High-Resolution In Vivo Molecular Imaging Technique Based On X-ray Fluorescence

The goal of this project is to combine XFI with a micro-CT to create a novel image guided XFI system. The micro-CT would image the mouse and locate the tumor region of interest (ROI). The mouse would then be moved along a translation stage to the XRF imaging station and raster in 3D to determine element presence and concentrations within the tumor and surrounding regions. A model of the XFI imaging system is shown below in Figures 1 and 2.

![Figure 1. XRF guided imaging](image1)

![Figure 2. X-ray collimation and focusing to get high resolution voxel data.](image2)

The focus spot would then be moved across the ROI to get element data theoretically presented below.

![Figure 3. Pixelized element data](image3)

This research will, for the first time, provide functional/molecular imaging capability to x-ray imaging, which we believe will be a significant advance in the x-ray technology and assist in applications in cancer drug development and cancer biology research.
The original testing setup is shown below in Figure 4. It was mounted on the end of a micro-CT source and highly collimated using the copper collimator block. The MDCs calculated for indium trichloride and iodine were 80 and 100 ug/mL respectively.

Figure 4. Original element differentiation and concentration setup. For a measurement reference, the aluminum filter is 16mm thick.

The tube only went up to 50 kVp so cisplatin was not yet measured. We are currently in the process of upgrading to a new tube that can go up to 160 kVp to test more elements and be able to start the measurement of a 1D chemical gradient, possibly moving on to 2D before July.