

Abstract Submitted
for the OSF13 Meeting of
The American Physical Society

Substrate Dependent Modulation of Cellular Response to External Electric Field¹ TOLOO TAGHIAN, University of Cincinnati, ABDUL SHEIKH, Yale University, University of Cincinnati, DARIA NARMONEVA, ANDREI KOGAN, University of Cincinnati — Although the regulatory effect of external electric field (EF) on cellular behaviors in vitro has been confirmed, the biophysical mechanisms of interaction of EF with cells are not clear. EF-cell interactions may be affected by both distribution of the induced EF within the cell, as well as the properties of the extracellular matrix (ECM), which is known to regulate cell response to the external stimuli. Therefore, mechanistic studies of EF interactions with the cell and its substrate are essential for the efficient control of the cell responses and development of EF-based therapies. To address this issue, we have developed a combined theoretical-experimental approach. Our 3D EF-cell interaction model solves Maxwell's equation (ANSOFT_HFSS) in wide frequency range to provide a precise induced EF distribution within the cell in its native configuration. Model predictions are compared with the experimentally measured responses of endothelial cells to the EF, including growth factor release and capillary morphogenesis, for cells cultured on synthetic and natural ECM. The results show that cell response to EF varies with EF frequency in a substrate dependent manner, thus providing a mechanistic insight in the biophysics of EF-cell interactions.

¹The authors acknowledge the financial support from the NSF (DMR- 1206784 & DMR-0804199 to AK); the NIH (1R21 DK078814-01A1 to DN) and the University of Cincinnati (Interdisciplinary Faculty Research Support Grant to DN and AK).

Toloo Taghian
University of Cincinnati

Date submitted: 13 Sep 2013

Electronic form version 1.4