Award ID:
RP180716

Project Title:
Noninvasive Diagnostic Imaging of Brain Cancer Using Hyperpolarized 13C-Labeled L-Tryptophan and L-Methionine

Award Mechanism:
High Impact/High Risk

Principal Investigator:
Lumata, Lloyd

Entity:
The University of Texas at Dallas

Lay Summary:

Glioblastoma multiforme (GBM) is a highly aggressive and mostly chemoresistant form of brain cancer with very dismal chance of survival. Early and diagnostically accurate detection of glioblastoma is thus of the utmost importance. Recent studies revealed that GBMs have a particular high addiction to consume two essential amino acids, methionine and tryptophan. This study proposes to capitalize on this GBM addiction by turning the abnormal metabolism of these two key amino acids in GBM into its diagnostic Achilles' heel using hyperpolarization technology. Hyperpolarization can enhance the magnetic resonance imaging (MRI) signals of biomolecules such as the amino acids by >10,000-fold. Since GBMs exhibit high consumption of methionine and tryptophan, it is expected that hyperpolarized MRI will have the sensitivity to non-invasively map out the high uptake of these two amino acids in brain tumors. Furthermore, hyperpolarized MRI has the specificity to potentially image the expected overproduction of the metabolic products of methionine and tryptophan metabolites (S-adenosyl methionine and kynurenine, respectively) in GBMs. The primary innovation of this project is that hyperpolarized 13C MRI is by far the only non-invasive technique that has the combined high specificity and superb sensitivity to potentially map out not only the high uptake of tryptophan and methionine in brain cancer, but also the bio-distribution of their resulting metabolites in vivo in real-time. No other current technology has this capability to potentially accomplish a feat of tracking tryptophan and methionine metabolism at the molecular level. This project could potentially provide the much-needed non-invasive diagnostic imaging of brain cancer without the highly ionizing X-ray radiation of CT scans, the radioactivity of PET tracers, or the pain and danger of intracranial biopsy.