



Application for QIBA Project Funding

<b>Title of Proposal:</b> Dynamic Susceptibility Contrast MRI Phantom		
QIBA Committee/Subgroup: PDF/DSC Taskforce		
NIBIB Task Number(s) which this project addresses:		
<b>PI (Project Coordinator or Lead Investigator Information)</b>		
Last Name: Wu	First Name: Ona	Degree(s): PhD
e-mail:		Tel #:
Institution/Company: Massachusetts General Hospital (MGH)		
Total Amount Requested:		

**Project Description**

Dynamic Susceptibility Contrast (DSC) MRI is routinely used in the clinics to image brain tumors. It has been hypothesized that changes in relative cerebral blood volume (rCBV) can be used as a biomarker to evaluate the efficacy of novel anti-tumor treatments. Differences in measured rCBV values over time may be due to both physiological and non-physiological factors, and therefore non-physiological variations need to be measured and limited. For multi-center clinical trials, stability of image acquisition across centers, vendors and time will be critical. We propose to design and to prototype a DSC phantom, and to perform phantom studies to evaluate the temporal and spatial stability of a DSC phantom using a “generic” acquisition protocol across multiple centers to assess reproducibility of these measurements. This information can then be used to provide estimates of bias and reproducibility that can be used to expedite the development of a DSC Profile. The phantom and protocols can ultimately be used for site qualification in multicenter clinical trials and for quality control in routine clinical practice.

This proposal is timely since DSC, and in particular rCBV, has already been shown to be a prognostic marker for overall survival in a recent trial of bevacizumab in GBM patients involving 21 patients and 5 sites. The results are encouraging but lacking some confidence until an appropriate DSC phantom is available to assess reproducibility of these measurements. To make such studies feasible on a larger scale involving more sites while maintaining high quality, a DSC phantom will be important. In addition, if DSC is to be used routinely in the clinics either to triage patients or to monitor treatment effects of antiangiogenic drugs, a phantom such as we propose will be essential for quality control. We will work with the different vendors to create a generic acquisition protocol. To perform the multicenter reproducibility study, we will scan the two prototype phantoms at 5 centers at two time-points one-week apart.

Co-investigators will include Ona Wu PhD (Massachusetts General Hospital), Bradley Erickson MD, PhD (Mayo Clinic); Matthias van Osch, PhD (Leiden University Medical Center); John Kirsch, PhD (Siemens); Karl Stupic, PhD (NIST); and Kathryn Keenan, PhD (NIST).

## **Primary Goals and Objectives**

Our primary goal is to develop a prototype DSC phantom from which a gradient of susceptibility values can be measured. We will work closely with NIST, building upon experience gained from existing NIST phantoms such as the DWI and DCE phantoms. NIST already has a Nano-Iron Phantom in development using iron oxide nano-agents in gels. Our secondary goal will be to create generic acquisition protocols by which we can assess the contrast-to-noise of the susceptibility measurements as well as stability across time across multiple vendors. Our third goal will be to estimate reproducibility and feasibility of performing these measurements across multiple centers (5 sites) at multiple time points (one-week apart). Prototype phantoms will be shipped to participating sites and data will be analyzed