AbstractID: 11970 Title: Diffusion Imaging: What It Can Tell Us About Cancer

The use of the self-diffusion characteristics of water to generate image contrast for magnetic resonance imaging (MRI) can provide a wealth of information about tissue microstructure. Diffusion imaging has demonstrated sensitivity to pathology in structured tissues (e.g., white matter, cardiac muscle fiber, kidney), where the structure may be altered. Additionally, the relative volume of water between intra- and extra-cellular compartments, as well as the permeability of tissue membranes dividing the compartments, may be affected by certain diseases. Cancer, in particular, affects water diffusivity in a number of ways. In tumor regions where a high density of cells exists, the diffusion of extra-cellular water can be more restricted than healthy tissue. In regions where the tumor has become necrotic or cystic, diffusion is less restricted. Tissue structure may not be affected equally in all directions. Invasiveness of cancer into neural fibers in the brain, or their preservation and displacement around a tumor, will exhibit differences in diffusion magnitude as well as direction of restriction. Finally, therapeutic intervention (radiation therapy or chemotherapy) of cancer can be monitored using diffusion techniques, where increases in diffusion within a tumor may suggest the efficacy of treatment.

This presentation will provide a survey of different diffusion MRI techniques, focusing in particular on when they may be helpful in the diagnosis and treatment of cancer.

Educational Objectives:

1) To describe how biological changes in tissue correlate with diffusive behavior of water.
2) To provide a simple picture of cancer and the different ways in which it can alter cellular diffusion characteristics.
3) To give an overview of the different diffusion imaging techniques in MRI: How do they work? What information do they provide? Under what contexts are they important in the diagnosis of cancer?