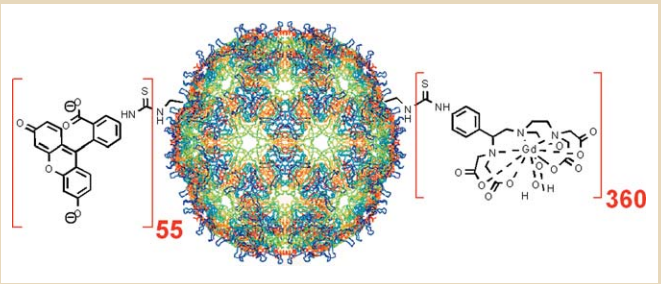
Researchers Decorate Virus Particles; May Enhance MRI Capabilities

Researchers at New York University (NYU) have made chemical modifications to nanometer-sized virus particles—a process that has the potential to improve 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.



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.

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 the signal, of MRI contrast agents. They also have tried to use this terrain to facilitate multimodality, in which a set of imaging probes, such as those for both magnetic resonance and optical imaging, are integrated.

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"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."

Although 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."

The study was funded by awards from the Alzheimer's Association and from the New York State Office of Science, Technology, and Academic Research. ■

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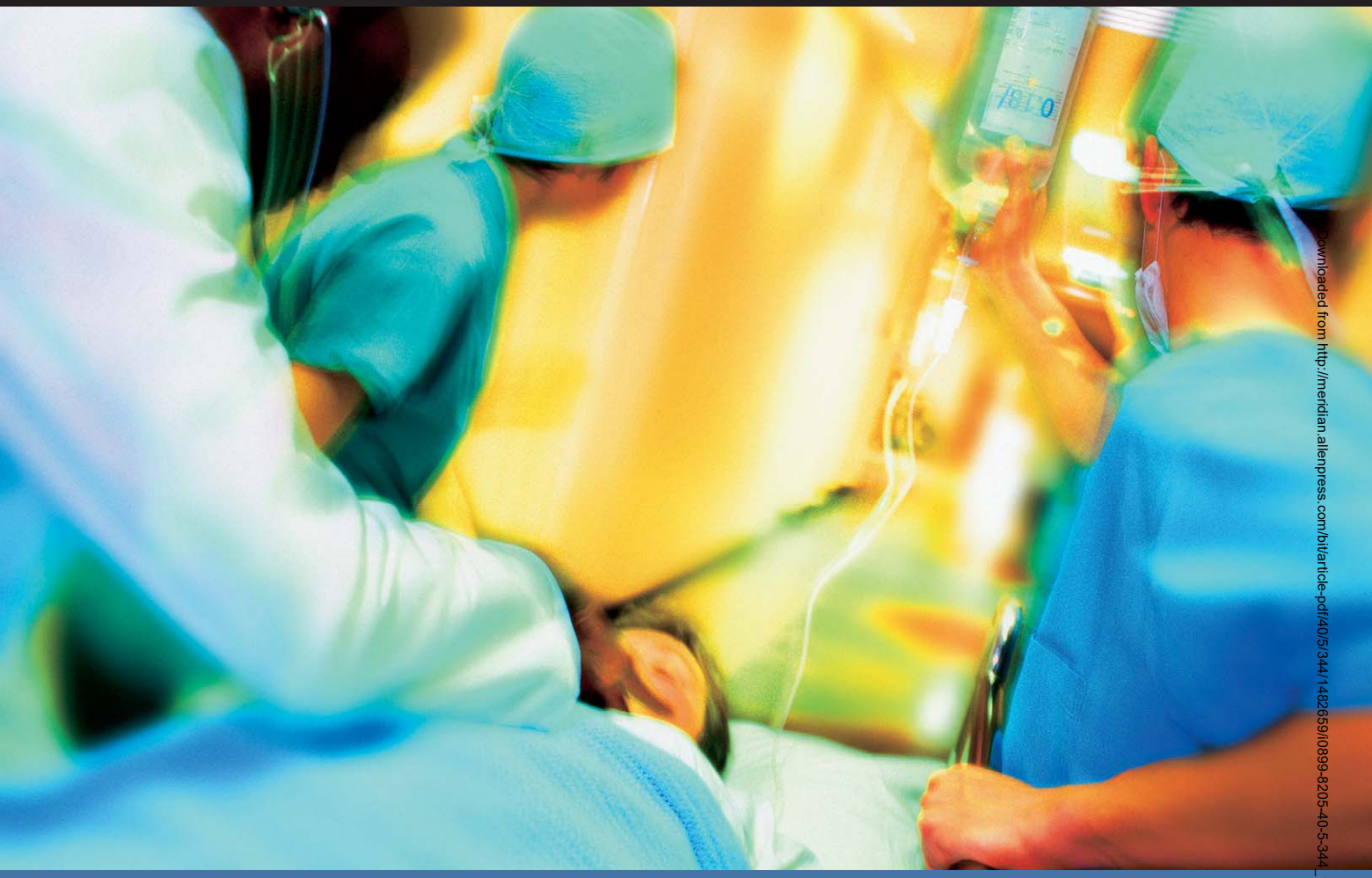

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New MRI Technique Offers Promise

A new cardiac MRI technique can noninvasively demonstrate blockage of the coronary arteries with high diagnostic accuracy, according to a study featured in a recent issue of *Radiology*.

Researchers at Massachusetts General Hospital (MGH) and Harvard Medical School in Boston, MA, and Beneficencia Portuguesa Hospital in São Paulo, Brazil, compared their new imaging technique against the current diagnostic standard, coronary angiography, which is an invasive procedure. The MRI findings yielded an accuracy of 88%.

"We have shown that cardiac MRI can be used reliably as an alternative to other more invasive detection techniques, due to its high diagnostic accuracy, its comprehensive evaluation of cardiac function, perfusion and viability and the lack of radiation exposure," said Ricardo C. Cury, MD, lead author and director of clinical cardiac MRI at MGH.

The authors applied a technique called *stress first-pass perfusion MRI* in combination with a delayed contrast-enhancement technique. This approach is different from the typical MRI sequences used to investigate the coronary arteries. With this combined technique, the researchers injected patients with a contrast material and then performed MRI at timed intervals to see if there was heart muscle ischemia attributable to coronary artery blockage and if there was damage (either tissue death or scarring) that indicated a prior heart attack.

In total, 46 patients with chest pain were enrolled in the study. All were scheduled to undergo coronary angiography. The patients were divided into two groups. The first group included 32 patients suspected of having Coronary Artery Disease (CAD), and the second included 14 patients with prior history of heart attack and suspected new arterial lesions. The MRI protocol included assessment of the left ventricle of the heart and blood flow during medicinally induced cardiac stress and rest and myocardial damage (delayed-enhancement technique). After MRI was completed, coronary angiography was performed for comparison.

Traditional angiography demonstrated significant CAD in 30 of 46 patients (65%). Of these 30 patients, MRI demonstrated CAD with an accuracy of 88%. In patients with only one diseased vessel, the accuracy of MRI increased to 96%. In patients who had previously undergone bypass graft surgery, the accuracy of MRI was 90%. ■