HOW CAMELS' ANTIBODIES ARE BEING STUDIED IN THE FIGHT AGAINST HIV

► Researchers in Dubai hope the potential revealed in their work can be developed into a life-saving treatment

DANIEL BARDSLEY

It has been more than three decades since HIV was discovered and the virus, which causes Aids, has claimed more than 35 million lives.

Although effective anti-retroviral drugs mean that people can live with HIV for decades, the optimal drug treatments to prevent resistance developing are not universally available. Last year, HIV-linked conditions claimed more than a million lives.

The continued death toll from HIV highlights the importance of developing better ways to prevent infections, of which there were nearly two million last year, the World Health Organisation said.

A vaccine that confers immunity to HIV has proved difficult to develop, despite considerable effort. The virus exists in different forms and evolves rapidly.

But efforts to prevent its spread have now turned to a surprising source – camels in the UAE.

The Central Veterinary Research Laboratory in Dubai has played an important role in looking at whether antibodies produced by camels could be used to battle HIV.

Recently published in the journal *Scientific Reports*, the work indicates camel antibodies have great potential. In tests, a combination of two particular types of antibody isolated from camel blood was able to neutralise most HIV strains from different subtypes tested.

"The approach we are following now is promising to protect against new infections in groups at high risk of sexual HIV transmission," said Dr Ursula Dietrich, the scientist leading the project at the Georg Speyer Haus research institute in Frankfurt.

It was thought that camels might prove useful in the fight against HIV because part of the antibodies they produce are much smaller than those generated by most other animals, including humans.

Dr Ulrich Wernery, of the Central Veterinary Research Laboratory, carried out the Dubai part of the research Anna Nielsen / The National

Known as nanobodies, these smaller structures are derived from antibodies consisting solely of two heavy chains of amino acids, which are the building block for protein, while typically antibodies are made of two heavy chains and two light chains.

They also have some features typically found in broadly neutralising human antibodies, which are effective against several HIV strains.

Previous research had found that nanobodies show promise for battling other illnesses affecting people.

Dr Dietrich's laboratory provided the Dubai laboratory with spike-like proteins from the HIV "envelope", which is on the surface of the virus and responsible for its infectivity. These envelope proteins are exposed to the immune system and are the target of neutralising antibodies. The proteins were derived from HIV subtype C, the virus's most common form.

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At the laboratory, these envelope proteins were injected once a week for six weeks into four camels to stimulate an anti-HIV immune response. "The camel recognises it as a foreign body and wants to get rid of it and it produces antibodies," said Dr Ulrich Wernery, the scientific director of the laboratory, who carried out the Dubai part of the research.

Dr Wernery took blood samples from the camels and these were analysed by the researchers, who were interested in the type of nanobodies that had been produced.

More than two dozen nanobodies were identified by Dr Dietrich's group and tested against various subtypes of HIV.

When the actions of two nanobodies were added together, VHH-A6 and VHH-28, they were effective against 19 out of 21 strains of the most common and harmful type of HIV, known as HIV-1.

The other main type, HIV-2, is largely restricted to West Africa and is less potent in its ability to cause illness.

"I was expecting a certain breadth but I was surprised that the combination of our best two nanobodies neutralised 19 out of 21 HIV-1 strains of our standard virus panel, which includes the major HIV-1 subtypes in particular subtype C, which accounts for more than half of the infections worldwide," Dr Dietrich said.

One of the other researchers involved in the project is Dr Eric Geertsma, a junior professor at the Institute of Biochemistry at Goethe University Frankfurt. He described nanobodies as having "massive potency".

"There may be more need to optimise them and find better ways to improve this neutralisation capability, but it's a promising start," he said. Nanobodies, he explained, were also helpful in allowing researchers to study membrane proteins.

When it comes to preventing HIV infection, Dr Dietrich is now leading an effort to use the nanobodies to confer "passive immunity" to people. Passive immunity describes a situation in which antibodies are directly supplied to a person.

It contrasts with "active immunity", which happens when that person's body produces the antibodies itself when they have, for example, been immunised against a virus, usually by injecting them with components of that virus in a form that is incapable of producing illness.

In work being done in collaboration with researchers in Stockholm in Sweden and Cologne in Germany, Dr Dietrich and her co-researchers are genetically engineering probiotic bacteria to produce the camel nanobodies.

The small size of the nanobodies makes it easier to engineer bacteria to synthesise them.

The aim is to achieve a high-level of expression of HIV-neutralising nanobodies in the vagina for passive immunisation at the primary sites of sexual transmission of HIV-1.

Given the difficulties in developing an HIV vaccine so far, however, Dr Dietrich is careful not to make predictions about how long it might take before the camel nanobodies can be used in a clinical setting to protect people from HIV.

"When I started with HIV research in 1987, scientists said there would be an HIV vaccine in five to 10 years, meaning that 20 years ago we should already have had an HIV vaccine," she said. "Do we?"

But Dr Dietrich was "very optimistic" that the approach she and her co-researchers are following could lead to effective preventative measures.

If and when it does happen, nanobodies produced by camels at the laboratory in Dubai will have played a central role in the efforts.