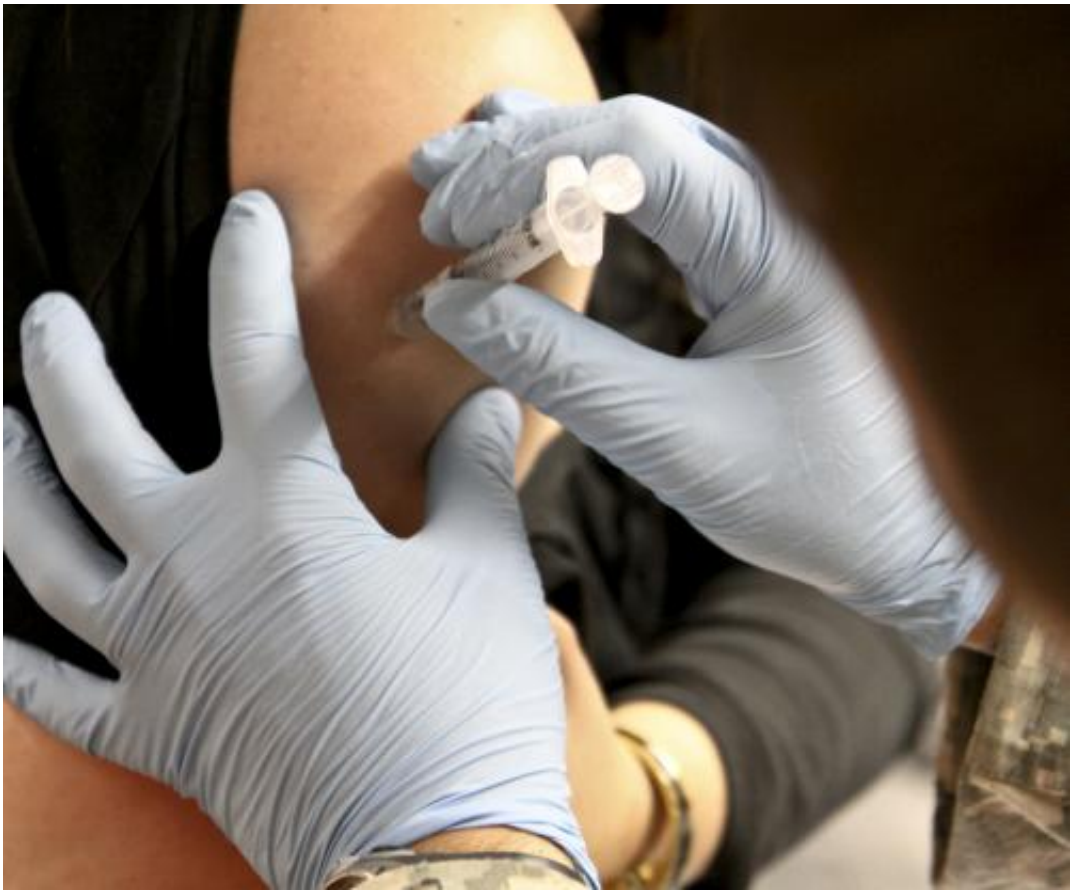
Research may be beating HIV, but a vaccine remains distant

July 11 2014, by John Mcluskey



This would be the ideal way to fight HIV. Credit: europedistrict, CC BY

Three decades since the onset of the infection in a global population, HIV care and treatment is looking very different. Given the difficulties involved, it is remarkable that having developed good treatments, the

global community is racing towards finding a vaccine cure.

The first clinical observation of AIDS was recorded in the US in 1981. The focus then was to identify what caused the new disease and to help people to a dignified death. Once HIV was identified, understanding the behaviour of the virus became vital.

Soon antiretroviral therapies were developed that attempted to disrupt the replication of the virus in the body. In the late 1990s, a combination of these therapies showed better results and had a huge impact on the future of HIV-infected individuals. In the UK the healthcare discourse changed from the person dying from AIDS to the person living with HIV. Today, those individuals diagnosed with HIV infection have a similar life expectancy to those without.

Now research is gathering pace to search for a cure. A recent advert from Cancer Research UK claims "research is beating HIV". However, it is not that simple.

There have been claims of a cure for a few individuals: the now famous Timothy Ray Brown, known as the "Berlin patient", became clear of his HIV while receiving bone marrow transplantation for his leukaemia. In Mississippi in the US, a baby was treated with antiretroviral therapies for the first 18 months of her life and appears to be infection-free. The "Visconti group" consisting of 14 patients with HIV who have had their antiretroviral therapies stopped with no sign of further infection.

However, bone marrow transplantation would not be the most appropriate way forward as the procedure carries risks in itself. Also two men undergoing treatment for lymphoma in Boston, US showed a return to HIV infection some months after their transplants. Seeking a cure is still needed.

The development of a vaccine for HIV is complex and this is what leads to its elusiveness. The purpose of a vaccine is to provide a protective immune response to a particular microorganism. The body's immune system produces antibodies that purge the microorganism with weapons tailored to specifically attack it.

But this is where the difficulties begin: HIV undergoes many mutations, as do most viruses and, therefore, we are not dealing with just one-size-fits-all weapon to fight a virus. The virus also has the ability to evolve resistance to immune control. Our understanding of HIV's adaptive evolution must improve if vaccination development is going to be effective.

In creating an appropriate approach to vaccine development the response of the immune system to the virus is important as we want to encourage the development of antibodies to the proteins within the virus. According to a new review published in the journal Science, two approaches to elicit antibody protection in HIV are being pursued: a vaccine that is potent and produces broadly reactive neutralising antibodies (bnAbs) and vaccines that induce "conventional antibodies".

Broadly reactive neutralising antibodies (bnAbs) are considered important as they are more likely to cope with mutations of viruses. When developed they ought to be potent and induce high levels of protection. But there are complexities with their structure and it may take months to years in order to evolve a response.

On the other hand, conventional antibodies are less potent but they are produced by the majority of infected individuals and are the only antibodies that have been seen in vaccine trials to date. Unlike bnAbs, conventional antibodies take only weeks to months to evolve a response.

While bnAbs are probably the desired approach to vaccine development,

vaccines that support conventional antibodies should not be ignored as they have shown some success in clinical trials. It is not the time to put all our eggs in one basket and research into the development of a vaccine should concentrate on both approaches.

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