Scientists fight cancer with nanotechnology

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(PhysOrg.com) -- Nanotechnology researchers at the University of Arkansas at Little Rock have developed a method of detecting, tracking, and killing cancer cells in real time with carbon nanotubes.

The discovery opens the prospect of a new, major front in the fight to eradicate cancer with promise for a new generation of cancer treatment beyond surgery, radiation, and chemotherapy.

Dr. Alex Biris, University of Arkansas at Little Rock (UALR) chief scientist at the Nanotechnology Center and assistant professor of applied science in University's Donaghey College of Engineering and Information Technology, and Dr. Vladimir P. Zharov, professor and director of the Phillips Classic Laser and Nanomedicine Laboratories in the University of Arkansas for Medical Sciences (UAMS) Winthrop P. Rockefeller Cancer Institute, published their findings in the latest issue of the *Journal of Biomedical Optics*.

“Until now, nobody has been able to fully understand and study in vivo and in real time how these nanoparticles travel through a living system,” Biris said. “By using Raman spectroscopy, we showed that it is possible not only to monitor and detect nanomaterials moving through the circulation, but also to detect single cancer cells tagged with carbon nanotubes. In this way, we can measure their clearance rate and their biodistribution kinetics through the lymph and blood systems.”

Zharov emphasized that in vivo Raman flow cytometry is promising for the detection and identification of a broad spectrum of various

nanoparticles with strong Raman scattering properties, such as cells, bacteria, and even viruses.

“Before any clinical application of nanoparticles, it is imperative to determine their pharmacological profiles,” Zharov said. “And this tool will provide this function as a supplement or even an alternative to the existing methods.”

In their research, Biris, Zharov, and UAMS colleague Ekaterina Galanzha, M.D., injected a single human cancer cell containing carbon nanotube material in the tail vein of a test rat. They were able to follow the circulation of the carbon nanotubes in the blood vessels to the rat’s ear, tracking the cell through the rat’s blood stream, lymphatic system, and tissue with a Raman spectrometer.

In the same issue of the scientific journal, Biris and Zharov published a second paper discussing how nanoparticles can tag cancer cells. A laser then heats the nanoparticles, killing the cancer cell.

“If we are able to target cancer cells using these nanomaterials, we can monitor where the cancer cells are specifically located, and then we can kill them,” Biris said.

He said the live rat experiment shows how the cancer killing process leaves only a dead cell and nanoparticles that, within a matter of hours, disintegrate and die.

Dr. Mary Good, dean of UALR’s Donaghey College of Engineering and Information Technology, said the medical and economic ramifications of the discovery are significant.

“The research Dr. Biris and Dr. Zharov have conducted indeed is significant and promising,” said Good, former technology undersecretary

of Commerce in the Clinton administration. “It points to a whole new direction for medical applications for nanoparticles. There still is extensive time needed for research into the ultimate utility for these approaches and for human subject experiments. But this early work is exciting and provides long-term hope for more effective cancer treatments.”

Biris, 34, said the UALR Nanotechnology Center’s aim is to accelerate the development of commercial applications of nanotechnology and its potential to revolutionize medical advancements and the next generation of manufacturing of other products.

Provided by University of Arkansas at Little Rock