# FRACTIONATED IONIZING RADIATION IMPACT ON BREAST CANCER CELLS MCF-7

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Cancer is one of the leading causes of death globally. Various methods are used to cure oncological diseases and radiation therapy is among the most frequently applied treatments. However, in some cases the treatment fails and cancer recurrence takes place. One of the theories states that cancerous tissue renewal after radiation therapy is due to the activity of cancer stem cells (CSC's). [1] These cells are thought to be radioresistant because of their slow cell cycle, rapid DNA repair mechanisms, ROS scavenging, ability to detoxify or exclude cytotoxic agents. [2] One of the cell surface markers used to identify CSC's is a transmembrane glycoprotein CD44 – a hyaluronic acid receptor, which is responsible for cell adhesion, proliferation and migration. [3] It is well known that the expression of CD44 is increased in CSC's. [4]

The main purpose of this research is to determine the response of cancer cells to fractionated ionizing radiation. In this study we investigate changes of morphological properties such as cell size and granularity, differences in autofluorescence, CD44 expression levels and accumulation of quantum dots (QD's) in breast cancer cells MCF-7 after treatment with ionizing radiation. In our work MCF-7 cells were treated with fractionated ionizing radiation (3x4 Gy) using linear accelerator. The expression of CD44 was assessed using monoclonal antibody conjugated with FITC and as model nanoparticles carboxylated CdSe/ZnS QD's were employed. Quantitative measurements were obtained by flow cytometer and for qualitative evaluation confocal fluorescence microscope was used. CD44 expression allows the estimation of CSC's proportion in radioresistant cells' population produced by fractionated ionizing radiation, autofluorescence may evince the changes in molecular mechanisms caused by radiation therapy and intracellular accumulation of QD's can let us gain insight into the effect of ionizing radiation on the internalization of substances as well as to evaluate a possible usage of QD's in diagnostics and therapy of radioresistant cells.

Such researches could provide a better comprehension of fractionated radiation therapy impact on cancer cells and give a deeper understanding of optimizing radiation therapy or combining several treatment methods with respect to elimination of radioresistant CSC's so that the cancer treatment would be improved and patients' survival rates increased.

[1] Rycaj, K., & Tang, D. G. (2014). Cancer stem cells and radioresistance. *International journal of radiation biology*, *90*(8), 615-21.
[2] Yoshida, G. J., & Saya, H. (2015). Therapeutic strategies targeting cancer stem cells. *Cancer science*, *107*(1), 5-11.
[3] Senbanjo, L. T., & Chellaiah, M. A. (2017). CD44: A Multifunctional Cell Surface Adhesion Receptor Is a Regulator of Progression and Metastasis of Cancer Cells. *Frontiers in cell and developmental biology*, *5*, 18. doi:10.3389/fcell.2017.00018
[4] Chen, C., Zhao, S., Karnad, A., & Freeman, J. W. (2018). The biology and role of CD44 in cancer progression: therapeutic implications. *Journal of hematology & oncology*, *11*(1), 64. doi:10.1186/s13045-018-0605-5