The hemodynamic response and neurovascular coupling: From sources to measures to models.

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The hemodynamic response function and its measurements are the basis of the broad majority of functional brain imaging applications in humans. As MRI hardware and sequences are improving at breathtaking speed, high resolutions in space and time are becoming more and more feasible. Exploiting these new measurement techniques calls for a better understanding of neurovascular coupling and the hemodynamic response function. Despite a decade of intense debate, the neuronal substrates of underlying the origin of the BOLD signal is still elusive, with major questions centred around the temporal and spatial properties or the oxygen metabolism remain unclear. Here we present four current approaches using cutting edge imaging techniques to measure and model neurovascular coupling and the hemodynamic response function. We will discuss variations in the above-mentioned time courses for a variety of situations, and highlight applications derived from the current state of understanding.

Learning Objectives:

1. Evaluate current concepts of neurovascular coupling and its consequence for functional brain imaging.
2. Discuss the effects of brain states on BOLD measurements.
3. Explain current models of the hemondynamic response.

Are blood flow and oxygen metabolism driven by different aspects of neural activity?
Richard Buxton, University of California, San Diego, CA , United States

Abnormal physiological parameters underlying neurovascular decoupling in focal epilepsy: from models to paradigms
Jorge Riera Diaz, Florida International University, Miami, FL, United States

New model for the fMRI hemodynamic response function based on brief arterial vasodilation
David Ress and Jung Hawn Kim

From Visual Stimulus to BOLD Measurements, a complete spatiotemporal model derived from sub millimetre fMRI
Kevin Aquino, MJ Beakspear, A Puckett, P. Robinson and MM. Schira