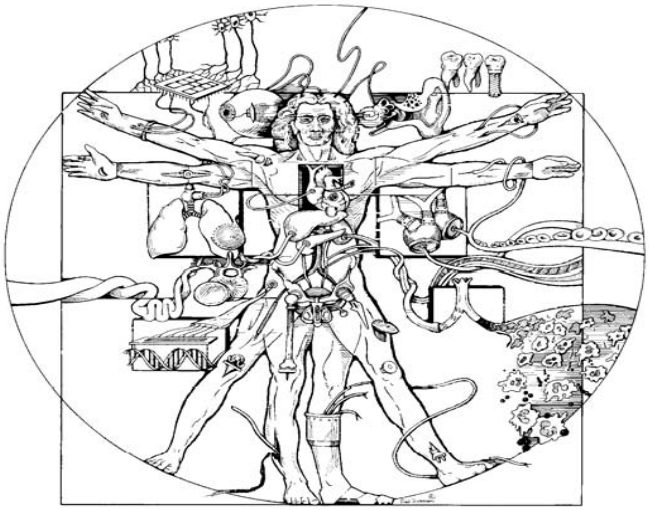
Biomedical Engineering Seminar



Biomedical Engineering is proud to announce the Doctoral Defense of

Kevin Harkins

The University of Arizona

"Biophysical Mechanisms of Diffusion-Weighted MRI Assessed Through Computational Modeling and Experiments in Bioreactor Cell Cultures"

Abstract: The apparent diffusion coefficient (ADC) is a quantitative measure of water diffusion in tissue which is sensitive to the microstructural features of brain tissue and can be measured non-invasively with diffusion-weighted MRI (DWMRI). Within minutes after the onset of ischemic stroke, the ADC of water decreases 30-50% within the affected tissue. Although this was initially discovered nearly two decades ago, there is no consensus on the biophysical mechanisms responsible for the drop in ADC after ischemia. This dissertation investigates the biophysical mechanisms which determine the ADC through mathematical models of water diffusion in tissue as well as experiments in hollow fiber bioreactor (HFBR) cell cultures.

The mathematical model of water diffusion in tissue predicts that the biophysical mechanisms which affect the ADC are diffusion time dependent. At short diffusion times, the ADC is sensitive to the intrinsic diffusivity of intracellular water, while at long diffusion times, the ADC is sensitive to changes in the intracellular volume fraction. Furthermore, the ADC changes associated with ischemia can be account for completely by a change in the intracellular cell volume fraction when the intracellular T2 is allowed to be lower than the extracellular T2.

A unique feature of the HFBR bioreactor cell culture system is that it allows the diffusive properties of intracellular water to be investigated individually. The change after ischemia in the ADC measured from intracellular water (iADC) is dependent upon the diffusion time used to collect iADC measurements. At short diffusion times, the iADC decreases after ischemia, which is likely due to a decrease in the energy dependent movement of water within the cell. At long diffusion times, the iADC increases after ischemia, which is related to cell swelling. The results from the HFBR experiments are consistent with the mathematical model and provide a clear picture of the biophysical mechanisms important to measurements of water diffusion in living and ischemic tissue with DWMRI.

Friday, June 26th, 2009
9:00 am
MRB 102

Host: Ted Trouard (626-2177)

Persons with a disability may request a reasonable accommodation by contacting the Disability Resource Center at 621-3268 (V/TTY). Requests should be made as early as possible to allow time to arrange the accommodation