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Tracing the footprints of radiation: temporal and spatial patterns of γH2AX signaling in different human cells after exposure to X-rays and UV-C light

Ionizing radiation (IR) is an excellent probe to elicit a biological response and study the molecular mechanisms of DNA damage and repair in human cells, with implications in radiation protection and optimization of its medical use. This work focuses on γH2AX, a widely-used DNA damage marker, analyzing its induction, kinetics, and persistence in three cell lines with different radiosensitivity, after exposure to X-rays and near-ionizing UV-C light. Combining fluorescence microscopy, flow cytometry, and clonogenic survival assays, we provide a detailed characterization of the spatial and temporal dynamics of γH2AX signaling and its relationship with cell viability, cell cycle phase and long-term survival. Cell-line specific responses are found, highlighting the importance of accounting for cellular phenotype and DNA repair proficiency when interpreting γH2AX-based assays. These insights may guide improved experimental design and interpretation in radiation biology studies, both for basic and translational research.

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