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# A deterministic model of the effect of electric field on chemotherapeutics delivery into a tumor

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Due to biological barriers in a tumor microenvironment, drug delivery into the tumor will experience challenges. For example the tumor microenvironment is very heterogeneous due to angiogenesis, creating significant challenges for effective drug delivery. Application of an electric field has the potential to overcome some of these barriers. Electric field can enhanced drug transport by increasing the cell permeability and increasing the tumor drug uptake rate. Applying electric field in a cancer cell leads to three major electrokinetic phenomena namely, electrophoresis (particle/ion movement), electroosmosis (ion fluid movement) and electroporation. Electroporation phenomena facilitates the introduction of chemotherapeutics particles into the cancer cell by increasing the permeability in the blood vessel membrane. Computational models have been developed to study some of these phenomena [1-4]. However, to our knowledge, a computational model that simultaneously considers all three phenomena is missing in the literature. In Moarefian et al. [5] a mathematical model was developed and subsequent simulations have suggested that applying electric field will enhance chemotherapeutics delivery. The authors did not consider electroporation effect on organelles in the cancer cell and how the electroporation could increase drug diffusion. Finally they ignored the electroosmosis effect in the intercellular matrix around the cancer cell and in the blood vessel. In this presentation we will discuss a new model that relaxes the assumptions discussed above. The hypothesis is that the model would lead to a significantly more realistic prediction of the optimum electric field that would result in the maximum fraction of cell killed. A platform to test and validate has not been performed by Moarefian et al.[5]. Here we proposed the preliminary design of microfluidic device to study the effect electroporation on drug delivery.

References

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