Nanotechnology shows promise in cancer fight

By Julie Kirkwood and Ethan Forman
Staff Writers

Technology developed locally to repair armor on the battlefield may be used to win another war -- the war on cancer.

Triton BioSystems of Chelmsford has developed cancer-fighting beads -- each 80,000 times smaller than the tip of a hair strand -- that supposedly latch onto a tumor and kill it with the aid of a magnetic field, causing little if any side effects. The experimental procedure being developed to treat late-stage breast and prostate cancer has shown some positive results with mice, but could be years away from being tested on humans.

"We are confronting a disease that today in 2004 -- metastatic breast cancer -- that doesn't have a cure, and we hope this will contribute to the health and well-being of Massachusetts citizens and U.S. citizens," said Susan Braunhut, a biology professor at University of Massachusetts Lowell, which is partnering with Triton to develop the therapy.

Yesterday, Congressman Martin T. Meehan, D-Lowell, touted the "nanotechnology" at a press conference and announced $1 million in federal money would be spent to help develop it. He promised to find ways to infuse the project with more federal funds.

"The targeted nanotherapeutic process represents an effective, fast and easy-to-use treatment that could potentially save many, many lives across this country," said Meehan.

But experts say this "nanotechnology" is still experimental and has yet to produce significant results.

"Related things have been done before and they haven't worked that well," said Robert S. Langer, professor of biomedical engineering at Massachusetts Institute of Technology. "Cancer is just an incredibly tough disease. There are so many studies where mice have been treated and there's good results and it doesn't transfer to people."

The company is also cautiously optimistic. Triton and UMass Lowell don't plan to start clinical trials until 2005, meaning it will be several years before the treatment is available to patients, if at all.

Researchers explained how it works: Metallic beads 40 nanometers (40 billionths of a meter) in width are injected into a patient's bloodstream. The researchers are able to attach "guides" to the beads, called antibodies, that seek out and stick to the tumors.

"The antibody is like a stealth bomber," Braunhut said. "It finds its way through the bloodstream and sticks to the surface of the cell."

Once the tiny beads gather at the tumor, a doctor would turn on a magnetic beam that passes through the skin above the tumor site. The beads on the tumor surface would then convert that magnetic energy into heat. The temperature, which reaches 170 degrees, would kill the tumor cells. The beads, made of iron oxides, would dissolve in the body harmlessly within two to three weeks.

The breakthrough moment in the laboratory, Braunhut said, was when the researchers tested the beads on tumor cells in dishes. The tumor cells died. Normal cells subjected to the same process survived unharmed. After that, Braunhut said, "we pretty much knew it was going to work."

In subsequent experiments on mice, the bead-magnet procedure effectively shrank tumors, she said. The mice did not appear to experience any pain or side effects from the treatment. The researchers plan to publish those results later this year.

The therapy is actually a spinoff of a successful technology Triton BioSystems' parent company, Triton Systems, developed for the U.S. military to repair armor on the battlefield. Triton Systems' founders created Triton BioSystems in 2001 to apply the remote-heating technology to cancer treatment.

The five-employee company was seeded with $1.2 million and has raised $4 million for the research. It aims to raise $18 million more in the next round, said Samuel Straface, Triton BioSystems' chief executive officer.

This is not the first time researchers have tried such techniques.

Experiments with magnetic fields and therapeutic heat as a cancer treatment have been underway since the 1960s. The research gained new momentum about 10 years ago with the advent of nanotechnology. A team of scientists in Germany discovered that the small size of nanoscale metal beads allows them to heat up quickly at weak magnetic strengths that will not injure a patient.

Now companies worldwide are developing therapies based on the same concept. The German researchers at Humboldt University are trying to cure cancer with magnetic fields and nanoparticles in liquid suspensions.

Since hearing about Triton BioSystems' research, cancer patients have called and e-mailed Braunhut and Straface to support the research and ask to join clinical trials that are more than a year away, Braunhut said.

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