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## **UNM Research Looks at Cancer**

By Olivier Uyttebrouck

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Chemotherapy can save the lives of cancer patients, but side effects of the toxic drugs are too often painful and destructive.

Researchers at the University of New Mexico are developing a technique they say can deliver minute amounts of cancer-fighting drugs directly into a diseased cell without harming healthy tissue, sparing patients the worst effects of chemotherapy.

The delivery system uses a man-made nanoparticle, or "protocell," loaded with a potent drug cocktail that is released only after it burrows inside a cancerous cell.

UNM Cancer Center director Dr. Cheryl Willman described the protocell as "a little nuclear bomb" that can target specific cancer cells.

Ashley is lead author of an article published in the April 17 online edition of the journal *Nature Materials* that describes the technology.

Willman, a co-author, said she expects the National Cancer Institute-funded study to lead to human drug trials within five years.

She said protocells offer an attractive alternative to chemotherapy treatments, which fight cancer by infusing toxic chemicals in a patient's bloodstream, destroying all fast-growing cells.

"To cure a kid with leukemia today, we're giving them huge infusions of very high-dose drugs for years," Willman said. Chemotherapy can leave a child with devastating side effects, including sterility and mental disabilities.

UNM Cancer Center researchers recently began mouse studies that use protocells to target acute lymphoblastic leukemia, or ALL, a deadly childhood cancer diagnosed in about 5,000 U.S. children each year.

The technique has attracted enthusiastic interest from researchers investigating a broad range of cancers, Willman said.

"To have a stable protocell that could be targeted to a specific cancer type is very appealing to many, many people," she said. "So we are getting tons of calls."

Protocells build on the work of Sandia research and UNM professor Jeff Brinker, a co-author of the study, who has pioneered techniques for creating complex structures so small they can only be viewed with an electron microscope.

Proteocells consist of porous nanoparticles surrounded by a protective coating similar to the membrane that surrounds living cells, said Ashley, a Sandia post-doctoral fellow who graduated last year from UNM.

Proteocells mimic living cells and can drift harmlessly in the bloodstream for days seeking out cancerous cells, she said.

The proteocell is covered with agents that avoid healthy tissue and bond only with cancerous cells, where it releases its cargo of drugs, Ashley said.

The silica core is laced with pores that allow researchers to load it with a variety of cancer-killing drugs.

"We're really trying to engineer proteocells to be universal drug carriers," she said. "We can load really a limitless number of drugs."

The idea of making cell-like nanoparticles and using them to deliver drugs is not new. Scientists in the 1960s discovered they could make tiny containers called liposomes, which are water-filled sacks wrapped in a lipid bilayer similar to the membrane of a living cell.

The U.S. Food and Drug Administration has approved a variety of drugs for delivery by liposomes, including some anti-cancer drugs.

But the UNM study contends that proteocells are a million times more effective than liposomes at targeting and killing cancerous cells.

"Liposomes haven't worked well in cancer therapy, because they are very unstable when injected in the human body," Willman said. The watery core of the liposome breaks down eventually, releasing its toxic drugs into the bloodstream, resulting in the same harmful side effects as conventional chemotherapy, she said.

But the rigorous "silica cage" inside the proteocell keeps the drugs intact until they reach their target cell, and the stability makes the proteocell more effective than liposomes at targeting cancer cells, Ashley said.

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