Russian scientists teach ultrasound find and kill cancer cells

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A group of physicists and biologists from Russia under the supervision of Professor Viktor Timoshenko from the National Research Nuclear University MEPhI (Russia) has used silicone nanoparticles for highlighting and destroying cancer tumors with the help of the ultrasound, leaving healthy tissues unharmed. The study has been published in *Nanotechnology*.

"We have found a part-load mode for therapeutic treatment of cancer cells, which doesn't lead to massive explosion of cells but is largely reduced to the destruction of intracellular organs by nanoparticles," says Andrey Sviridov from the Lomonosov MSU. He says that covering the particles in a biopolymer doesn't worsen their acoustic properties, but leads to a better therapeutic effect.

Lately physicists, chemists, and nanotechnologists are developing new surgical and therapeutic methods that are conducted without body rupture and damaging of tissues and organs. For example, researchers have developed nanoparticles that are introduced into tumors and then heated with a laser. This destroys the cancer, but doesn't affect healthy cells. A similar effect is caused by gene therapy and special medicines, preventing the growth of vessels in tumors and starving cancer cells.

Sviridov and his colleagues have created special silicone nanoparticles, which can also be used for studying cancer tumors and their destruction via ultrasound.

The main problem of such methods of cancer treatment is that ultrasound and nanoparticles often act indiscriminately, destroying not only tumor, but also healthy cells. Moreover, such nanoparticles often too quickly dissolve inside the organism.

Timoshenko, Sviridov, and their colleagues have solved this problem, covering nanoparticles from porous silicone with a layer of dextran, a biopolymer from dextrose molecules. Such particles, the biologists claim, not only dissolve more slowly than their uncovered analogues, but shine under ultraviolet radiation, which allows their use to highlight researched tumors and cell samples.

The particles were via ultrasound separately and in the presence of nanoparticles on cancer cell cultures extracted from human larynx tumors.

As experiments have shown, "clear" ultrasound doesn't affect cancer cells, while its combination with nanoparticles kills them, destroying mitochondria and other organelles in cancer cells.

Apart from ultrasound strengthening, the nanoparticles can be used for delivery of medicines and other molecules inside healthy or cancer cells. Heating with the help of ultrasound or radio waves makes therapeutic molecules more mobile, which strengthens their efficiency. These techniques will need to pass a series of clinical tests on animals or volunteers over several years, and such experiments don't always end up positively.

More information: A P Sviridov et al. Cytotoxicity control of silicon nanoparticles by biopolymer coating and ultrasound irradiation for cancer theranostic applications, *Nanotechnology* (2017). DOI: 10.1088/1361-6528/aa5b7c

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