FREQUENCY DOMAIN FLUORESCENT MOLECULAR TOMOGRAPHY AND MOLECULAR PROBES FOR SMALL ANIMAL IMAGING

Naresh Gandhi Kujala

Dr. Ping Yu, Dissertation Supervisor

ABSTRACT

In this thesis, we have developed a frequency domain fluorescent molecular tomographic system based on the heterodyne technique using a single source and detector pair for small animal imaging. In our system, the intensity of laser source is modulated to produce a diffuse photon density wave in the tissue. The phase of the diffuse photon density wave is measured by comparing the reference signal with the signal from tissue by using a phasemeter. In parallel, we have developed and evaluated fluorescent Alexa Fluor 680 and Alexa Fluor 750-Bombesin (BBN) probes to target gastrin-releasing peptide (GRP) receptors on prostate and breast cancer for optical molecular imaging. Confocal fluorescence microscopic imaging of the molecular probes for *in vitro* PC-3 prostate and T-47D breast cancer cell lines indicated specific uptake, internalization and receptor blocking of these probes. *In vivo* investigations in severely compromised immunodeficient (SCID) mice bearing xenografted PC-3 prostate and T47-D breast cancer lesions demonstrated the ability of this new molecular probes to specifically target tumor tissue with a high selectively and affinity.