Roles for mesenchymal stem cells as medicinal signaling cells

Understanding the in vivo identity and function of mesenchymal stem cells (MSCs) is vital to fully exploiting their therapeutic potential. New data are emerging that demonstrate previously understudied roles of MSCs in vivo. Understanding the behavior of MSCs in vivo is crucial as recent results suggest these additional roles enable MSCs to function as medicinal signaling cells. This medicinal signaling activity is in addition to the contribution of MSCs to the maintenance of the stem cell niche and hematopoiesis. There is increasing evidence that not all cells described as MSCs share the same properties. Most MSCs reside in a perivascular location and have some functionalities in common with those of the pericytes and adventitial cells located around the microvasculature and larger vessels, respectively. Here we focus on the characteristics of MSCs that have been demonstrated to be similar to those of pericytes located around the microvasculature, defined as perivascular MSCs (pMSCs). Although we focus here on pMSCs, it is important to bear in mind that pericytes are found in many types of blood vessels, and that not all pericytes are thought to be pMSCs.

MSCs in cancer metastasis

pMSCs response to injury and inflammation involves the release of cytokines, chemokines, and other factors that can contribute to the metastatic process. In particular, pMSCs have been shown to promote tumor cell adhesion and extravasation through the regulation of endothelial cell function. The ability of pMSCs to release the chemokine CXCL12, which promotes chemotaxis and adhesion, contributes to their ability to attract tumor cells. Additionally, pMSCs express the chemokine receptor CXCR4, which can facilitate tumor cell migration. These factors, along with their capacity to release the cytokine TGF-β, which inhibits the immune response, contribute to the ability of pMSCs to create a perivascular niche that promotes tumor growth and metastasis.

Bone marrow stromal cells and mesenchymal stem cells are known to exhibit immunosuppressive properties. They can inhibit T cell proliferation and cytokine production, which can contribute to the suppression of the immune response. This is important for the suppression of tissue regeneration and the promotion of tumor growth. Moreover, pMSCs have been shown to release the cytokine IL-10, which can inhibit the production of pro-inflammatory cytokines and promote the induction of regulatory T cells. These factors contribute to the ability of pMSCs to suppress the immune response and facilitate tumor growth.

MSCs in vitro and therapeutic applications

MSCs can be isolated from various sources, including bone marrow, adipose tissue, and umbilical cord blood. They can be expanded in culture and differentiated into various cell types, including chondrocytes, adipocytes, and osteoblasts. This makes them useful for cell-based therapies and tissue engineering applications. In vitro, MSCs can be used to study their biological properties and to develop new therapeutic strategies.

In vivo, MSCs are known to have a variety of functions, including the promotion of tissue regeneration, the inhibition of immune responses, and the induction of anti-inflammatory effects. They can also differentiate into various cell types, including chondrocytes, adipocytes, and osteoblasts. This makes them useful for cell-based therapies and tissue engineering applications.