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(G*) (POS-44) Metamaterial-Assisted Wireless Electric Field Application for Studying Breast Cancer Cell Migration

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Breast cancer is the most common cancer type in women accounting for ˜25% of new cases of all cancers and 14% of cancer deaths in Canadian females. The metastatic spread of breast cancer cells from the primary tumour is the dominant contributor to mortality in these patients. The mechanisms by which cancer cells metastasize are diverse with suggestions that in vivo generated electric fields (EF) may contribute to directed breast cancer cell migration (electrotaxis)[1,2]. However, the mechanism of electrotaxis is unknown. Recently, new contactless electrotaxis assays have been developed and wirelessly applied AC EF were shown to alter the directional migration of breast cancer cells[3]. These results motivated us to further investigate the possible effect of wireless DC EF on breast cancer cell migration considering the endogenous occurrence of DC EF in tissues. We used 3D printing and biocompatible metamaterials to develop a wireless DC EF electrotaxis device, which allows for customized EF control and cell migration imaging. Multiphysics modeling characterized the DC EF in the cell chamber, offering improved reproducibility and consistency of EF application to the cells. Using this prototype device, we tested the migration of MDA-MB-231 cells, a human metastatic breast cancer cell line. Our preliminary results showed that the wireless DC EF altered cell migratory turning behaviors. The results of our ongoing research integrating experimental and modeling approaches will be presented. This metamaterial-assisted wireless EF device may be broadly useful for electrotaxis studies with the potential to enable novel therapeutic intervention strategies for cancers.

[1] C. McCaig, et al. "Controlling cell behavior electrically: current views and future potential"Physiological reviews vol. 85,3 (2005):943-78

[2] D. Wu, et al. "DC electric fields direct breast cancer cell migration, induce EGFR polarization, and increase the intracellular level of calcium ions"Cell biochemistry and biophysics vol. 67,3 (2013):1115-25

[3] D. Ahirwar, et al. "Non-contact method for directing electrotaxis"Scientific reports vol. 5 (2015):11005

Keyword-1

Metamaterial

Keyword-2

Wireless Electric Field

Keyword-3

Cancer Cell Migration

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