# Nanoparticle 'smart bomb' targets drug delivery to cancer cells

February 12 2009

Researchers at North Carolina State University have successfully modified a common plant virus to deliver drugs only to specific cells inside the human body, without affecting surrounding tissue. These tiny "smart bombs" - each one thousands of times smaller than the width of a human hair - could lead to more effective chemotherapy treatments with greatly reduced, or even eliminated, side effects.

Drs. Stefan Franzen, professor of chemistry, and Steven Lommel, professor of plant pathology and genetics, collaborated on the project, utilizing the special properties of a fairly common and non-toxic plant virus as a means to convey drugs to the target cells.

The researchers say that the virus is appealing in both its ability to survive outside of a plant host and its built-in "cargo space" of 17 nanometers, which can be used to carry chemotherapy drugs directly to tumor cells. The researchers deploy the virus by attaching small proteins, called signal peptides, to its exterior that cause the virus to "seek out" particular cells, such as cancer cells. Those same signal peptides serve as "passwords" that allow the virus to enter the cancer cell, where it releases its cargo.

"We had tried a number of different nanoparticles as cell-targeting vectors," Franzen says. "The plant virus is superior in terms of stability, ease of manufacture, ability to target cells and ability to carry therapeutic cargo."

Calcium is the key to keeping the virus' cargo enclosed. When the virus is in the bloodstream, calcium is also abundant. Inside individual cells, however, calcium levels are much lower, which allows the virus to open, delivering the cancer drugs only to the targeted cells.

"Another factor that makes the virus unique is the toughness of its shell," Lommel says. "When the virus is in a closed state, nothing will leak out of the interior, and when it does open,
it opens slowly, which means that the virus has time to enter the cell nucleus before deploying its cargo, which increases the drug's efficacy."

The researchers believe that their method will alleviate the side effects of common chemotherapy treatments, while maximizing the effectiveness of the treatment.

Source: North Carolina State University