

Researchers develop and test new molecule as a delivery vehicle to image and kill brain tumors

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A single compound with dual function – the ability to deliver a diagnostic and therapeutic agent – may one day be used to enhance the diagnosis, imaging and treatment of brain tumors, according to findings from Virginia Commonwealth University and Virginia Tech.

Glioblastomas are the most common and aggressive brain tumor in humans, with a high rate of relapse. These tumor cells often extend beyond the well-defined tumor margins making it extremely difficult for clinicians and radiologists to visualize with current imaging techniques. Researchers have been investigating enhanced methods of attacking these cells in order to possibly delay or prevent brain tumor relapse.

In a study published in the August issue of the journal *Radiology*, the research team led by Panos Fatouros, Ph.D., a former professor and chair of the Division of Radiation Physics and Biology in the VCU School of Medicine who retired in 2010, demonstrated that a nanoparticle containing an MRI diagnostic agent can effectively be imaged within the brain tumor and provide radiation therapy in an animal model.

The nanoparticle filled with gadolinium, a sensitive MRI contrast agent for imaging, and coupled with radioactive lutetium 177 to deliver brachytherapy, is known as a theranostic agent – a single compound capable of delivering simultaneously effective treatment and imaging.

The lutetium 177 is attached to the outside of the carbon cage of the nanoparticle.

"We believe the clustering properties of this nanoplatform prolong its retention within the tumor, thereby allowing a higher radiation dose to be delivered locally," said Michael Shultz, Ph.D., a research fellow in Fatouros' lab in the Department of Radiology in the VCU School of Medicine.

"This theranostic agent could potentially provide critical data about tumor response to therapy by means of longitudinal imaging without further contrast administration," said Fatouros.

A nanoparticle called a functionalized metallofullerene (fMF), also known as a "buckyball," served as the basis of this work and was created by study collaborator, Harry Dorn, Ph.D., a chemistry professor at Virginia Tech, and his team. In 1999, Dorn and his colleagues were able to encapsulate rare earth metals in the hollow interior of these nanoparticles that can easily be recognized by MRI techniques.

"Although this is a limited animal study, it shows great promise and hopefully this metallofullerene platform will be extended to humans," said Dorn.

Provided by Virginia Commonwealth University

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