

Role of Bioelectricity in the Regeneration

Editorial:

Endogenous electrical signals play an instructive role in many cellular behaviors, including development, wound healing, Cancer progression, and tissue regeneration. Specifically, during tissue regeneration, two events during which stem cells actively proliferate and differentiate, endogenous electrical signals (like membrane potential (V_{mem})) plays an important role. Membrane potential (V_{mem}) refers to the voltage difference across a cell's bilayer membrane that is established by the balance of intracellular and extracellular ionic concentrations. Although maintenance of ionic homeostasis is a critical feature of cell viability and metabolism, a clear relationship has been suggested between the V_{mem} levels and the cell functions like proliferation and differentiation. The V_{mem} across the membrane of cells that are in high proliferative states (embryonic, adult stem cells, cancer cells,

etc.) have been shown to trend towards being more positive and are depolarized, while the V_{mem} of cells that are in low proliferative states (neurons, fibroblasts, skeletal muscle cells, fat cells, etc.) are more negative or hyperpolarized. Several authors have shown a correlated change in V_{mem} with either initiation or cessation of growth.

While considerable modern work underscores the link between V_{mem} and the cell cycle, this fascinating bioelectric control mechanism is still not well known in the field of regenerative medicine. Here, in this study we investigate how the membrane potential (V_{mem}) establish itself in different proliferative (e.g. Cancer cells, Mesenchymal stem cells) and non-proliferative cells (e.g. fibroblasts) to verify the differences in the level of V_{mem}. Changes in V_{mem} are investigated using membrane voltage sensitive fluorescence dye DiBAC4 in synchronized seeded populations in culture with increase in time, density, and cell contact. In addition to that, we also investigate the role of V_{mem} in these cells in controlling the regeneration related events (Cell proliferation and differentiation) by pharmacological blockade of ion channels, to find out if this mechanism is an attractive target for the modulation in regenerative medicine.