Public Abstract

First Name:Hang
Middle Name:
Last Name:Xu
Adviser's First Name:Lixin
Adviser's Last Name:Ma
Co-Adviser's First Name:Baolin
Co-Adviser's Last Name:Deng

Graduation Term:FS 2017
Department:Chemical Engineering
Degree:PhD

Title:Development of novel site-specific imaging probes for prostate cancer detection

Prostate cancer is a leading cause of cancer death worldwide for men. Molecular imaging is believed to be significant in decreasing cancer death rate by improving early detection accuracies for cancer. It relies on molecular imaging probes to image particular cellular or molecular abnormalities in living body. The main objective of this research is to develop tumor-selective molecular imaging probes, for targeted detection of human prostate cancers using non-invasive medical imaging instruments such as magnetic resonance imaging (MRI), photoacoustic imaging (PAI), and near-infrared fluorescence imaging (NIRFI). Bombesin (BBN) is a short peptide which targets to gastrin releasing peptide receptor (GRPr) overexpressed by human prostate cancers. Two BBN labeled nanoparticle imaging probes were described. First, a bovine milk protein coated ultra-small (with a 5 nm core) iron oxide nanoparticle conjugated with BBN, USPIO(Cy7.5)-BBN, was developed, characterized, and studied for targeted detection of human prostate cancer using MRI and optical imaging instrument. Second, a silica coated iron oxide nanoparticle (with a 10 nm core) decorated with fluorescent labeled bombesin (SIO-AF750-BBN) was developed as a multimodal photoacoustic, optical and MRI imaging probe, with an emphasis on photoacoustic imaging enhancement to increase the detection sensitivity of prostate tumor and circulating tumor cells. Finally, a family of fluorescent bombesin antagonist analogs was developed and demonstrated to have a high binding affinity and selectivity, and a high imaging efficacy to the prostate cancer cells, as well as a desirable biodistribution profile in human cancer mouse models, indicating their potentials to be translated to clinical use for imaging-guided surgery and therapy. In conclusion, this Ph.D. work addresses the issues of discovery and development of site-specific and multi-modality molecular probes for cancer targeted imaging.