

## Bankhead-Coley Cancer Research Program

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Postdoctoral Research Fellowship  
(2-year project)*

**Project Title:** Proton Beam Dose Verification Using PET/CT Imaging in Conjunction with 3D Polymer Gel Dosimetry

**Project Summary:** Unlike conventional radiation beams that damage healthy cells along their path to the tumor, proton beams can be tailored to deposit most of the dose in a well-defined volume and at a specific depth inside the body. However, proton beams are very sensitive to patient-specific variables, such as motion during delivery or the presence of heterogeneities (bone and lung tissue) in the beam path. This is why it is critical to ensure that radiation dose distributions are being accurately delivered to cancer patients. The most direct approach to dose verification is PET/CT imaging of patients after each treatment. This technique is based on measuring the spatial distribution of proton-beam activated positron emission and superimposing it onto a CT data set, which provides information about the spatial distribution of dose in relation to relevant anatomical sites and allows making treatment plan adjustments. However, the relationship between dose and PET activity is complex and has not been thoroughly studied. This project will investigate the characteristic features of PET activity distributions under different clinically relevant circumstances. Unlike earlier studies that compared measured PET signal to calculated dose, this project will use a unique, proton-sensitive 3D polymer gel dosimetric phantom that allows us to directly correlate delivered dose to activity in the same device.