Cobalt Nanoparticles Boost Imaging Sensitivity and Edge Detection

March 26 2009

(PhysOrg.com) -- Magnetic resonance imaging (MRI) can serve as a very sensitive technique for detecting small tumors in the body, but it is not as good at identifying the edges of a tumor. Photoacoustic imaging tomography (PAT) is not as sensitive as MRI, but it excels at pinpointing the location of subsurface tissue structures, presumably including the edges of tumors. To take advantage of the best of both of these imaging techniques, a team of investigators led by Fanqing Frank Chen, Ph.D., University of California, San Francisco, has developed a "nanowonton" of cobalt and gold to create an imaging contrast agent for use with both MRI and PAT.

Reporting its work in the *Proceedings of the National Academy of Sciences of the United States of America*, this team describes how it created the imaging agent by first preparing cobalt nanoparticles and then coating them with a uniform layer of gold. Cobalt nanoparticles are highly effective as MRI contrast enhancing agents, but by themselves, they are not suitable for use in humans. The gold layer not only makes the nanoparticles biocompatible but also adds PAT contrast enhancement as a particle characteristic. The investigators designed the gold coating to have a shape and thickness that maximizes the PAT response to a 700-nm imaging laser.

Imaging experiments with these nanowontons showed that they are detectable at low picomolar levels using MRI. This level of sensitivity would likely be sufficient to spot very small tumors in the body. Additional experiments confirmed that PAT was able to detect particle edges, which is where the PAT signal drops off dramatically. The investigators note that they are now experimenting with other nanoparticle shapes, particularly nanorods, with the goal of increasing MRI sensitivity. The researchers also note that with proper particle design, these hybrid nanomaterials also could serve as photothermal agents that could kill tumors by cooking them to death when energized by light.

This work, which is detailed in the paper "Picomolar sensitivity MRI and photoacoustic imaging of cobalt nanoparticles," was supported in part by the National Cancer Institute's Specialized Program of Research Excellence (SPORE). Investigators from the University of California, Los Angeles, Lahore University in Pakistan, Bruker Optics, University of Michigan, and the University of California, Berkeley, also participated in this study. An abstract of this paper is available at the journal's Web site.

Provided by National Cancer Institute