CANCER PREVENTION & RESEARCH INSTITUTE OF TEXAS

Award ID:
RP180873

Project Title:
Molecular Targeted Magnetic Resonance Reporter for Cancer Detection

Award Mechanism:
High Impact/High Risk

Principal Investigator:
Carson, Daniel

Entity:
Rice University

Lay Summary:

Colorectal cancer (CRC) is the 2nd leading cause of cancer-related deaths in Texas. Early diagnosis is central to cancer care. Often only tumors greater than 5mm can be imaged using existing technologies, limiting the ability of early diagnosis. Our proposed constructs, "MR Reporters," will significantly increase the sensitivity of detecting cancer by utilizing several amplification steps and combining the versatile binding affinity of antibodies with the sensitivity of hyperpolarized Magnetic Resonance (MR). Antibodies have high-affinity and specificity to their protein targets and several are approved for cancer treatment. MR Reporters utilize antibody based molecular targeting and leverage >10,000 fold sensitivity enhancement by a novel MR technique called hyperpolarization to create a highly sensitive early detection method for cancer and enabling real-time detection of metabolism. In a MR Reporter, an antibody is attached to a protein that catalyzes the conversion of hyperpolarized small molecules; therefore, metabolites of the hyperpolarized compounds are only observed in the presence of the reporter. We are attaching a plant based protein to the N-terminus of an antibody that recognizes human mucin protein (MUC1). MUC1 protein positively correlates with tumor proliferation, invasiveness, and metastasis in CRC. Our proposed MUC1 antibody specifically recognizes a large section of MUC1. We will therefore, create a high affinity MUC1 targeted MR Reporter, evaluate its ability to detect CRC in animal models and determine if our MR Reporter can be combined with gold nanoparticles for therapeutics. The MR Reporters will enhance signal amplitude through multiple MUC1 antibodies binding to one MUC1 protein, catalytic amplification of the signal and enhancement through the use of hyperpolarization. This methodology will significantly increase the sensitivity of targeted molecular imaging in MR and can be extended to other cancers.