Researchers decorate virus particles

June 14 2006

Researchers at New York University have made chemical modifications to nanometer sized virus particles--a process that has the potential to improve magnetic resonance imaging (MRI) techniques. Their results are reported in the latest issue of *Nano Letters*.

The study was conducted jointly by NYU's Department of Chemistry and the Department of Radiology at the NYU School of Medicine. The study is part of a collaborative discussion group between these departments called Molecular Imaging and Contrast Agents (MICA). Contrast agents are chemical compounds that enhance the ability of medical imaging techniques, such as MRI, to discriminate between different tissue types. MICA includes Chemistry Professor James Canary, radiologist Dr. Edwin Wang, and assistant chemistry professor Kent Kirshenbaum. Assistance for the study was provided by the University of New Mexico's Department of Molecular Genetics and Microbiology at its Health Sciences Center.

The protein coats of viruses provide an attractive platform for tailoring the physical properties and functions of molecular assemblies because they contain a large number of chemically reactive groups organized in a very precise array. Other researchers have recently sought to enhance MRI capabilities through the use of similar large molecular assemblies by increasing the size, and therefore signal, of MRI contrast agents. They have also tried to use this terrain to facilitate "multi-modality," in which a set of imaging probes, such as those for both MR and optical imaging, are integrated.

The NYU researchers were able to show the attachment of a large number of gadolinium chelates--the chemical compound used in MRI contrast agents --on the surface of the viral particles. This resulted in the generation of a very intense signal when Wang imaged their samples in a clinical MRI scanner.

"Our work validates some hypotheses in the field of Magnetic Resonance Imaging contrast agents," explained Kirshenbaum, the study's corresponding author. "Previous studies have predicted that as you increase the particle size of an MR contrast agent, you should see it become more effective--as the particle takes longer to tumble in solution, it should become more capable of influencing the response of neighboring water molecules. Our study provides evidence that this effect works. Since the signal that radiologists observe in MRI scans is generated primarily from water molecules within the body, we potentially have the ability to get better contrast and clearer images that can distinguish between different tissue types."

While Kirshenbaum cautioned that many obstacles remain in using this process to enhance MRI for clinical applications, he said the results point to the potential of enhancing specific MRI capabilities.

"If a radiologist wants to design a versatile probe that can be used in a variety of different imaging protocols, a chemically modified virus particle now appears to be an attractive option for this type of sophisticated application," he noted. "For example, if we can decorate the particles so that they are recognized by specific receptors on cell surfaces, we may be able to use MRI to image tumors much smaller than can currently be seen."

Source: New York University