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**A physiologically-based spatiotemporal model of fMRI hemodynamic responses.** JACKIE HUBER, School of Physics, University of Sydney, Australia, PETER DRYSDALE, PETER ROBINSON, School of Physics, University of Sydney, Australia; Brain Dynamics Center, Westmead Hospital, Australia — A 3D cerebrovascular model is developed to describe the spatiotemporal Blood Oxygen Level Dependent (BOLD) functional MRI (fMRI) response. Modelling spatial effects is particularly important as technology improves, shrinking image voxels and thereby increasing voxel interdependence. Specifically, poroelastic theory, originally developed in geophysics, is used to model the brain tissue and vasculature as a porous continuum. The model yields equations describing conservation of mass, momentum, and deoxyhemoglobin, plus the effect of neuronal activity on blood flow. The equations reproduce existing, non-spatial, hemodynamic models in the relevant limit. Imposition of continuity of flow between adjacent points enables potential investigation of spatial phenomena such as 'blood steal' which has been proposed to account for negative BOLD signals abutting sites of positive BOLD responses. This model will enable future study of spatiotemporal relationships between stimuli and experimental fMRI BOLD responses.

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