making of the antigen preparation
 - ✓ Purification – The isolated antigen is purified
 - ✓ Formulation – The purified antigen is combined with adjuvants, stabilizers and preservatives to form the final vaccine preparation.
- 

GROWING THE MICROORGANISMS

GROWING BACTERIA

- BATCH CULTURE
- CONTINUOUS CULTURE

GROWING VIRUSES

- Methods used are :
 - ▢ **CELL (TISSUE) CULTURES** – cultured cells grow in sheets that support viral replication and permit observation for cytopathic effect.
 - ▢ **BIRD EMBRYOS** – incubating egg is an ideal system; virus is injected through the shell.
 - ▢ **LIVE ANIMAL INOCULATION** – occasionally used when necessary

ATTENUATION

- Attenuation (bacterial or viral) represents the **process of elimination or greatly reducing the virulence of a pathogen.**
- This is traditionally achieved by, for example, chemical treatment or heat, growing under adverse conditions or propagation in an unnatural host.
- Although rarely occurring in practice, a theoretical danger exists in some cases that the attenuated **pathogen might revert to its pathogenic state.**

Methods usually employed to inactivate bacteria or viruses subsequently used as dead/inactivated vaccine preparations

- **Heat treatment**
 - **Treatment with formaldehyde or acetone**
- 

Formulation of Vaccine

Other than microorganism or its part a vaccine contain the following substance:-

Suspending fluids - The liquid which contains the chemicals used during production which kill or weaken the organism for use in vaccines.

- Sterile water, saline or fluids containing protein

Preservatives and stabilizers

-- **Monosodium glutamate (MSG)** and 2-phenoxy-ethanol which are used as stabilizers in a few vaccines to help the vaccine remain unchanged when the vaccine is exposed to heat, light, acidity, or humidity.

- ▶ **Antibiotics**
- ▶ **Thimerosal**

Adjuvants enhance vaccine immunogenicity

Adjuvants or enhancers –

- Aluminium gels or salts (Alum)

Alum is used in several licensed vaccines including:

- Haemophilus influenza
- Inactivated polio virus
- Hepatitis A (HAV)

INFECTION OF CELLS
WITH BTV VIRUS



REMOVE DEBRIS



INACTIVATING AGENT



CONCENTRATION
& PURIFICATION
BY CHROMATOGRAPHY



PURIFIED BTV ANTIGEN
CONCENTRATE



Virus
concentration

PUR BENEFITS

- Superior safety
- Excellent efficacy
- Durable protection

BLENDING
BTV ANTIGEN
WITH ADJUVANTS



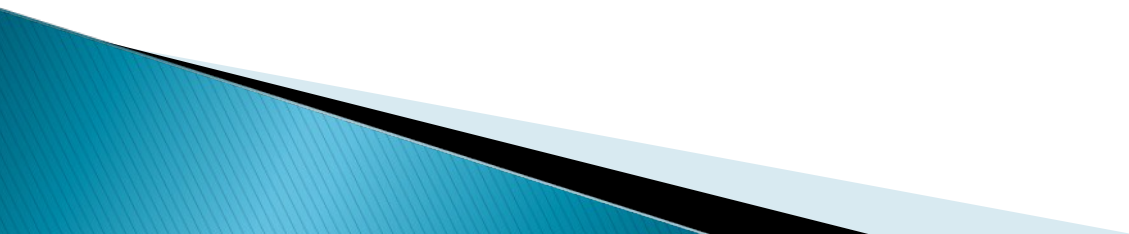
AlSap
[Aluminium Hydroxide
+ Purified Saponin]

FILLING INTO
10, 50, 100 ML
BOTTLES



- Unique dose volume
sheep and cattle
- Monovalent as well
as bivalent vaccines

Thank You



Questions?