ABSTRACT Cancer diagnoses, and increasingly treatment, are progressively being aided by the development of new medical and molecular imaging technologies. Central to the utility of these procedures has been the concurrent development of contrast agents that enable clinicians to clearly delineate tumor peripheries, determine pathologies, and develop personalized intervention strategies. Nanotechnology has provided innovative materials that have been proven to provide elevated contrast in a number of different imaging modalities. Specifically, tumor tissue-specific nanoparticles have shown great potential as contrast agents for the direct in vivo detection of a number of cancers. This seminar will focus on two examples of nanoscale contrast agents. The first of these is a composite material consisting of Fe₃O₄ nanoparticles embedded in a 200 nm diameter porous Si nanoparticle “superstructure.” The composite exploits the dipolar coupling of superparamagnetic nanoparticles trapped within a secondary inorganic matrix, and has been shown to enhance the transverse relaxivity contrast in a 3 T MRI more than 1.6 fold when compared to similar, unencapsulated Fe₃O₄ nanoparticles. The second describes the enhanced visualization of breast cancer in X-ray Computed Tomography that was achieved by using Bi₂S₃ nanoparticles of 10 nm diameter modified to display a tumor targeting peptide (LyP-1, CGNKRTGRGC). In these studies the accumulation of the nanoparticle contrast agent within the tumor was increased by 260% compared to nanoparticles that did not contain the homing peptide.

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