CANCER PREVENTION & RESEARCH INSTITUTE OF TEXAS

Award ID:
RP150701

Project Title:
Non-invasive Colonoscopy by Molecular Imaging of Mucin Targeted Hyperpolarized Silicon Nanoparticles

Award Mechanism:
High Impact/High Risk

Principal Investigator:
Carson, Daniel D

Entity:
Rice University

Lay Summary:

A non-invasive, high-definition colonoscopy would benefit diagnosis of colon cancer. Conventional colonoscopy can damage the gut and is often limited by patient tolerance. Virtual colonoscopy, which employs computed tomography or magnetic resonance (MR) scans, is non-invasive, but is limited by radiation exposure, and it cannot detect lesions smaller than 5 mm. The. Bhattacharya laboratory at M. D. Anderson Cancer Center has developed a direct in vivo imaging modality of hyperpolarized silicon nanoparticles (SiNPs) using MR Imaging. Using hyperpolarization, the sensitivity of the conventional MR signal is enhanced over 10,000X. Unlike other hyperpolarized nuclei, the signal from SiNPs is long-lived (<50 min), thereby allowing a longer than normal time window for biomedical imaging. In parallel, the Carson laboratory at Rice University has developed nanoparticle based approaches for sensitively detecting the very large, highly accessible transmembrane mucin glycoproteins overexpressed by many cancers. Together, this team will develop mucin-targeted SiNPS that will detect mucin- overexpressing colon cancer cells. Real-time targeting will be imaged on MRI scanners by the enhanced long-lived hyperpolarized signal from the SiNPs in mouse models expressing mucin glycoproteins. The advantages of hyperpolarized silicon imaging in the clinic are that (a) it is non-invasive, non-toxic, and non-radioactive; (b) the technique can be utilized by the widely available MRI scanner; and (c) it provides rapid feedback for decision-making related to patient selection, disease staging, and treatment monitoring. An early detection system for colon cancer with specific and well calibrated biomarker(s) similar to that of colonoscopy for “at risk” populations will greatly improve the prognosis of colon cancer. In addition, this same imaging platform can extend to other mucin over-expressing cancers including those of lung, ovarian and pancreatic cancers.