Researchers use nanoparticles as destructive beacons to zap tumors

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A group of researchers from Wake Forest University Baptist Medical Center is developing a way to treat cancer by using lasers to light up tiny nanoparticles and destroy tumors with the ensuing heat.

Today at the 52nd Annual Meeting of the American Association of Physicists in Medicine (AAPM) in Philadelphia, they will describe the latest development for this technology: iron-containing Multi-Walled Carbon Nanotubes (MWCNTs) -- threads of hollow carbon that are 10 thousand times thinner than a human hair.

In laboratory experiments, the team showed that by using an MRI scanner, they could image these particles in living tissue, watch as they approached a tumor, zap them with a laser, and destroy the tumor in the process.

If this sounds like science fiction, it is not. The work builds on an experimental technique for treating cancer called laser-induced thermal therapy (LITT), which uses energy from lasers to heat and destroy tumors. LITT works by virtue of the fact that certain nanoparticles like MWCNTs can absorb the energy of a laser and then convert it into heat. If the nanoparticles are zapped while within a tumor, they will boil off the energy as heat and kill the cancerous cells.

The problem with LITT, however, is that while a tumor may be clearly visible in a medical scan, the particles are not. They cannot be tracked once injected, which could put a patient in danger if the nanoparticles were zapped away from the tumor because the aberrant heating could destroy healthy tissue.

Now the team from Wake Forest Baptist has shown for the first time that it is possible to make the particles visible in the MRI scanner to allow imaging and heating at the same time. By loading the MWCNT particles with iron, they become visible in an MRI scanner. Using tissue containing mouse tumors, they showed that these iron-containing MWCNT particles could destroy the tumors when hit with a laser.

"To find the exact location of the nanoparticle in the human body is very important to the treatment," says Xuanfeng Ding, M.S., who is presenting the work today in Philadelphia. "It is really exciting to watch the tumor labeled with the nanotubes begin to shrink after the treatment."

The results are part of Ding's ongoing Ph.D. thesis work -- a multi-disciplinary project led by Suzy Torti, Ph.D., professor of biochemistry at Wake Forest Baptist, and David Carroll, Ph.D., director of the Wake Forest University Center for Nanotechnology and Molecular Materials, that also includes the WFB Departments of Physics, Radiation Oncology, Cancer Biology, and Biochemistry.

A previous study by the same group showed that laser-induced thermal therapy using a closely-related nanoparticle actually increased the long-term survival of mice with tumors. The next step in this project is to see if the iron-loaded nanoparticles can do the same thing.

If the work proves successful, it may one day help people with cancer, though the technology would have to prove safe and effective in clinical trials.

Dan Bourland, Ph.D., associate professor of radiation oncology and

Ding's advisor, praises the high quality of Ding's work and says that the project is a strong example of today's "team science" that is needed for success in the biomedical fields.

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