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Gene-tweaking key to new vaccines

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Gene-tweaking key to new vaccines



The US Centre for Disease Control and Prevention (CDC), an institute that draws national attention on developing and applying disease prevention and control, mentions that vaccine antigens can be produced by genetic engineering technology. Referred to as recombinant vaccines, this technology has opened path for a number of alternative strategies for vaccine production.

In genetically modified vaccines, the toxic part of disease causing organism is removed so that the body reacts to the presence of the organism and produces antibodies without causing side effects. Genetic engineering can be used to introduce a gene coding for an immunogenic protein from one organism into the genome of another, such as vaccinia virus. The organism expressing a foreign gene is called a recombinant. Following injection into the subject, the recombinant organism replicates and expresses sufficient amounts of foreign protein to induce a specific immune response to the protein. (Also read Vaccine delivery technologies of the future)

The CDC further explains that Hepatitis B vaccines are produced by insertion of a segment of the hepatitis B virus gene into the gene of a yeast cell. The modified yeast cell produces pure hepatitis B surface antigen when it grows. *Salmonella typhi* bacteria are genetically modified in the Live typhoid vaccine (Ty21a). The live attenuated influenza vaccine (LAIV) has been engineered to replicate effectively in the mucosa of the nasopharynx.

Indian vaccine developer Shantha Biotechnics developed the country's first genetically engineered vaccine, Shanvac, against Hepatitis B in 1997. The vaccine is much cheaper than the available Hep-B vaccines in the market. GeneVac-B, developed by Serum Institute of India, is also a genetically engineered Hepatitis B vaccine and has been clinically tired for safety and efficacy. Gene Vac-B is a non-infectious recombinant DNA Hepatitis B vaccine. It contains purified surface antigen of the virus obtained by culturing genetically-engineered Hansenula polymorpha yeast cells having the surface antigen gene of the Hepatitis B virus. The Hepatitis-B surface antigen (HBsAg) expressed in the cells of Hansenula polymorpha is purified through several chemical steps and formulated as a suspension of the antigen adsorbed on aluminium hydroxide.

The researchers from the University of Western Ontario in Canada have developed a new HIV vaccine containing genetically modified virus, and trials are being done to experiment efficacy of the vaccine.

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Dr Gerardo Guillen, biomedical research director, Centro de Ingenieria Genetica y Biotecnologia (CIGB), from Cuba, says genetically engineered vaccines hold potential future in the current vaccine technology spectrum. "Haemophilus vaccine is the only synthetic vaccine in the world developed naturally. The CIGB has been developing vaccines using genetic engineering and biotechnology techniques and has successfully developed Heberoviac-HB, Trivac-HB, and Heberpenta."

US-based Bavarian Nordic is conducting phase III trial of therapeutic cancer vaccine Prostvac that uses smallpox viral vector to stimulate the immune system. The developers of the vaccine believe that it has the potential to significantly extend the lives of men with advanced prostate cancer where limited treatment options are available. Merck's Gardasil is Human Papilloma Virus (HPV) vaccine, a genetically modified, trans-species vaccination for girls for preventing cervical cancer.