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Breakthrough Cancer-Killing Treatment Has No Side Effects

Funding sought for human trials.

Story by Timothy Wall

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Fred Hawthorne's cancer therapy awaits funding for human trials. Photo by Shane Epping.

Each year in the United States, cancer kills more than 500,000 people, according to the Centers for Disease Control and Prevention. Decades of cancer research recently led to a breakthrough under University of Missouri Curators' Professor M. Frederick Hawthorne. Hawthorne's team has developed a new form of radiation therapy that put cancer into remission in mice. This innovative treatment produced none of the harmful side effects of conventional chemotherapy and radiation treatments. Clinical trials in humans could begin soon after Hawthorne secures funding to upgrade facilities.

"Since the 1930s, scientists have sought success with a cancer treatment known as boron neutron capture therapy (BNCT)," says Hawthorne, a recent winner of the National Medal of Science awarded by President Barack Obama at a White House ceremony Feb. 1, 2013. "Our team at MU's International Institute of Nano and Molecular Medicine finally found the way to make BNCT work by taking advantage of a cancer cell's biology with nanochemistry."

Compared to normal cells, cancer cells grow faster and absorb more materials. Hawthorne's team took advantage of that fact by getting cancer cells to absorb and store a boron chemical he designed. In a recent experiment with mice, Hawthorne exposed boron-infused tumors to neutrons. As predicted, the boron atom destroyed the cancer cells but spared neighboring healthy cells.

Boron's physical properties made Hawthorne's technique possible. A particular form of boron splits when it captures a neutron and releases lithium, helium and energy. Like pool balls careening around a billiards table, the helium and lithium atoms in the cancer cell destroy it from the inside without harming surrounding tissues.

"A wide variety of cancers can be attacked with our BNCT technique," Hawthorne says. "The technique worked excellently in mice. We are ready to move on to trials in larger animals, then people. However, before we can start treating humans, we will need to build suitable equipment and facilities. When it is

built, MU will have the first radiation therapy of this kind in the world."

Hawthorne, who came to MU from the University of California, Los Angeles in 2006, says his discovery was possible only at MU. "First, it is an example of a small number of universities in the United States with a large number of science and engineering disciplines on the same campus," Hawthorne says. "Second, the largest university research nuclear reactor is located at MU. Finally, it has strong, collegial biomedicine departments. This combination is unique."

In March, *The Proceedings of the National Academy of Science* published the study, entitled "Boron neutron capture therapy demonstrated in mice bearing EMT 6 tumors following selective delivery of boron by rationally designed liposomes."

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