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Subject Profiles of Gene Expression Induced by Ionizing Radiation in Different Human Cell Types

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Abstract

Ionizing radiation disrupts chemical bonds in biomolecules, such as proteins and DNA, which result in important cellular damage. Exposure to relatively high doses of ionizing radiation such as those delivered to the tumor in a radiotherapy protocol is generally lethal for the cell. However, non-lethal dose of ionizing radiation can be delivered during radiotherapy to the healthy tissue surrounding the tumor. Although the effects of ionizing radiation at the cellular level are quite well established (cell cycle arrest, senescence, apoptosis, mitotic catastrophe), questions remain concerning the molecular pathways regulating these cellular responses, including those differentiating the responses between tumor and normal cells. In normal cells, the p53 protein plays a central role. However, the efficacy of radiation treatments on tumor cells is often reduced because of the frequent inactivation of the p53 protein in those cells. Our study used the microarray technology to investigate the molecular pathways induced by irradiation in transformed and nontransformed human cells. Profiles of gene expression obtained with cDNA microarrays were regarded as steps to characterize the general response to ionizing radiation and, possibly also, differentiating the response between transformed and nontransformed cells. Possible implications of such research include the development of radiosensitizing (to maximize the effect of radiotherapeutic irradiation) and of radioprotecting strategies. Transcriptional profiles were investigated in transformed (Jurkat, HL60) and non-transformed (freshly isolated lymphocyte subpopulations) cells of hematopoietic origin. Also, because HeLa carcinoma-derived cells expressing human papilloma virus (HPV) 18 derived E2 protein represent a reliable model to study the p53 pathway, which is normally activated in response to radiation, molecular profiles were obtained to characterize this pathway in these cells.