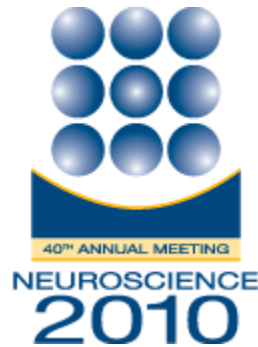


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### Presentation Abstract

Program#/Poster#: 192.7/FFF11

Title: Two-photon microscopic measurement of distribution and cerebral metabolic rate of oxygen in cortical tissue

Location: Halls B-H

Presentation Time: Sunday, Nov 14, 2010, 10:00 AM -11:00 AM

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Abstract: The ability to measure oxygen partial pressure ( $pO_2$ ) with high temporal and spatial resolution in three dimensions is crucial for understanding oxygen delivery and consumption in normal and diseased brain. Until now, the lack of technologies for direct 3D mapping of oxygen availability in the brain has been a major limiting factor in investigations of oxygen metabolism. This limitation was overcome by recent development of the two-photon-enhanced phosphorescent nanoprobe, which allows for direct high-resolution mapping of cortical tissue and intravascular  $pO_2$ .

We applied this new technology to obtain for the first time extensive  $pO_2$  maps in rat's cortical tissue. Measurement through a sealed cranial window reveals steep  $pO_2$  gradients around both pial and descending arterioles. In contrast,  $pO_2$  maps around ascending venules and capillaries indicate significant heterogeneity of the tissue oxygen concentration in venous and capillary compartments. Most importantly, high density tissue  $pO_2$  maps

allow for the first time calculation of the cerebral metabolic rate of oxygen (CMRO<sub>2</sub>) based on tissue pO<sub>2</sub> gradients with unprecedented spatial resolution. The calculation was performed using pO<sub>2</sub> gradients around arterioles based on the Krogh's model.

The developed methodology enables high-resolution depth resolved mapping of cortical tissue pO<sub>2</sub> and assessment of CMRO<sub>2</sub> that will provide critical insight into the metabolism and function of the normal brain as well as into various neurological conditions and stroke. Furthermore, this methodology can be directly applied in other areas, such as cancer and heart failure, where accurate non-invasive determination of pO<sub>2</sub> is the key to understanding physiological function. The synergism of two-photon phosphorescent measurements of pO<sub>2</sub> with other two-photon microscopy tools for imaging of neuronal, vascular and metabolic activity opens the door to a more integrative approach for addressing critical questions regarding the order of pathological events in the progression of disease and promises to provide an objective way for screening of potential therapies

Disclosures: **S. Sakadzic**, None; **D.A. Boas**, None; **A. Devor**, None; **M.A. Yaseen**, None; **E. Roussakis**, None; **V.J. Srinivasan**, None; **S.A. Vinogradov**, None.

Keyword(s): oxygen  
phosphorescence  
life time imaging

Support: R01NS057476  
P50NS010828  
R01EB007279  
R01HL081273  
R21EB009118

[Authors]. [Abstract Title]. Program No. XXX.XX. 2010 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2010. Online.

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