

Researchers devise method for enhancing CEST MRI

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Researchers at New York University and NYU Langone Medical Center have created a novel way to enhance MRI by reducing interference from large macromolecules that can often obscure images generated by current chemical exchange saturation transfer (CEST) methods.

Their work, which appears in the [Nature publishing group](#) journal *Scientific Reports*, has the potential to improve MRI for cartilage as well as for [brain tissue](#).

"We have found a way to eliminate signals of certain molecules and thereby clean up the image of parts of the body that could be used by medical professionals in order to make diagnoses," explained Alexej Jerschow, a professor in NYU's Department of Chemistry.

The study's other authors were: Ravinder Regatte, professor, Departments of Radiology and [Orthopedic Surgery](#), NYU Langone Medical Center; Prodromos Parasoglou, a post-doctoral research fellow, and Ding Xia, an assistant research scientist, at the Center for [Biomedical Imaging](#), Department of Radiology at NYU Langone Medical Center; and Jae-Seung Lee, an NIH research fellow, who holds appointments in NYU's Department of Chemistry and NYU Langone Medical Center.

The researchers' work aims to improve a decade-old method, chemical exchange, which has been used to enhance MRI techniques. Under this approach, scientists exploit the movement of atoms from their natural

molecular structure to water in the body in order to enhance their visibility.

However, these efforts have often been hindered by the presence of [macromolecules](#), which continue to obscure the smaller molecules that are of interest to doctors and other health-care professionals in making assessments. The macromolecules' interference is the result of two phenomena: their size and their frequencies.

Neutralizing the macro-molecular frequency interference was the focus of the NYU method reported in *Scientific Reports* recently.

Previously, Jerschow, Regatte, and colleagues created a non-invasive imaging technique for glycosaminoglycans (GAGs), which are molecules that serve as the building blocks of cartilage and are involved in numerous vital functions in the human body. Here, under chemical exchange, they separated out the GAG protons from those of water, creating an inherent contrast agent. Testing the idea in tissue samples, the researchers found that the available GAG protons provided an effective type of contrast enhancement, allowing them to readily monitor GAGs through a clinical MRI scanner.

In the *Scientific Reports* work, the researchers again focused on improving visibility of GAGs through MRI. But, in this effort, they sought to block the signaling impact of the macromolecules that obscure the observation of GAGs.

To do so, they took advantage of macromolecules' broad frequency spectrum—a trait that allows for easy detection and neutralization. Specifically, the researchers could, in effect, "bleach" the signal out by simultaneously using multiple irradiation frequencies. As a result, macromolecular interference diminished and enhanced the quantitative assessment of GAGs.

"This method gives us the opportunity to correct existing CEST methods by focusing on molecular signals of interest with much better precision than currently exists," explains Regatte.

Provided by New York University

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