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Co-regulation of cell behavior by electromagnetic stimulus and extracellular environment¹ TOLOO TAGHIAN, University of Cincinnati, ABDUL SHEIKH, Yale University University of Cincinnati, DARIA NARMONEVA, ANDREI KOGAN, University of Cincinnati — Chronic wounds do not effectively respond to pharmacological treatments because of insufficient blood supply (Impaired angiogenesis) in the wound. Developing non-pharmacological treatments requires application of advanced technology to control natural cell signals to trigger desired cell responses. Application of external electric field (EF) has been shown to enhance angiogenesis through manipulation of naturally-generated EF in the ionic environment surrounding cells and across the cell membrane; however biophysical mechanisms of cell responses to EF remain unknown. EF-cell interactions may be affected by both the distribution of the induced EF within the cell and the properties of the extracellular matrix (ECM), which is known to regulate cell response to the external stimuli. We have developed a combined theoretical-experimental approach to study EF-cell interactions. Our theoretical 3D interaction model provides spatial distribution of the induced EF in cell and extracellular space and predicts a frequency specific cell response to EF. Experimentally measured responses of cells to EF including growth factor expression and capillary morphogenesis confirm this prediction. We show that natural versus synthetic ECM can differentially mediate cell response to EF.

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