Siemens Competition
Math : Science : Technology
Regional Finalist

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Mentor: Dr. Andre Martins
Project Title: *Imaging Diamagnetic L-Lactate with Paramagnetic CEST Agents by MRI* (Biochemistry)

Contrast agents can be used in Magnetic Resonance Imaging (MRI) for signal contrast enhancement of diseased tissues. Chemical Exchange Saturation Transfer (CEST) is a mechanism largely explored by new paraCEST applications involving paramagnetic lanthanide complexes that can be responsive to pH, temperature, and metabolite concentrations. L-Lactate is a very reliable tumor marker that, as a diamagnetic molecule, possesses an extremely small NMR CEST chemical shift; therefore, it is difficult to image selectively. Our findings show that the addition of lanthanide complexes such as Eu(III)-EDTA and Eu(III)-DO3A shifts the CEST signal of the hydroxyl proton in L-lactate downfield substantially enough to be used to assess lactate concentration. In addition, we reveal the innovative way in which Eu(III)-DO3A emits a visible CEST signal, from the bound water molecule(s), that is only present when L-lactate has been added. These results provide the framework for diagnosing and mapping tumor growth by imaging lactate concentrations in tissues using MRI.