'Nanobubbles' kill cancer cells

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(PhysOrg.com) -- Using lasers and nanoparticles, scientists at Rice University have discovered a new technique for singling out individual diseased cells and destroying them with tiny explosions. The scientists used lasers to make "nanobubbles" by zapping gold nanoparticles inside cells. In tests on cancer cells, they found they could tune the lasers to create either small, bright bubbles that were visible but harmless or large bubbles that burst the cells.

"Single-cell targeting is one of the most touted advantages of nanomedicine, and our approach delivers on that promise with a localized effect inside an individual cell," said Rice physicist Dmitri Lapotko, the lead researcher on the project. "The idea is to spot and treat unhealthy cells early, before a disease progresses to the point of making people extremely ill."

The research is available online in the journal *Nanotechnology*.

Nanobubbles are created when gold nanoparticles are struck by short laser pulses. The short-lived bubbles are very bright and can be made smaller or larger by varying the power of the laser. Because they are visible under a microscope, nanobubbles can be used to either diagnose sick cells or to track the explosions that are destroying them.

In laboratory studies published last year, Lapotko and colleagues at the Laboratory for Laser Cytotechnologies at the A.V. Lykov Heat and Mass Transfer Institute in Minsk, Belarus, applied nanobubbles to arterial plaque. They found that they could blast right through the deposits that

block arteries.

"The bubbles work like a jackhammer," Lapotko said.

In the current study, Lapotko and Rice colleague Jason Hafner, associate professor of physics and astronomy and of chemistry, tested the approach on leukemia cells and cells from head and neck cancers. They attached antibodies to the nanoparticles so they would target only the cancer cells, and they found the technique was effective at locating and killing the cancer cells.

Lapotko said the nanobubble technology could be used for "theranostics," a single process that combines diagnosis and therapy. In addition, because the cell-bursting nanobubbles also show up on microscopes in real time, Lapotko said the technique can be use for post-therapeutic assessment, or what physicians often refer to as "guidance."

Hafner said, "The mechanical and optical properties of the bubbles offer unique advantages in localizing the biomedical applications to the individual cell level, or perhaps even to work within cells."

Provided by Rice University