Researchers develop new dichloroacetate formulation for cancer treatment

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Shanta Dhar, right, and Sean Marrache

Health forums were abuzz in 2007 with news that a simple, inexpensive chemical may serve as a viable treatment to many forms of cancer. The drug dichloroacetate, or DCA, was touted as a cure-all, but after years of work, scientists are still searching for ways to make the unique treatment as effective as possible.

Now, researchers at the University of Georgia have discovered a new way to deliver this drug that may one day make it a viable treatment for numerous forms of cancer. They published their findings in the American Chemical Society's journal *ACS Chemical Biology*.

"DCA shows great promise as a potential cancer treatment, but the drug doesn't find and attack cancer cells very efficiently in the doses researchers are testing," said Shanta Dhar, an assistant professor of

chemistry in the UGA Franklin College of Arts and Sciences. "We have developed a new compound based on DCA that is three orders of magnitude more potent than standard treatments."

Every cell in the body needs energy to divide and grow, and most of them do this by breaking down sugar. When cells misbehave, they are normally deprived of their food and die in a process called apoptosis.

Cancerous cells, however, find a way around the natural order by discovering other sources of energy. Dhar's technology, which she calls Mito-DCA, destroys the cancer by focusing on a part of the cell called mitochondria, commonly known as the powerhouse of cells because they generate most of the cell's chemical energy.

"By targeting the mitochondria, we can force cancerous cells to die just as regular malfunctioning cells would," said Dhar, who is part of the UGA Cancer Center. "But the drug we have developed affects only cancerous cells, leaving normal cells undisturbed."

In their experiments, Dhar and her research team exposed cancer cells to Mito-DCA. The results showed that the engineered chemical substance was able to switch the glycolysis-based metabolism of cancer cells to glucose oxidation, meaning that the cancer cells can once again die via apoptosis.

Mito-DCA also suppressed the production of lactic acid in cancerous cells, which allows them to avoid detection by the body's immune system. With this cloaking device damaged, the body's own T-cells are better able to recognize tumors and eliminate them.

While the UGA researchers' model focused specifically on prostate cancer, Dhar is hopeful that their technique may prove useful for other forms of cancer.

"This is only the beginning of this project," she said. "We will continue to test Mito-DCA and find new avenues for treatment."

More information: The full paper is available online: pubs.acs.org/doi/ipdf/10.1021/cb400944y

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