

# Vaccines types and process of vaccination

Gulshan Kumar  
School of Fisheries

# Introduction

- Vaccine is a substance used to stimulate the production of antibodies and provide immunity against one or several diseases, prepared from the causative agent of a disease, its products, or a synthetic substitute, treated to act as an antigen without inducing the disease.

# Classification

- Whole-Pathogen Vaccines
- Subunit Vaccines
- Nucleic Acid Vaccines

# Whole-Pathogen Vaccines

- 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.

- Scientists first described the ability of inactivated, or killed, microbes to induce immunity in the 19<sup>th</sup> century.
- This led to the development of **inactivated vaccines**, which are produced by killing the pathogen with chemicals, heat or radiation.
- Advances in tissue culture techniques in the 1950s enabled development of **live-attenuated vaccines**, which contain a version of the living microbe that has been weakened in the laboratory.

- Modern genetic engineering techniques have enabled creation of chimeric viruses, which contain genetic information from and display biological properties of different parent viruses.
- A NIAID-developed live-attenuated **chimeric vaccine** consisting of a dengue virus backbone with Zika virus surface proteins is undergoing early-stage testing in humans.

# 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.

- Vaccines against bacterial illnesses, such as diphtheria and tetanus vaccines, aim to elicit immune responses against disease-causing proteins, or toxins, secreted by the bacteria. The antigens in these so-called **toxoid vaccines** are chemically inactivated toxins, known as toxoids.



- **Recombinant protein vaccine** in which antigenic proteins are expressed in an expression system like E coli, Yeast or Insect cells using rDNA technology.

# Nucleic acid vaccines

- Another investigational approach to vaccination involves introducing genetic material encoding the antigen or antigens against which an immune response is sought. The body's own cells then use this genetic material to produce the antigens.
- **Types of nucleic acid vaccines**
- DNA plasmid vaccines
- mRNA vaccines
- Recombinant vector vaccines