University of Mosul
Lecture No.: 1
College of Veterinary Medicine
Date:2026
Unit of Scientific Affairs
Website:

Lecture title: vaccine

Lecturer Affiliation:

Ammar M. Al-Aalim

Department of Microbiology, College of Veterinary Medicine, University of Mosul, Mosul, Iraq.

Summary:

1- Learning what the vaccine is
2- 2- The most common Types of vaccines

Vaccine

A vaccine is a biological preparation that improves immunity to a particular 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. The agent stimulates the body's immune system to recognize the agent as foreign, destroy it, and "remember" it, so that the immune system can more easily recognize and destroy any of these microorganisms that it later encounters.

Vaccines are dead or inactivated organisms or purified products derived from them.

There are several types of vaccines in use. These represent different strategies used to try to reduce risk of illness, while retaining the ability to induce a beneficial immune response.

Inactivated

Some vaccines contain killed, but previously virulent, micro-organisms that have been destroyed with chemicals, heat, radioactivity or antibiotics. Examples are the influenza vaccine, cholera vaccine,bubonic plague vaccine, polio vaccine, hepatitis A vaccine, and rabies vaccine.

Attenuated

Some vaccines contain live, attenuated microorganisms. Many of these are live viruses that have been cultivated under conditions that disable their virulent properties, or which use closely related but less dangerous organisms to produce a broad immune response. They typically provoke more durable immunological responses and are the preferred type for healthy adults. Examples include the viral diseases yellow fever, measles, rubella, and mumps. Attenuated vaccines have some advantages and disadvantages. They have the capacity of transient growth so they give prolonged protection, and no booster dose is required. But they may revert to the virulent form and cause the disease.

Subunit

Protein subunit- rather than introducing an inactivated or attenuated micro-organism to an immune system (which would constitute a "whole-agent" vaccine), a fragment of it can create an immune response. Examples include the subunit vaccine against Hepatitis B virus that is composed of only the surface proteins of the virus (previously extracted from the blood stream of chronically infected patients, but now produced by recombination of the viral genes into yeast), the virus like particle (VLP) vaccine against human papillomavirus (HPV) that is composed of the viral major capsidprotein, and the hemagglutinin and neuraminidase subunits of the influenza virus. One method of production involves isolation of a specific protein from a virus and administering this by itself. A weakness of this technique is that isolated proteins can be denatured and will then bind to different antibodies than the

proteins in the virus. A second method of subunit vaccine is the recombinant vaccine, which involves putting a protein gene from the targeted virus into another virus. The second virus will express the protein, but will not present a risk to the injector. This is the type of vaccine currently in use for hepatitis, and it is experimentally popular, being used to try to develop new vaccines for difficult to vaccinate viruses such as Ebola and HIV.

DNA Vaccine

In the past decade and a half, the DNA vaccine concept has been tested and applied against various pathogens and tumor antigens. The optimized gene sequence of interest is delivered to the skin, subcutaneum or muscle by one of several delivery methods. The expression of plasmid-encoded genes will produce foreign antigens and elicits immunological response. Until now, four DNA vaccine products have been approved, all in the area of veterinary medicine.

Vaccines are very effective on stable viruses, but are of limited use in treating a patient who has already been infected. It is also difficult to successfully deploy them against rapidly mutating viruses, such as influenza (the vaccine for which is updated every year) and HIV. Antiviral drugs are particularly useful in these cases

Example of a vaccine

Vaccine Target	Product Name	Company involved	Date licensed and country	Target organism	Benefits
West Nile virus	West Nile Innovator	Centers for Disease Control and Prevention and Fort Dodge Laboratories	2005 USA	Horses	Protects against West Nile virus infection
Infectious Haematopoietic necrosis virus	Apex-IHN	Novartis	2005 Canada	Salmon	Improves animal welfare, increase food quality and quantity
Growth hormone releasing hormone	LifeTide-SWS	VGX Animal Health	2007 Austrilia	Swine and food Animals	Increases the number of piglets weaned in breeding sows
Melanoma	Canine Melanoma Vaccine	Merial, Memorial Sloan-Kettering Cancer Center and The Animal Medical Center of New York	2007 USA, conditional license	Dogs	Treats aggressive forms of cancer of the mouth, nail bed, foot pad or other areas as an alternative to radiation and surgery

Current licensed DNA therapies (Adapted from Kutzler MA & Weiner et. al)