EVALUATION OF RADIATION GUIDED GENE THERAPY USING PINHOLE IMAGING AND REGION-OF-INTEREST (ROI) ANALYSIS As an alternative to biopsy, non-invasive nuclear medicine imaging has been proposed to study the biodistribution of vector mediated and radiation guided gene therapy. In this work, serial pinhole planar imaging is used to characterize the uptake of (1) Iodine-131 (^{131}I) labeled adenovirus vector (^{131}I Ad.Egr-TNF) alone and (2) ^{131}I labeled anti-humanTNF antibody (^{131}I anti-hTNF) in irradiated Glioma (GL261) in a murine model. In the first experiment, intratumoral and intravascular injection of ^{131}I Ad.Egr-TNF was performed 1hr and 24hrs prior to imaging. In the second experiment, intratumoral and intravascular injection of Ad.Egr-TNF was performed 24hrs prior to single fraction tumor irradiation to 10Gy total dose, followed 48hrs later by injection of ^{131}I anti-hTNF. Control animals received no radiation dose. A single-head gamma camera equipped with a pinhole collimator was used to acquire planar images at one hour, 24hrs, 48hrs and 72hrs post anti-hTNF injection. Semi-quantitative ROI analysis was used to measure absolute image counts and average counts per pixel within the tumor region as a function of time. Intravascular (intratumor) injection of radiolabeled vector (Expt. #1) showed an increase (decrease) in tumor uptake over a 24hr period. Radiation guided uptake of radiolabeled antibody decreased by factors of ~5.5 and ~5.2 (Expt. #2) for intravascular and intratumor injections, respectively, over 72hrs. Irradiated tumor tissue showed a slight increased uptake of ^{131}I anti-hTNF relative to control at 1hr and a decreased uptake at later time points.