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Leveraging hyperpolarized spin states to visualize biochemical processes

Kayvan R. Keshari

Memorial Sloan Kettering Cancer Center

Abstract

Transformation has been shown to have a dramatic impact on the metabolic state of the cell. Recent reports have demonstrated that specific alterations in oncogenes and signaling pathways results in increases in pathway flux as well as diversion of substrates. Moreover, there is an argument that changes in metabolism can directly affect cell fate and thus promote oncogenesis or neurodegeneration. Interrogation of key metabolic pathways in relevant systems has been hindered though by a lack of technologies capable of monitoring metabolism non-invasively in multicellular systems to humans. Recent work has applied quantum approaches to overcome the sensitivity limitations of nuclear magnetic resonance. Through hyperpolarization of NMR active spins in metabolic substrates, one can transiently overcome the limited sensitivity of NMR and MRI for detecting biochemical processes, revealing real time biochemical transformations. This talk will focus on the use of this approach, in conjunction with isotope tracing, to mechanistically interrogate biochemical flux through multiple pathways in living systems.