3-D skin and lung epithelial models for radiation biology studies

Acheva, Anna
STUK-Radiation and Nuclear Safety Authority, Laippatie 4, 00880 Helsinki, FINLAND

☎ +358 40 48 59 256
Anna.Acheva@stuk.fi

There are numerous studies of the targeted and non-targeted effects of ionizing radiation (IR) in two-dimensional (2-D) cell cultures. As a result, most of the dogmas in radiation biology have been postulated after experiments on monolayer cultures *in vitro*. However, 2-D culture models lack the normal structural organization of tissues in an organism. More complex models containing different cell types enabling the intercellular interactions characteristic for a tissue *in vivo* are therefore required to validate the extent and relevance of the effects in relation to human radiation exposures. Models of either monotypic three-dimensional (3-D) cultures or more sophisticated organotypic co-cultures including multiple cell types have been developed. 3-D *in vitro* models allow the study of cell-to-cell and cell-extracellular matrix interactions, as well as the influence of the microenvironment on cellular differentiation, proliferation, apoptosis and gene expression. In the last few years the radiation biology laboratrories in STUK and Queen's University Belfast have been utilizing 3-D organotypic skin and 3-D lung epithelial models for studying the low dose radiation induced bystander effects and role of tissue microenvironment in early stages of lung carcinogenesis. The 3-D models showed significant differences in response to ionizing radiation when compared to 2-D cells from same lineages. This could implicate need of more sophisticated than monolayer cells models for testing new treatment modalities and understanding the early stages of low dose radiation induced cellular changes.

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