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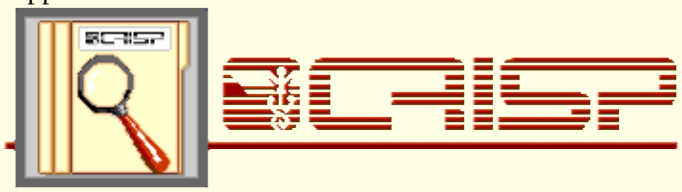

Abstract

Grant Number:	1R01MH059934−01A1
PI Name:	DETRE, JOHN A.
PI Title:	ASSISTANT PROFESSOR OF NEUROLOGY
Project Title:	PHYSIOLOGY & PATHOPHYSIOLOGY OF ACTIVATION FLOW COUPLING

Abstract: DESCRIPTION: (Adapted from the Investigator's Abstract) A fundamental aspect of brain physiology is the coupling between regional neuronal activation and changes in regional cerebral blood flow (CBF), herein referred to as activation−flow coupling (AFC). This coupling is the basis of many functional neuroimaging techniques that detect regional brain activation in response to specific sensorimotor or cognitive tasks by utilizing changes in regional CBF as a surrogate marker for neuronal activation. However, neither the specific mechanisms underlying AFC nor the effects of pathophysiological changes or the influences of vasoactive drugs on AFC have been well characterized. Neuroimaging techniques such as functional MRI (fMRI) can monitor changes in regional hemodynamics with high spatial and temporal resolution. Activation paradigms may be administered singly, periodically, or in blocks, yet the hemodynamic consequences of these differing experimental designs are largely unknown. Further, as neuroimaging studies are extended to patient populations for diagnostic purposes, the effects of pathophysiological changes on AFC responses must be better understood to allow results of such studies to be correctly interpreted. The proposed research is motivated by the goal of better understanding factors influencing AFC responses and neuroimaging techniques which rely on AFC as a surrogate marker of neural activity. Signal averaged laser Doppler monitoring will be used to measure AFC responses in a rat model of AFC, with CBF changes recorded from somatosensory cortex in response to electrical forepaw stimulation. The applicant will also monitor tissue oxygenation changes by in vivo phosphorescence quenching to characterize changes in oxygen utilization in relation to blood flow and will monitor somatosensory evoked responses elicited by stimulation as a measure of neural activity. A laser Doppler−imaging system will also be implemented to investigate spatial aspects of AFC. These studies will provide further insight into the parameters affecting the AFC. A computerized 'virtual instrument' allows stimulus and recording parameters to be flexibly controlled. Specific aims of the proposed research include characterization of the stimulus timing effects on the AFC response, characterizing oxygenation changes; characterizing the interactions between AFC and vasomotion oscillations; and the effects of hemodynamic impairment on the AFC response. These studies will provide further insight into the parameters affecting the AFC response, and will suggest approaches for optimizing and interpreting functional imaging data.

Thesaurus Terms:
biological signal transduction, brain circulation, brain scanning, evoked potential, pathologic process, somesthetic sensory cortex, vasomotion

biological model, brain electrical activity, carotid artery, hemodynamics, nitric oxide synthase, oscillatory blood flow, oxidoreductase inhibitor, oxygen consumption, phosphorescence, respiratory oxygenation, stimulus interval
bioimaging /biomedical imaging, laboratory rat, laser, ultrasound blood flow measurement

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