

Title: Nanotechnology in Medical and Neurological Imaging

Current nanotechnology in medical imaging exists in various forms. Molecular contrast agents for Magnetic Resonance (MR) and Computerized Tomography (CT) imaging that delineate vascular structures, evaluate perfusion, and interrogate the adequacy of the Blood-Brain Barrier in neurological disease. Other biochemical imaging techniques that evaluate function include Positron Emission Tomography (PET) and Single Photon Emission Computed Tomography (SPECT) where specific molecules such as glucose or methionine can be labelled and imaged. These biochemical techniques have a minimal resolution of 3000 to 5000 microns compared to the current minimal resolution of MR and CT of 300 to 500 microns. The clinical use of higher field magnets has also allowed in-vivo resolution to decrease even further. Novel contrast agents such as iron oxide nanoparticles and molecular agents to interrogate enzymatic function are in development and clinical testing. MR imaging has also extended beyond the anatomic to the cellular level and is now used to interrogate the diffusion characteristics of tissue, to evaluate functional changes with neuronal activation, and to delineate the axonal fibers orientation in white matter. All of these current technologies and future endeavors will be discussed.