

# Possible vaccine for HIV-1 by effective neutralization by chemically charged *bs* gp120 recognition of CD4 T cells

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Advances in microbiology research revealed that a section of HIV-1 has a region of proteins that remain free of mutation despite all of the different strains of the HIV, and is termed to be the Achilles heel of the virus. The gp120 region may be the key structure to focus on to find an effective covalent vaccine for the virus. The gp120 region is the highlight in finding a vaccine because it is the one structure of the fast, highly mutable virus, that remains free of mutation because the gp120 structure would preclude virus-cell interaction. The first step of the HIV virus replication is for it to enter the host's healthy T cells through membrane fusion, the gp120 region is the structure that is bonded to the host's CD4 receptor on the cellular membrane. Cellular membrane fusion of the T cell and the virus is completed by the gp41 region bonding to the host's T cell's CCR5 or CCRX4 co-receptor. Once the fusion is complete, the integrase inserts its DNA into the host's cell's genome, causing the cell to make HIV molecules, until the cell's resources are used up. New research has led scientist, such as Dr. Paul and his team, to develop a vaccine that has shown to produce *abs* that are able to effectively disable the virus against the human cells. In animal trials, mice have been given a chemically activated gp120 region that is naturally able to bond to the host's B cells, resulting in effective *abs* being created to fight the infection. Also, the study showed that the chemically activated gp120 vaccine was effective against a vast array of different strains of HIV from around the world. This would be the first antigen that is able to create effective *abs* to fight HIV. The main difference between the new vaccines compared to the old ones is its chemically charged properties that allow it to create a covalent bond with memory B cells, allowing lymphocytes to create *abs* that are effective, instead of progressing towards tolerance, as seen in previous HIV administered medications. The study of the gp120 *bs* on the viral envelope, may hold the key to developing the first effective vaccine, allowing immunity from HIV for everyone.

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## Introduction

It is important to understand the role of the immune system with a human infected with the HIV virus. Within the T cell lymphocytes there are two main classes, helper T cells (*th*) and cytotoxic T cells (*tc*). The *tc* cells are made to recognize and get rid of infected or otherwise malfunctioning cells. The regulation of the clonal growth and antibody variety is done by the *th* cells. The *th* cells are made to divide rapidly, and produce cytokines that regulate the process of a proper immune response. The *th* cells are the main target for the HIV virus. The fragments of a recognized virus are on the surface of the B cells and

the macrophages, there the specific known viral *abs* are immediate antigenic stimuli that cause B cell replication and expansion resulting in *ab* production. This only occurs if the fragment of the virus is found on both the B and the *th* cell. Without the command to the B cell, no message will get sent to secrete *abs*.

For a pathogen that resides inside the host cell the best response is the use *tc* cells, because this process will try to eliminate the virus through killing the virus's host cell completely. HIV has found an evolutionary ability to remain latent within its host. This ability is the reason HIV will remain dormant for so many years before

appearing active. HIV specifically aims for the *th* cells because they have to interact with both B cells to cause *ab* production, along with other T cells to defeat the infection. The cellular membrane of the *th* cells, could block the HIV contamination, if monoclonal *abs* were made by the B cells recognizing the virus. An effective HIV cure lies within a vaccine, normally they work by introducing a weak antigen into the body, the immune system will recognize it by B cells, they in turn will create *abs* that allow *tc* cells to kill the viral infection. The new antigen increases the production of antibodies to rid the virus of healthy human cells.

The development of a vaccine for human immunodeficiency virus has long been researched since the 1980s, the biggest problems lies in the virus efficiently mutating its structure to create different strands, one base pair mutation approximately once every 2000 base pairs. This frequent mutation may be good or bad for the virus depending on the combination; the change usually leads to such things as tolerance to medications. The beneficial mutations will lead to new strains of HIV which can be tolerated by most vaccines. The HIV-1 is classed as a retrovirus, because it makes a DNA copy, and inserts into the host cells genome to further replicate. Different Antiretroviral (ARV) medications interact with the virus in different ways, but they all repress the speed of growth of the HIV-1 virus. The ARV medications will not cure the patient of HIV-001, but prolong the time they stay healthy by slowing down the HIV life cycle. The way to defeat HIV is creating a vaccine, which will not only combat that strain of HIV but also, all of the mutated strains that will be produced due to evolution.

### Recent Progress

In 2009, Dr. Paul's research team produced a chemically activated gp120 prototype vaccine, allowing bonding of the two modular regions of the gp120. After years of trails, the research team has identified *abs* that are capable of neutralizing a genetically diverse HIV infected DNA, and have found ways to immunize animals to create them. An antigen was found that creates protective antibodies that can stop infection of human cells from a variety of strains of HIV. The main difference is the study of the chemical property that allows covalent bonding to occur. "The tolerance signal is converted to a stimulatory signal because strong covalent binding to the B cells liberates a large amount of energy that is not available in traditional binding reactions," said Dr. Paul. The new vaccine allows the production of a variety of neutralizing *abs* to the HIV virus. This sheds new light on a new way to prevent the virus from ever infecting the host. A chemically charged HIV gp120 protein was used to create *abs* in mice, monoclonal cells. These *abs* were then tested with a variety of HIV strains. The results showed that the

cultured human cells where clear of infection. Previous HIV vaccines have only shown to stimulate the production of *abs* to the mutated segments of the virus membrane, but didn't make *abs* for the regions that are needed for virus attachment to host T cells that have a latent infection.

The use of the chemically active gp120 vaccine, overrides the HIV natural response. Naturally *abs* production is the result of antigens binding on the surface of B cells using covalent forces. HIV uses a non-covalent bond when attached to the B cell, this causes the virus to be over looked, and no action is taken to move the immune reaction forward. The chemically charged vaccine will allow the B cell to recognize the virus, because proper attachment is made using the energy from the vaccine that is not found within nature. Also, the vaccine has "two modular antigenic regions," when the bond of just one of these regions is all that is needed to create a signal that calls for *abs*.

In the case of HIV, non-covalent binding of its cell attachment site induces a state of B cell tolerance, permitting infection to proceed unchecked. Our covalent vaccination approach breaks the tolerance and stimulates production of *abs* that inactivates the virus.

### Discussion

One of the biggest problems with finding a HIV vaccine is due to the virus being able to manipulate into different strains. *Abs* failure is mostly due the genetic varieties of the HIV virus. New research has shown that two segments of the *bs* on the viral envelope, gp120 and gp41 fail to manipulate. With this unchanging section of protein, a newly found set of antibodies are identified and oppose the HIV virus successfully. The ground breaking *abs* technique by the use of a chemically charged vaccine has been shown to neutralize the HIV virus 100 percent within isolated human cells, from all the strains from different parts of the world. There were successful animal trails, and with isolated humans cells. Currently new drugs are in the deliberate time taking first steps of the human trails the real question is will the test work in human trails. It is successful within isolated human cells inside of the lab, but is in the first phases of human trails to the public. This prototype vaccine may fail, causing only vaccination for one strain of HIV leading it to mutate to different strains. It may prevent *th* cells from normal recognitions with B cells. Without normal interactions, the failure of the immune system would be imminent.

There have been more failures than success stories when searching for the HIV vaccine, but each failure is acknowledged that is learned and used again. There is hope for those who are suffering. There is many more trails and studies that are mandatory to find a successful and safe vaccine. The cure for AIDS will result in protective, effective *abs* and more importantly there

attachment at the gp120 *bs*. There is a chance that the new understandings of the gp120 *bs* on the HIV envelope, will yet lead to new ground breaking understandings and possibly a vaccine.

**References**

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