The Torch
Vol. 2 (19)

Cell signalling in stem cells

Mariyam Sulaiman

The area of stem cell research evokes in us an amalgam of emotions like hope, excitement and anticipation. We are witnessing many breakthroughs and innovative discoveries in this field and much of it comes from in-depth study and research in the properties and functioning of stem cells. Learning about functioning is a crucial step towards this goal. Cell signalling is the ability of cells to perceive and correctly respond to their microenvironment. It plays a vital role in the development, tissue repair, immunity, tissue homeostasis, etc. An in-depth study of this mechanism could lead to more effective treatment of diseases through the creation of artificial tissue. Extracellular cell signalling pathways are classified into different types based on the distance over which the signal functions, such as paracrine signalling, autocrine signalling, synaptic signalling and endocrine signalling. Many molecular mechanisms control the self-renewal and differentiation of stem cells. Some of them are the Akt pathway, TGF-beta pathway, WNT pathway, VEGF Pathway, p53 pathway, Notch pathway, JAK-STAT pathway, TLR pathway, NF-KB pathway, mTOR pathway, AMPK pathway, MAPK pathway, etc. Each of these pathways controls the various developmental functions in our body, and deregulation of any of this results in very drastic effects. Detailed study of these signalling pathways holds key towards much better understanding and applications in the field of regenerative medicine, as the disruption of many of them is the key cause of many major diseases.

Down-regulated expression of the AMPK pathway is found in human embryonic stem cells and induced pluripotent stem cells when compared with differentiated cells. AMPK signalling pathway is found to suppress cancer by negatively regulating cell proliferation. Similarly, interruption of the TGF-beta pathway has been seen in human cancers, such as advanced carcinoma, and gastric and colon cancer. Deregulation of WNT Pathway may lead to metastasis and tumorigenesis. Likewise, inactivation of yet another pathway, the p53 pathway has been associated with tumour development and it is supposed that more than half of all cancers can contain p53-inactivating mutations. The p53 pathway critically inhibits the generation of induced pluripotent stem cells. Blocking the p53 pathway greatly enhances the ease and effectiveness of transmuting differentiated cells into induced pluripotent stem cells. Thereby, reactivation of p53 could be a potential opportunity to inhibit the formation of cancer stem cells and thereby treating tumours. Glitches in the NF-KB Pathway can lead to autoimmune disease, inflammation and cancer. A more detailed study into these facts could pave the way towards a possible cure to counter these problems. The possibilities and opportunities in the research of this field are immense, which makes a detailed study of these pathways even more important for the advancements in regenerative medicine.

Keywords: Stem cells, Cell signalling, Signalling pathways

Citation:
Mariyam Sulaiman. Cell signalling in stem cells. The Torch. 2021. 2(19). Available from:
https://www.styvalley.com/pub/magazines/torch/read/cell-signalling-in-stem-cells.