Public release date: 11-Feb-2008

Contact: James Devitt
james.devitt@nyu.edu
212-998-6808
New York University

NYU, Tel Aviv University create non-invasive imaging method for diagnosing osteoarthritis

Researchers at New York University and Tel Aviv University have developed a non-invasive imaging method that can be used to diagnose and monitor a number of diseases, including osteoarthritis and inter-vertebral disc degeneration, in their early stages. Their work appears in the latest issue of the journal Proceedings of the National Academy of Sciences (PNAS).

The research team examined glycosaminogycans (GAGs), which are molecules that serve as the building blocks of cartilage and are involved in numerous vital functions in the human body. Mapping the GAG concentration in vivo, or in a living organism, is desirable for the diagnosis and monitoring of a number of diseases. It is also valuable in determining the efficacy of drug therapies. For instance, GAG loss in cartilage typically marks the onset of osteoarthritis and inter-vertebral disc degeneration.

However, the existing techniques for GAG monitoring based on traditional magnetic resonance imaging (MRI) have limitations: they cannot directly map GAG concentrations or they require the administration of contrast agents. The NYU-Tel Aviv research team sought a more direct measurement of GAGs. In this study, they employed the exchangeable protons of GAG to directly measure GAG concentration in vivo.

Knowing that GAG molecules have proton groups that are not tethered tightly, the researchers investigated whether proton exchange in GAGs could allow concentrations of the molecule to be measured by the MRI. By separating out the GAG protons from those of water, they can be used as a sort of 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. The in vivo application of this method showed that this technique can be readily implemented in a clinical setting.

This chemical exchange saturation method (gagCEST) not only could provide a non-invasive way to diagnose osteoarthritis in its very early stages, but could also help to indicate early

interventions for degenerative disc disease, which is responsible for lower back pain, and defects in heart valves and, potentially, the cornea.

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The research was conducted by NYU Chemistry Professor Alexej Jerschow, Professor Ravinder Regatte of the Department of Radiology at NYU's School of Medicine, Professor Gil Navon, Tel Aviv University, and Wen Ling, who holds appointments in the chemistry departments at NYU and Tel Aviv University.