

## Study of Local Heating in Combination Treatment of Hyperthermia with Radiation Therapy for Breast Cancer Treatment

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**Abstract:** Hyperthermia increases the temperature in the tissue, making targeted cells more sensitive to following treatments such as radiation therapy. The local effect in the combination of hyperthermia and radiation treatment in breast cancer therapy has been studied by comparing gene expression levels in cells receiving different treatment but contained in the same environment.

**Keywords:** hyperthermia, radiation therapy, microwave antenna, gene analysis, breast cancer

### 1. Introduction

The damages induced by radiation therapy on tumor cells can be increased when combined with hyperthermia treatment. The mechanism behind this sensitization effect is still unknown and has to be investigated to develop the combination therapy modality. Previously obtained results have shown surprising behavior in gene expression levels depending on the applied treatment. These results might have been affected by environmental conditions at which genes are highly sensitive to.

### 2. Method

To study local effects in the combination of hyperthermia and radiation therapy while limiting the effects of the environment, the experiment was designed to have a single petri dish contain cells undergoing different treatments. By heating the center of the petri dish with a microwave antenna, a temperature gradient is created thanks to the ambient cooling effects. The center of the petri dish undergoes hyperthermia treatment while the outer part is not heated.

The microwave antenna was designed using CST 2020 and studied through simulations. The temperature in the petri dish was obtained by using temperature measurements and interpolation methods with Python code. After collecting the cells, gene expression levels were studied after extraction of RNA, synthesis of cDNA and use of RT-qPCR.

### 3. Results and Conclusion

Differences in gene expression levels are observed in the same petri dish. Since the cells are subject to the same environment, these differences are due to the difference in treatment modality. Increases and decreases in gene expression levels are observed depending on the studied gene and give a better understanding of the underlying mechanisms in the combination of hyperthermia and radiation therapy for breast cancer.

### References

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