Modeling Electromagnetic Signals of Multiple Breast Cancerous Cells

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This work represents a model that simulates electrophysiological activities performed by MCF-7 cells which is the most common standard breast cancer cell line. The model considers distribution of the multiple cells with typical intercellular spacing estimated for MCF-7 cells. No interactions between adjacent cells are assumed due to the extensive evidence regarding the disruption of intercellular communications among breast cancerous cells. The intercellular spacing between two adjacent cells assumed to be more than one order of magnitude smaller than the cell size. This assumption leads to employ non-uniform finite difference discretization for efficient computational cost. The model is then utilized to investigate the electric signals generated by multiple cells at different stages of cell division. The numerical results demonstrate that the biopotential signal generated by two cells is amplified compared with that of a single cell. This amplification depends on the cell stage and is consistent when multiple cells are considered. This observation could explain the reported large variations of recorded biopotential signals from breast cancer patients.