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Molecular imaging of cancer with core/shell nanoparticles

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Standard clinical MRI often fails to detect cancer in its early development stages. Therefore application of molecular sensing would ensure earlier and more accurate diagnosis. To increase MRI sensitivity contrast agents containing gadolinium are used, providing hyperintense T1-weighted tumor MR image. Superparamagnetic nanoparticles have recently been used to reduce T2 and T2*, thus decreasing MR signal in areas corresponding to the location of the disease. Accumulation of these contrast agents is solely based on differences in the vasculature of tumor and normal tissues, and MRI detection of specific tumor types is not achieved. We investigated magnetic and biochemical properties of iron oxide core and core/shell nanoparticles for breast and glioma cancers. Triple negative breast cancer and glioma specific sdAb were conjugated with nanoparticles and IR markers using amine-functionalized coating. The IR and T2-weighted MR images were collected before and after injection of the targeted contrast agent. The agents consist of targeted NaDyF₄/NaGdF₄ nanoparticles, where the core and shell sizes were controlled independently to provide maximum tumor contrast by application of synergetic T1/T2 MR pulse sequences. This allows better tumor delineation and positive, tumor-specific contrast. A 9.4T MRI system was used to measure relaxation time values of the tumor and normal tissue. Using IR and MRI we have shown the efficacy of the new contrast agents, thus potential suitability for the early detection of cancerous tissues.

Biography

Boguslaw Tomanek, following the completion of his PhD at the Polish Academy of Sciences Krakow, Poland in 1995 joined the National Research Council of Canada. In 2000 he became the head of the MR Technology group. In 2001 he established the Institute for Biodiagnostics (West) in Calgary, Canada. He led the team who created the first intraoperative MRI system; discovered a new mechanism of fMRI and gradient-free MRI. He has published over 100 publications, several book chapters; he is a reviewer for various journals and a recipient of several achievement awards. His current area of interest is molecular MR imaging.

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