&#65533;&#65533; The functions of regenerative stem cells include the following:- Anti-inflammatory/Immunomodulation:

In general, in vitro studies demonstrate that bone marrow-derived MSCs (BM-MSCs) and adipose-derived MSC limit inflammatory responses and promote anti-inflammatory pathways. When present in an inflammatory environment, data demonstrates that BM-MSCs may alter the cytokine secretion profile of dendritic cell (DC) subsets and T-cell subsets causing a shift from a proinflammatory environment to an anti-inflammatory or tolerant environment. BM-MSCs do not express MHC class II antigens or costimulatory molecules and they suppress T cell proliferation. AD-MSC suppress mixed lymphocyte reactions and inhibits T cell proliferation induced by a third cell type or by mitogenic factors. Both types of MSC are able to control lethal graft versus host disease (GVHD) in mice after haploidentical hematopoietic transplantation.   &#65533; Trophic Support:

Multiple studies demonstrate that MSCs secrete bioactive levels of cytokines and growth factors that that support angiogenesis, tissue remodeling, differentiation, and antiapoptotic events. AD-MSCs secrete a number of angiogenesis-related cytokines such as:- Vascular endothelial growth factor (VEGF) Hepatocyte growth factor (HGF) Basic fibroblast growth factor (bFGF) Granulocyte-macrophage colony stimulating factor (GM-CSF) Transforming growth factor &#65533; ? Differentiation:

Adipose derived MSC studies demonstrate a diverse plasticity, including differentiation into adipo-, osteo-, chondro-, myo-, cardiomyo-, endothelial, hepato-, neuro-, epithelial and hematopoietic lineages, similar to that described for bone marrow derived MSC.&#65533; These data are supported by in vivo experiments and functional studies that demonstrated the regenerative capacity of adipose-derived MSCs&#65533;to repair damaged or diseased tissue via transplant engraftment and differentiation. &#65533; Awad and colleagues reported significant improvements using autologous MSC delivery in a rabbit Achilles tendon repair model compared to cell-free collagen control rabbits. Nixon and colleagues demonstrated statistically significant&#65533; improvement in histological repair of a collagenase-induced injury in the superficial digital flexor tendonitis in horses treated with autologous regenerative cells harvested from fat. In a caprine model of traumatic joint injury, BM- MSCs delivered intra-articularly engrafted and repaired meniscal tissue, leading to a statistically significant reduction in the progression of osteoarthritis. Multiple studies demonstrate in vivo bone regeneration and repair in animal models. Bruder and colleagues demonstrated in two studies that BM-MSCs could be used to repair a critical defect in a non-union fracture model in dogs. Cowan and colleagues demonstrated that AD-MSCs heal a critical-size mouse calvarial defect in which there was increased bone formation and mineralization compared to controls. A human clinical case showed a dramatic regeneration of the calvarium in a young girl with severe traumatic damage. In a rodent cerebral infarct model, Jeong and colleagues demonstrated that infracted rats administered magnetically labeled AD-MSC administered two weeks after the creation of an infarct experienced restoration of locomotor function compared to controls.   <p

style="text-align: center;"> Homing:

Homing (chemotaxis) is an event by which a cell migrates from one area of the body to a distant site where it may be needed for a given physiological event.&#65533; Homing is an important function of MSCs and other progenitor cells and one mechanism by which intravenous or parenteral administration of MSCs permits an auto-transplanted therapeutic cell to effectively target a specific area of pathology.
&#65533;&#65533;&#65533;&#65533; Nilsson and colleagues demonstrated that labeled cells of bone lineage injected intravenously into mice can engraft, form bone, and give rise to osteocytes and bone lining cells detectable on the mouse femur.
&#65533;&#65533;&#65533;&#65533; Chen and colleagues performed peripheral intravenous experiments using a cerebral arterial occlusion model of stroke and demonstrated that labeled BM-MSCs administered&#65533; hours and 7 days post-injury has demonstrated migration to the area of injury as well as a dramatic reduction in stoke infarct size.

 Revascularization:

Adipose derived regenerative cells contain endothelial progenitor cells and MSCs that assist in angiogenesis and neovascularization by the secretion of cytokines, such as hepatic growth factor (HGF), vascular endothelial growth factor (VEGF), placental growth factor (PGF), transforming growth factor (TGF?), fibroblast growth factor (FGF-2), and angiopoietin.
&#65533;&#65533;&#65533;&#65533; Chen and colleagues examined the effect of intravenous administration of BM-MSCs after cerebral arterial occlusion in the rat and demonstrated new capillary formation, increased vessel formation and increased VEGF (vascular endothelial growth factor) expression in the areas of the lesion.
&#65533;&#65533;&#65533;&#65533; In an in vivo model of hind limb eschemia, intravenous injection of AD-MSC were associated with an increase in blood flow and capillary density and incorporation of the cells in the leg vasculature.
&#65533;&#65533;&#65533;&#65533; Rehman and colleagues demonstrated that nude mice with ischemic hind limbs demonstrated marked perfusion improvement when treated with human AD-MSC.

  Anti-apoptosis:

Apoptosis is defined as a programmed cell death or &#65533;cell suicide&#65533;, an event that is genetically controlled.&#65533; Under normal conditions, apoptosis determines the lifespan and coordinated removal of cells.&#65533; Unlike necrosis, apoptotic cells are typically intact during their removal (phagocytosis).&#65533;
&#65533;&#65533;&#65533;&#65533; Rehman and colleagues demonstrated this effect in acutely injured tissue denied critical blood-flow resulting in ischemia. AD-MSC significantly reduced endothelial cell apoptosis.
&#65533;&#65533;&#65533;&#65533; Kortesidis and colleagues also demonstrate that BM-MSCs express factors that support cell survival and avoid apoptosis thereby preserving cells that would otherwise be destroyed. &#65533; &#65533;