



High-magnetic-field MRI brain studies of disease markers



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Funding Grants: G.S. Boebinger (NSF DMR-1157490, NSF DMR-1644779);

S.C Grant (UCGP, AHA 10GRNT3860040, NIH RO1-NS102395); L Frydman (ISF/NSFC 2508/17, ERC-2016-PoC #751106)

The scientific utility of magnetic resonance imaging (MRI) is enhanced by contrast mechanisms. In the contrast mechanism known as chemical exchange saturation transfer (CEST), water-exchangeable protons are labeled with a radio frequency pulse which then, through an exchange mechanism, alter the main water signal used for generating neurological MRI images. When measured at 21.1T, CEST relaxation mechanisms show promise to open up untapped contrasting possibilities. This study explores this potential contrast in two neurological diseases, stroke and brain tumor.

Fast spin-echo images weighted by CEST contrast were collected on rats at 21.1 T, focusing on models of ischemic stroke and grafted glioma cells that were followed over time as they developed into brain glioma tumors.

An intense CEST contrast was observed on rat glioma tissues, considerably larger than hitherto observed at lower fields. However, CEST contrasts did not reach statistical significance in the experiments on stroke.

This study shows that CEST at 21.1T could reveal new biomarkers for observing brain tumors.

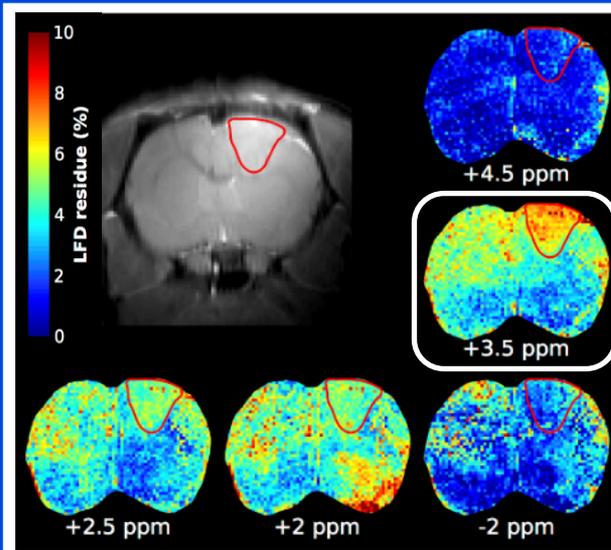


Figure 1: Quantitative chemical exchange saturation transfer (CEST) signals obtained on a rat brain with a tumor (red circled region). Notice the strong positive contrast appearing at +3.5 ppm (red circled region) for the tumorous tissue. This contrast shows promise for use as a biomarker for cancer detection.

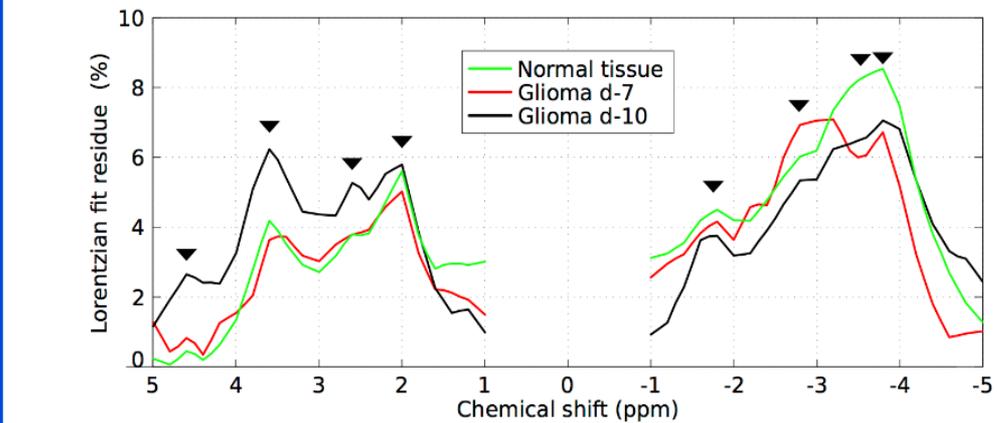


Figure 2: CEST spectra in which the black arrows indicate multiple spectral changes arising from glioma. The vertical scale denotes % with respect to the maximum water signal.

Facilities and instrumentation used: 21 T Ultra-wide-bore Magnet in the NMR/MRI User Facility

Citation: T. Roussel, J.T. Rosenberg, S.C. Grant, L. Frydman. *Brain investigations of rodent disease models by chemical exchange saturation transfer at 21.1 T.* **NMR in Biomedicine** 31, 11, e3995 (2018). DOI: <http://doi.org/10.1002/nbm.3995>