EXTERNAL BEAM GUIDED DRUG DELIVERY USING RADIOLABELED MICROSPHERES: EVALUATION WITH NUCLEAR MEDICINE AND AUTORADIOGRAPHY REGION-OF-INTEREST (ROI) TECHNIQUES Radiation induced microsphere aggregation within tumor blood vessels may be used to facilitate the delivery of novel gene therapies. We are currently investigating approaches to optimized drug delivery in Glioma (GL261) murine models using radiolabeled microspheres. Our preliminary data indicate that it is feasible to label microspheres with single-photon emitting radionuclides, induce aggregation within tumors and characterize the resulting microsphere biodistribution using photon-imaging techniques. In this study, pinhole gamma-camera imaging and autoradiography are used to characterize the uptake and distribution of Indium-111 (^{111}In)-labeled microspheres (^{111}In-M) in irradiated and non-irradiated GL261 bearing mice. The following experiments were performed: (1) ^{111}In-M tail-vein administration followed by imaging, (2) ^{111}In-M administration, 10 minute time delay, tumor irradiation to 10Gy total dose, imaging; (3) 10Gy dose followed by ^{111}In-M administration and imaging, (4) variable dose (0 – 10Gy) followed by ^{111}In-M administration 30min post-irradiation, then imaging at 30min, 24hrs and 48hrs post-administration. Tumors from Expt. #4 were excised and sectioned for autoradiography studies. Control animals received no radiation dose. Our initial gamma-camera results indicate proportionally greater uptake of ^{111}In-M administered just prior to single fraction irradiation (Expt. #2) when compared to ^{111}In-M uptake administered just after irradiation (Expt. #3). Autoradiography studies (Expt. #4) show some trend in uptake with radiation dose when compared to untreated control animals. Biodistribution imaging studies of combined therapy in mice may provide information of medical significance for clinical protocol development.