Scientists test nanoparticle 'alarm clock' to awaken immune systems put to sleep by cancer

July 25 2014

Researchers at Dartmouth-Hitchcock Norris Cotton Cancer Center are exploring ways to wake up the immune system so it recognizes and attacks invading cancer cells. Tumors protect themselves by tricking the immune system into accepting everything as normal, even while cancer cells are dividing and spreading.

One pioneering approach, discussed in a review article published this week in *WIREs Nanomedicine and Nanobiotechnology*, uses nanoparticles to jumpstart the body's ability to fight tumors. Nanoparticles are too small to imagine. One billion could fit on the head of a pin. This makes them stealthy enough to penetrate cancer cells with therapeutic agents such as antibodies, drugs, vaccine type viruses, or even metallic particles. Though small, nanoparticles can pack large payloads of a variety of agents that have different effects that activate and strengthen the body's immune system response against tumors.

There is an expanding array of nanoparticle types being developed and tested for cancer therapy. They are primarily being used to package and deliver the current generation of cancer cell killing drugs and progress is being made in that effort.

" Our lab's approach differs from most in that we use nanoparticles to stimulate the immune system to attack tumors and there are a variety of potential ways that can be done," said Steve Fiering, PhD, Norris Cotton

Cancer Center researcher and professor of Microbiology and Immunology, and of Genetics at the Geisel School of Medicine at Dartmouth. "Perhaps the most exciting potential of nanoparticles is that although very small, they can combine multiple therapeutic agents."

The immune therapy methods limit a tumor's ability to trick the immune system. It helps it to recognize the threat and equip it to effectively attack the tumor with more "soldier" cells. These approaches are still early in development in the laboratory or clinical trials.

"Now that efforts to stimulate anti-tumor immune responses are moving from the lab to the clinic, the potential for nanoparticles to be utilized to improve an immune-based therapy approach is attracting a lot of attention from both scientists and clinicians. And clinical usage does not appear too distant," said Fiering.

Fiering is testing the use of heat in combination with nanoparticles. An inactive metallic nanoparticle containing iron, silver, or gold is absorbed by a cancer cell. Then the nanoparticle is activated using magnetic energy, infrared light, or radio waves. The interaction creates heat that kills cancer cells. The heat, when precisely applied, can prompt the immune system to kill cancer cells that have not been heated. The key to this approach is minimizing healthy tissue damage while maximizing cancerous tumor destruction of the sort that improves recognition of the tumor by the immune system.

Fiering cautions that there is a great deal of research and many technical variables that should be explored to find the most effective ways to use nanoparticles to heat tumors and stimulate anti-tumor immunity.

According to Fiering, this approach is far from new, "The use of heat to treat cancer was first recorded by ancient Egyptians. But has reemerged with high tech modern systems as a contributor to the new paradigm of

fighting cancer with the patients' own immune system."

Provided by The Geisel School of Medicine at Dartmouth