



News Release

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Virus-Like Particle Shows Promise for Cancer Drug Delivery

UNM-Sandia researchers' new nanocarrier could yield safer, more effective cancer treatment

Albuquerque, NM – September 1, 2011 – Fresh from the success of the “protocell” – a nanoparticle capable of killing cancer cells with one million times the effectiveness of existing technology – UNM Cancer Center and Sandia National Laboratory scientists have developed another nanocarrier that could make cancer treatment safer and more effective.

This time, the tiny vehicle they’re using is a virus-like particle, or VLP. (How tiny? Just twenty-eight nanometers across – 28 billionths of a meter.) VLPs have the outer structure of a virus but do not contain any viral material and are non-infectious. Instead, these protein shells have been engineered to carry a mix of cancer-fighting drugs and selectively deliver their deadly cargo to cancer cells, bypassing healthy cells.

Unleashed against liver cancer cells in the laboratory, the VLPs created by the UNM-Sandia team wiped out virtually all malignant cells while sparing normal liver cells and other healthy cells. Although a few cancer-targeting VLPs have been developed and tested in laboratory settings before, this new VLP is more effective, and selective, than previous particles. The UNM Cancer Center and Sandia researchers believe their improved VLP could be the basis for a new drug delivery system targeting cancer and other diseases. Their research was published on the cover of the July 26 print edition of *ACS Nano*, a journal of the American Chemical Society dedicated to interdisciplinary nanoscience and nanotechnology research.

“We think VLPs have enormous potential,” said UNM Cancer Center researcher David Peabody, PhD, Professor of Molecular Genetics and Microbiology and a co-author of the paper. “While other types of nanocarriers have been the focus of research efforts over the past few decades, VLPs have gotten relatively little attention. But in fact, as our research shows, they are very well suited to selectively delivering drugs to cancer cells.”

“Conventionally administered chemotherapy drugs often have severe side effects for patients,” explained Carlee Ashley, PhD, Harry S. Truman Postdoctoral Fellow at Sandia National Laboratories and the paper’s lead author. “The toxicity of these drugs to healthy cells can limit the therapeutic dose to a level that is less than optimal for killing cancer cells. With VLPs, we’re able to both concentrate the dose and target the chemotherapy drugs and other anti-cancer agents specifically to cancer cells.”

The VLPs used in the UNM-Sandia team’s research are derived from a bacteriophage, or virus that targets bacteria. But they carry none of the infectious contents of a virus, retaining only the outer coat – the vessel into which the researchers loaded their lethal cargo of chemotherapy drugs, protein toxins, therapeutic RNAs and nanoparticles called quantum dots (used for imaging).

In order to deliver this cargo specifically to the liver cancer cells used in their experiments, the researchers modified the VLPs with peptides known to have an affinity for receptors clustered on the surface of liver cancer cells but absent from non-malignant cells. In the team’s VLP experiments, the targeting peptides enabled the VLP nanocarriers to hook into and enter the liver cancer cells; other peptides aided in the release of anti-cancer agents within the cells. Given the specificity of the peptide-receptor interaction, relatively few normal liver cells and other healthy cells types were affected.

The VLPs proved to be not just highly selective, but also highly efficient. The UNM-Sandia team found that, on average, a ratio of 2.5 VLPs to one cancer cell was sufficient to kill an entire population of liver cancer cells in the laboratory, with minimal impact on the viability of normal cells.

These results lay the groundwork for testing and refining the VLPs as targeted nanocarriers in further laboratory experiments, animal models and, eventually, human clinical trials. And the team’s success underscores the potential of VLPs as drug delivery vehicles for a range of cancers and other diseases.

Paper reference

“Cell-Specific Delivery of Diverse Cargos by Bacteriophage MS2 Virus-like Particle” was published in the July 26 print edition of *ACS Nano* (www.acsnano.org). Authors include Carlee E. Ashley (UNM, Sandia Labs), Eric C. Carnes (UNM), Genevieve K. Phillips (UNM Cancer Center), Paul N. Durfee (UNM), Mekensey D. Buley (University of Oklahoma), Christopher A. Lino (UNM), David P. Padilla (UNM), Brandy Phillips (UNM), Mark B. Carter (UNM), Cheryl L. Willman (UNM Cancer Center), C. Jeffrey Brinker (UNM Cancer Center, Sandia Labs), Jerri do Carmo Caldeira (UNM), Bryce Chackerian (UNM Cancer Center), Walker Wharton (UNM Cancer Center) and David S. Peabody (UNM Cancer Center).

VLPs and cancer drug delivery, cont.

About the UNM Cancer Center

The UNM Cancer Center is the Official Cancer Center of New Mexico and the only National Cancer Institute (NCI)-designated cancer center in the state. One of just 66 NCI-designated cancer centers nationwide, the UNM Cancer Center is recognized for its scientific excellence, contributions to cancer research and delivery of medical advances to patients and their families. It is home to 85 board-certified oncology physicians representing every cancer specialty and 127 research scientists hailing from leading institutions such as MD Anderson, Johns Hopkins and the Mayo Clinic. The UNM Cancer Center treats more than 65 percent of the adults and virtually all of the children in New Mexico affected by cancer, from every county in the state. In 2010, it provided care to more than 15,800 cancer patients. The Center's research programs are supported by nearly \$60 million annually in federal and private funding.

UNM Cancer Center contact information

Dorothy Hornbeck, JKPR, (505) 797-6673, dhornbeck@jameskorenchen.com

Audrey Manring, UNM Cancer Center, (505) 925-0486, amanring@salud.unm.edu

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