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Commentary

A Short Panorama Description of Vaccines

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ABOUT THE STUDY

A vaccine can provide active immunity to a specific pathogen by stimulating the immune system to attack the pathogen. After being stimulated by a vaccine, antibody-producing cells known as B cells (or B lymphocytes) remain sensitised and ready to respond to the agent if it ever gains entry into the body. A vaccine may also provide passive immunity by delivering antibodies or lymphocytes that have already been produced by an animal or human donor. Vaccines applied to mucosal surfaces, such as those lining the gut or nasal passages, appear to elicit a stronger antibody response and may be the most effective route of administration.

The challenge in vaccine development is to create a vaccine that is powerful enough to protect against infection without making the individual seriously ill. To that end, scientists have developed a variety of vaccines. Weakening or attenuation vaccines are made up of microorganisms that have lost their ability to cause serious illness but still have the ability to stimulate immunity. They can cause the disease to be mild or subclinical. Measles, mumps, polio (the Sabin vaccine), rubella, and tuberculosis vaccines are all attenuated. Vaccines that have been inactivated or killed by heat or chemicals are known as inactivated vaccines.

Although inactivated vaccines elicit an immune response, it is often less complete than with attenuated vaccines. Because inactivated vaccines are less effective against infection than those made from attenuated microorganisms, larger doses of inactivated vaccines are used. Inactivated microorganisms are used to create vaccines against rabies, polio (the Salk vaccine), some types of influenza, and cholera. A subunit vaccine is another type of vaccine that is made from proteins found on the surface of infectious agents. Vaccines for influenza and hepatitis B are examples of this. Toxoids are formed when toxins, metabolic by-products of infectious organisms, are inactivated and can be used to stimulate immunity against tetanus, diphtheria, and whooping cough (pertussis).

Recombinant DNA technology has also been useful in the development of vaccines against viruses that cannot be grown successfully or are inherently dangerous. The desired antigen's genetic material is inserted into an attenuated form of a large virus, such as the vaccinia virus, which carries the foreign genes "piggyback." The modified virus is injected into a person to stimulate antibody production against foreign proteins, thereby conferring immunity. After receiving genes derived from disease-causing microorganisms, the vaccinia virus may be able to function as a live vaccine against a huge array of diseases.

Vaccines against Human Papillomavirus (HPV) are created using recombinant technology and Viruslike Particles (VLPs). Because the vaccines do not contain live HPV biological or genetic material, they cannot cause infection. There are two types of HPV vaccines available: a bivalent vaccine made with VLPs from HPV types 16 and 18, and a tetravalent vaccine made with VLPs from HPV types 6, 11, 16, and 18.

RNA-based vaccines have piqued the interest of researchers as a means of preventing diseases such as influenza, cytomegalovirus infection, and rabies. messenger RNA (mRNA) vaccines are advantageous because the method of production allows them to be developed more quickly than other vaccines. Furthermore, their production can be standardised, allowing for rapid scale-up for the production of large quantities of vaccine. Novel mRNA vaccines are both safe and effective; they contain no live virus and the RNA does not interact with human DNA.

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