AbstractID: 8656 Title: Cell Survival Following X-ray Activated Auger Electron Radiotherapy

Purpose: To examine enhancement of cell killing as a function of both radiosensitizer (IUdR) concentration and x-ray beam energy by measuring CHO cell survival following monochromatic x-ray activated Auger electron radiotherapy.

Method and Materials: The dose-response of CHO cells was measured by irradiating monolayers of log-phase cells to 1-8 Gy using 30 keV, 35 keV, and 4 MV x-rays. Estimated maximum radiosensitizer DNA-incorporation (18% thymidine replacement) was obtained by adding 8 μL IUdR (20 μM in media) 21-39 hours before irradiation. Cell culture tubes were irradiated at 30 and 35 keV by an effective field size of 2.8×2.5-cm^2 on a monochromatic, x-ray beamline at LSU's CAMD synchrotron. Dose was determined from ionization chamber-measured dose rates (18-27 $cGy \cdot min^{-1}$ at 100 mA) and verified with GAFCHROMIC® EBT film. Cell culture flasks were also irradiated with 4 MV x-rays produced using a Varian Clinac 21EX (30×30-cm^2 field, 0.5-cm depth). Clonogenic assays were performed at the Pennington Biomedical Research Center, where cells were plated, incubated, and allowed to grow for 1 week, then fixed and stained with crystal violet. Colonies of 50 or more cells were scored as survivors. Sensitization enhancement ratio (SER) was calculated as the ratio of doses at 10% surviving fraction.

Results: Survival curves for control cells (without IUdR) were identical for the 30 keV, 35 keV, and 4 MV beams. Cells with DNA-incorporated IUdR showed increased sensitization: SER≈2 with 4 MV, SER≈4 with 30 keV, and SER≈5 with 35 keV x-ray beams.

Conclusion: Our initial results are consistent with those reported previously by others. Future work studying SER as a function of photon energy and percent IUdR replacement of thymidine in DNA is intended to provide sufficient data to develop radiobiological models, which when utilized with the dose distribution, will provide a mechanism for planning x-ray activated Auger electron therapy.