The Bench and Beyond

SAN DIEGO BIOMEDICAL RESEARCH INSTITUTE

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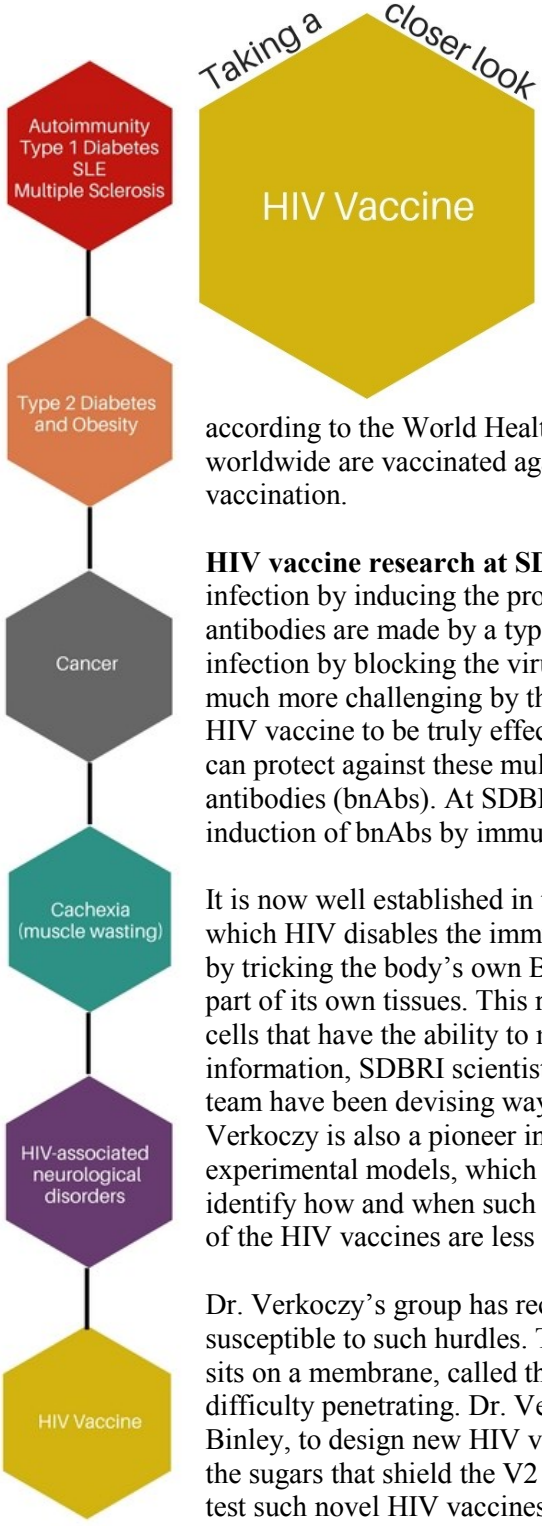

Human Immunodeficiency Virus (HIV) kills immune cells causing a severe deficiency in the numbers and function of the immune system. This immune deficiency is called AIDS (Acquired Immune Deficiency Syndrome). If not treated, people with AIDS are much more susceptible to infection than healthy people. They are also at greater risk of developing cancer, neurocognitive disorders, and often experience dramatic weight loss with profound loss of muscle.

Developing an HIV vaccine is a major global health initiative. The success of vaccines to reduce illnesses such as influenza (flu), polio, measles, tetanus, diphtheria, and others justifies the initiative to create an HIV vaccine that can minimize HIV-related deaths and illness. Moreover, according to the World Health Organization (WHO), more than 75% of all 1-year-old children worldwide are vaccinated against at least one disease indicating a consensus in the advantages of vaccination.

HIV vaccine research at SDBRI: Vaccine development at SDBRI is focused on preventing HIV infection by inducing the production of proteins called antibodies. Virus-fighting or "neutralizing" antibodies are made by a type of immune cell called B cells. These antibodies protect the body from infection by blocking the virus' ability to attach to and infect cells. In the case of HIV, this goal is made much more challenging by the fact that many strains of HIV have evolved worldwide. Therefore, for an HIV vaccine to be truly effective globally, it will most likely need to elicit neutralizing antibodies that can protect against these multiple strains. These protective antibodies are known as broadly neutralizing antibodies (bnAbs). At SDBRI, scientists are working to understand why it is so difficult to achieve induction of bnAbs by immunization with HIV.

It is now well established in the HIV vaccine field that one tactic by which HIV disables the immune system's ability to produce bnAbs is by tricking the body's own B cells into thinking that the HIV vaccine is part of its own tissues. This results in blocking the development of B cells that have the ability to make such proteins. Armed with this information, SDBRI scientist, Dr. Laurent Verkoczy and his research team have been devising ways to overcome such barriers. Dr. Verkoczy is also a pioneer in developing genetically-modified experimental models, which have allowed his team to more precisely identify how and when such roadblocks occur, and which components of the HIV vaccines are less susceptible to inducing such mechanisms.

Dr. Verkoczy's group has recently found that a part of HIV called, V2 apex, is potentially less susceptible to such hurdles. The V2 apex, however, is susceptible to another key challenge because it sits on a membrane, called the Envelope, that is covered by a dense "coat" of sugars, which bnAbs have difficulty penetrating. Dr. Verkoczy is currently collaborating with another SDBRI scientist, Dr. James Binley, to design new HIV vaccines that can enhance the production of bnAbs by B cells by removing the sugars that shield the V2 apex Dr. Verkoczy's team is also developing new experimental models to test such novel HIV vaccines for their ability to successfully induce bnAbs, before testing them in human trials.

Frequently Asked Questions!

Do vaccines only protect from viruses? No, a vaccine can be made to protect against bacteria and viruses. In fact, some of the best-known vaccines protect from bacteria, including tetanus, diphtheria and pertussis.

How many people are infected with HIV? The World Health Organization recently estimated that 36.7 million people live with HIV/AIDS worldwide with 1 million HIV-related deaths every year. New infections in 2017 were estimated at an alarming 1.8 million worldwide.

Why is it that a vaccine to HIV has not been developed yet? The short answer is, it's not for lack of trying! An enormous effort by thousands of scientists during a 30 year long global HIV vaccine design initiative, known as the "Manhattan Project for AIDS", highlights the difficulty in developing a successful vaccine to HIV. The problem includes a very clever virus design that shields itself from the immune system, and prevents successful immunization.

Can children develop HIV/AIDS? Yes, they can. HIV can be passed on from a mother to a child during pregnancy, childbirth and breastfeeding. The majority of HIV diagnoses under the age of 13 in the United States are the result of transmission from the mother during pregnancy.

Can mother-to-child transmission of HIV be prevented? Yes, it can. Women with HIV can take medications that prevent mother-to-child transmission. Also, medication given to babies for 4-6 weeks after birth can reduce the risk of HIV infection.

Will there ever be a successful HIV vaccine? Over the past 10 years biomedical research in HIV vaccine development has exploded with new and exciting information that has led to the design of a new generation of vaccine candidates, some of which are now in the preliminary stages of clinical testing. In the biomedical field there is growing optimism that a successful vaccine is on the horizon.

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