

## Biophysical properties of stem cells

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### Abstract

**Introduction:** Stem cells are defined by their potential to self-renew and to differentiate into many different cell types in the body, during early stage of life and growth. These cells play fundamental role in development of functional tissue engineering and regenerative medicine. Normally, stem cells are in contact to a specialized microenvironment which include of signalling factors, cell-cell contacts, stem cell niche supporting cells, and extracellular matrix (ECM). So, biophysical studies on the extra cellular matrix, membrane capacitance, migration, and differentiation is crucial for dynamic regulation of stem cell self-renewal and function.

**Methods:** The biophysical features of stem cells were investigated by several techniques including dielectrophoresis (DEP), confocal microscopy, and ultra-high voltage electron microscopy (UHVEM). The study was focused on biophysical differentiation potential of neural stem cells and shear stresses of osteocyte ECM structures.

**Results and discussion:** It was observed that substrate stiffness and extracellular matrix (ECM) composition have essential role in cell proliferation, spreading, migration and even stem cell differentiation. It also has been demonstrated that the electrophysiological property of membrane capacitance inversely correlates with the neurogenic potential and directly with astrogenic potential of neural stem cells. Fluid flow-induced shear stress, and substrate strain which result in altered cell membrane morphology can create tensile and compressed forces on cell-matrix contacts (focal adhesions) and intercellular junctions (adherents' junctions and gap junctions) in stem cells.

**Conclusion:** Biophysical characteristics of stem cell provide a completely novel and quantitative measure of stem cell fate potential to identify different type of stem cells. It is obvious that the extracellular microenvironment, or niche, is complex. So, further studies are needed to confirm both direct and indirect mechanisms of biophysical regulation within the in vivo system of stem cell niche.

**Keywords:** Stem cell, biophysical features, differentiation, extra cellular matrix,

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