

## **Non-invasive estimation of prostate tumor grade with PET [<sup>68</sup>Ga] Ga-PSMA-11 imaging**

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### **Background and Hypothesis:**

In the US alone, more than 160,000 men are diagnosed with prostate cancer each year. Prostate cancer grows slowly in many patients such that most die due to unrelated causes, yet 29,000 prostate cancer-related deaths occur annually in the US. The gravity of this mortality rate promotes over-treatment of low- and intermediate-risk cancer patients as well as monitoring of cancer via invasive biopsies to determine cancer grade. We hypothesize that molecular imaging methods can differentiate low- and intermediate- risk prostate cancer, guide optimal treatment, and eliminate morbidity associated with biopsy procedures.

### **Experimental Design or Project Methods:**

In this work, we used PET [<sup>68</sup>Ga] Ga-PSMA-11 imaging to estimate cancer grade through direct comparison with whole mount pathology, which is the gold standard for cancer grading. A tool was developed using Interactive Data Language (IDL) to automate 3D spatial registration of whole mount pathology slices with [<sup>68</sup>Ga] Ga-PSMA-11 PET images. Upon accurate spatial registration, quantitative analysis was performed to establish the relationship between regional [<sup>68</sup>Ga] Ga-PSMA-11 uptake and prostate cancer grade.

### **Results:**

Thus far, we have shown qualitatively that the whole mount pathology accurately maps to the correct 3D spatial location on the PET images. Upon spatial registration, using a ROC curve, we have found that [<sup>68</sup>Ga] Ga-PSMA-11 uptake could be used to detect both low- and high- risk tumor location (AUC = 0.82 and 0.84 respectively). Further, we demonstrated increasing uptake with greater risk.

### **Conclusion and Potential Impact:**

This study begins to establish the feasibility of noninvasive, imaging-based monitoring alternatives which can mitigate the need for invasive biopsies for prostate cancer. Ultimately, improved imaging methods have the potential for not only bettering prostate cancer monitoring but also for improving cancer outcomes and quality of life for prostate cancer patients.