



Application for QIBA Round-2 Project Funding

Title of Proposal: Validation of Breath Hold Task for Assessment of Cerebrovascular Responsiveness and Calibration of Language Activation Maps to Optimize Reproducibility.		
QIBA Committee/Subgroup: fMRI		
NIBIB Task Number(s) which this project addresses: 1,3,6,7,9		
Project Coordinator or Lead Investigator Information:		
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Institution/Company: Johns Hopkins Univ. School of Medicine		
Amount Requested:		

Project Description

Assessment of the integrity of cerebral vascular responsiveness (CVR) is a critical problem in clinical applications of fMRI brain mapping, and must be addressed in any attempt to quantitate fMRI results in patients. Neurovascular uncoupling (NVU) associated with brain tumors and other brain diseases may result in regional variations in CVR that affect the ability to generate a BOLD signal and thereby reliably and reproducibly localize eloquent cortex during presurgical mapping. Multiple studies have demonstrated that a breath-hold (BH) hypercapnia task is a reliable tool for assessing CVR and normalizing BOLD response among different subjects, different brain regions and various features of the scanning environment. In this project we plan to 1) validate use of a BH task for mapping of brain CVR and 2) use such maps to calibrate language task-based BOLD activation maps in order to both reduce intersubject variability and increase intrasubject reproducibility across scan sessions.

For the first objective, we will compare BH CVR maps with T2* DSC MR perfusion imaging maps using quantitative region of interest analysis to assess concordance of regions of decreased CVR with regions of abnormal perfusion in a cohort of 10 brain tumor patients. For the second objective, we plan to apply the normalization/calibration technique described by Thomason et al. (2007) to an existing dataset of approximately 10 normal right-handed native English speaking subjects who performed two BOLD language tasks--silent word generation and sentence completion--in addition to a breath hold (BH) task, as well as to a cohort of a similar number of brain tumor patients who performed similar tasks. Furthermore, for the patient cohort, analysis of multiple runs of the same language activation paradigms will assess intrasubject BOLD activation variability utilizing CVR-calibrated activation maps. The results of this study will help fill the high priority gaps of evaluation of neurovascular responsiveness, reproducibility and protocol optimization, defined by the QIBA fMRI subcommittee, and address NIBIB Tasks 1, 3, 6, 7, and 9 in the context of fMRI as a biomarker of brain function/dysfunction.