UNL team explores new approach to HIV vaccine

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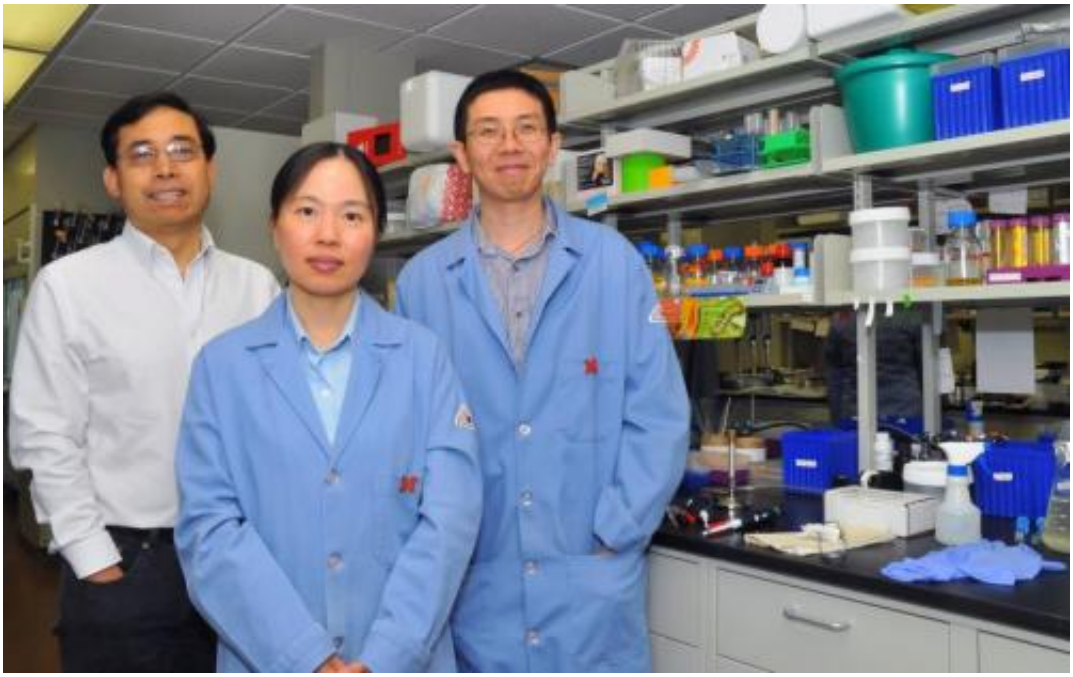

Qingsheng Li (left), Wei Niu and Jiantao Guo. Credit: Troy Fedderson/University Communications

Using a genetically modified form of the HIV virus, a team of University of Nebraska-Lincoln scientists has developed a promising new approach that could someday lead to a more effective HIV vaccine.

The team, led by chemist Jiantao Guo, virologist Qingsheng Li and synthetic biologist Wei Niu, has successfully tested the novel approach

for vaccine development in vitro and has published findings in the international edition of the German journal *Angewandte Chemie*.

With the new approach, the UNL team is able to use an attenuated—or weakened—HIV virus in the vaccine. The new method involves manipulating the virus' codons—a sequence of three nucleotides that form genetic code—to rely on an unnatural amino acid for proper protein translation, which allows it to replicate. Because this amino acid is foreign to the human body, the virus cannot continue to reproduce, Guo said.

Adaptive immunity is developed when the body's immune system develops antibodies that attack the virus. The virus is then shut off from replicating by removing the amino acid.

"Since the unnatural amino acid is not present in humans, the virus cannot further replicate and cause disease once a desirable protection is achieved," Guo said.

On June 1, they will begin the next phase of development through a four-year, $1.9 million grant from the National Institutes of Health and the National Institute of Allergy and Infectious Diseases. The grant will allow further research involving the genetically modified virus and lead to animal trials of the vaccine.

Since the HIV/AIDS pandemic began in the 1980s, an estimated 36 million people have died from the disease. Today, more than 35 million people live with the virus and 2.5 million new infections are recorded each year. No universal cure or vaccine exists, mainly because of the virus' persistent replication and evolution.

The most successful vaccination attempt in humans—a trial in Thailand in the middle of the last decade—had a roughly 31 percent efficacy rate.

But that vaccine used engineered versions of HIV genes and proteins, rather than the actual virus.

"The science tells us a live-attenuated vaccine would work best to stop the pandemic and possibly eradicate the disease," Li said. "But, using a live virus in a human trial has safety concerns."

Using an attenuated virus in a vaccine has not been accomplished before because HIV—even a weakened form of the virus—replicates rapidly, which allows it to evolve quickly and regain is virulence and disease-causing ability.

With the funds from the grant, Guo, assistant professor of chemistry, and Li, associate professor of biology, along with Niu, research assistant professor in chemistry, will perfect the technology and begin new trials.

The project is being completed with support from the UNL Department of Chemistry, School of Biological Sciences, Nebraska Center for Virology and Nebraska Research Initiative.

Provided by University of Nebraska-Lincoln