

# Using The Powers Of Viruses For Good

By [Olivier Uyttebrouck](#) / Journal Staff Writer on Sun, Oct 23, 2011

Viruses have long delivered diseases that kill – diseases such as plague, influenza, smallpox and HIV/AIDS.

But work by researchers at the University of New Mexico Cancer Center suggests they may become a powerful weapon in the battle against cancer, as well.

The unique cell-hunting ability of viruses could make them an ideal way to deliver drugs that kill cancerous cells without harming healthy cells nearby, says David Peabody, a UNM professor of molecular biology and an author of a recent article about the work.

“We’re essentially exploiting something that already exists in nature and engineering it for a different application,” he said in an interview last week.

In laboratory experiments, Peabody and others created virus-like particles that seek out cells causing liver cancer and deliver a three-drug cocktail directly into those cells.

Virus-like particles have the potential to deliver drugs with precision, avoiding dangerous and painful side effects for the patient, Peabody said.

“You might be able to make conventional chemotherapeutic agents more effective by making sure they go only to cells you wish to target for destruction,” he said.

“It’s kind of amazing,” Peabody said of the study’s results. “It surprised us that it worked as well as it did.”

The study, funded primarily by the National Institutes of Health, was published in a recent issue of the journal *ASCNano*. Researchers plan to begin animal studies next year, though the technology remains years away from practical application, Peabody said.

The researchers’ work makes use of the ability of viruses to find and infiltrate cells of a specific type.

A virus is a tiny bundle of genetic material surrounded by a protective shell.

Viruses can’t reproduce without help. They must find a host cell in which to insert the viral genes, essentially tricking the cell into producing many copies of the virus.

UNM researchers started with a virus called bacteriophage MS2, which targets *E. coli*, a bacteria that can be harmful to humans.

Researchers use genetic engineering techniques to make a replica of the virus that contains none of the genetic material found in the original MS2 virus.

In its place, they load the three-drug cocktail. One of the drugs in the cocktail is the toxic component of ricin – a substance deadly to cells.

“Now you have this particle that is essentially a delivery vehicle for whatever you put in it,” Peabody said. “We can make it enclose molecules of our choosing – drugs for example.”

The cocktail also contains doxorubicin, a decades-old drug used in cancer chemotherapy, and an “interfering RNA,” genetic material that damages a cell’s ability to reproduce.

Chemotherapy drugs are typically injected directly into a patient’s blood resulting in the death of healthy tissue.

Drugs aren’t all that researchers can load into virus-like particles. In some experiments, researchers added “imaging agents” that allowed scientists to track the particles using standard imaging techniques, he said.

The MS2 virus is a relatively simple virus.

The outer shell is composed of 180 copies of a single protein that “self-assemble” into tiny spherical particles, said Carlee Ashley, a post-doctoral fellow at Sandia National Laboratories and a co-author of the study.

Researchers can cover the protein shell with specialized proteins, called peptides, that bond with receptors on the surface of a cancerous cell, she said.

Ultimately, researchers want to build a “library” of virus-like particles, each with its own peptide sequence, that can bond to any kind of cancer, Ashley said.

Earlier this year, UNM researchers announced work on another type of nanoparticle for targeted drug delivery called “protocells,” which are composed of synthetic materials surrounded by a cell-like membrane. Like virus-like particles, they can be loaded with drug cargos for delivery to cancer cells.

UNM Cancer Center director Dr. Cheryl Willman, also an author of the study, said further research is needed to determine whether protocells or virus-like particles show the greatest promise as drug-delivery vehicles.

She said virus-like particles could also prove valuable as a type of vaccine against cancer. In fact, she thinks that may be where virus-like particles offer the best potential.

“I think this technology could be used to stimulate immune response against cancer cells,” Willman said Friday.

Because cancer cells closely resemble viruses, virus-like particles stimulate a strong immune response, which could hamper the particle’s ability to deliver drugs, she said. But that quality could make them ideal for strengthening the body’s defenses against cancer, she said.

Virus-like particles could display peptides that stimulate production of a type of white blood cell called T-cells, which play a role in fighting several types of cancer, she said. “My betting instinct is that (virus-like particles) may be more effective to stimulate an immune response, almost like a vaccine itself.”

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