COMPARATIVE ASSESSMENT OF RADIATION-INDUCED GENE EXPRESSION IN TWO-DIMENSIONAL VERSUS THREE-DIMENSIONAL THYROID CULTURES

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ABSTRACT- The purpose of this study was to compare radiation-modulated gene expression patterns between rat thyroid cells grown in flasks as two-dimensional cultures with those in bioreactors as three-dimensional tissue analogs. Methods: FRTL-5 cells were grown in tissue culture flasks and disposable bioreactor vessels. Replicate cultures were irradiated with 0, 50 or 200 cGy gamma-rays and the cells harvested for RNA 48 hours post irradiation. The RNA was hybridized to RAE 230A Affymetrix microarrays and differences in gene expression profiles determined using GeneSpring 7.2 software. Gene lists were generated to compare the unirradiated control pattern to either 50 or 200 cGy gamma irradiated patterns from both culture conditions. Comparative lists were then made between equivalent doses for both culture conditions. Results: Of the roughly 16,000 genes on the RAE 230A chip there were on average 8,000 genes expressed in the control cultures, representing genes/sequences specific to thyroid cells. In the experimental sets there were a greater number of modulated genes in the irradiated flask-grown cultures compared to the tissue analogs at both doses tested. There were very few genes modulated in common between and across doses for the two growth conditions. There were only two genes up-regulated in common to all four treatment groups and none were down-regulated in common to all four treatment groups. Conclusions: the results indicate that the same cells cultured under two different environmental constraints have dissimilar responses to radiation. Thus, the level of cellular assembly dramatically impacted how these cells responded to ionizing radiation. The work was supported by grants to LM Green from the Department of Energy # DE-FG02-02ER63448 and NASA # RAG9-1452.