Tagging tumors with gold: Scientists use gold nanorods to flag brain tumors

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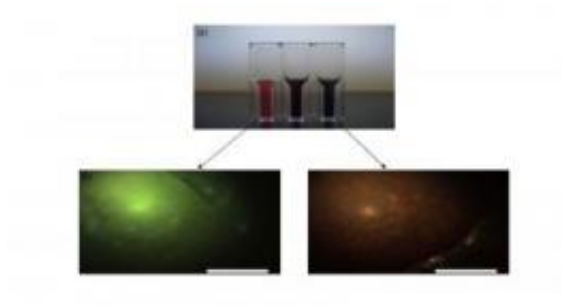

Gold nanoparticle solutions and corresponding phantom images. Top: (a) Three nanoparticle solutions of varying shape and size (left to right: gold nanospheres, short gold nanorods, long gold nanorods). Bottom: Darkfield images of brain-simulating phantoms containing (b) 60nm gold nanospheres and (c) gold nanorods. (Scale bar=50 μm) Credit: Kevin Seekell

"It's not brain surgery" is a phrase often uttered to dismiss a job's difficulty, but when the task actually is removing a brain tumor, even the slightest mistake could have serious health consequences. To help surgeons in such high-pressure situations, researchers from Prof. Adam Wax's team at Duke University's Fitzpatrick Institute for Photonics and Biomedical Engineering Department have proposed a way to harness the unique optical properties of gold nanoparticles to clearly distinguish a brain tumor from the healthy, and vital, tissue that surrounds it. The team will present their findings at the Optical Society's (OSA) Annual Meeting, Frontiers in Optics (FiO) 2011, taking place in San Jose, Calif.

next week.

Current techniques for outlining brain tumors vary, but all have limitations, such as the inability to perform real-time imaging without big, expensive equipment, or the toxicity and limited lifespan of certain labeling agents. Gold nanoparticles—which are so small that 500 of them end-to-end could fit across a human hair—might provide a better way to flag tumorous tissue, since they are non-toxic and relatively inexpensive to manufacture.

The Duke researchers synthesized gold, rod-shaped nanoparticles with varying length-to-width ratios. The different-sized particles displayed different optical properties, so by controlling the nanorods' growth the team could "tune" the particles to scatter a specific frequency of light. The researchers next joined the tuned particles to antibodies that bind to growth factor receptor proteins found in unusually high concentrations on the outside of cancer cells. When the antibodies latched on to cancer cells, the gold nanoparticles marked their presence.

The team tested the method by bathing slices of tumor-containing mouse brain in a solution of gold nanoparticles merged with antibodies. Shining the tuned frequency of light on the sample revealed bright points where the tumors lurked. The tunability of the gold nanoparticles is important, says team member Kevin Seekell, because it allows researchers to choose from a window of light frequencies that are not readily absorbed by biological tissue. It might also allow researchers to attach differently tuned nanoparticles to different antibodies, providing a way to diagnose different types of tumors based the specific surface proteins the cancer cells display. Future work by the team will also focus on developing a surgical probe that can image gold nanoparticles in a living brain, Seekell says.

More information: FiO presentation FWL4, "Controlled Synthesis of

Gold Nanorods and Application to Brain Tumor Delineation," by Kevin Seekell et al. is at 11:45 a.m. on Wednesday, Oct. 19.
http://www.frontiersinoptics.com/

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