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Mesenchymal stem/stromal cells (MSCs) in regenerative medicine

Recently, stem cells have become more and more popular in regenerative medicine approaches. In a search for a safe and therapeutically beneficial stem cell, many biomedical researchers have turned into using mesenchymal stem/stromal cells (MSCs) in their regenerative medicine endeavors. The pioneering work of Friedenstein in the 1960s with clonal, plastic adherent bone marrow-derived non-hematopoietic cells laid the ground for the introduction of MSCs in the 1990s. Since, MSCs and MSC-like cells have been isolated from various tissue sources and the multipotential differentiation capability has been demonstrated extensively. The minimum criteria for MSCs include plastic adherence, in vitro differentiation into adipogenic, chondrogenic and osteogenic lineages, absence of hematopoietic surface markers, and expression of C105, CD90, and CD73. MSCs have been shown to aid in repair of injured tissues through multiple mechanisms including differentiation, transfer of mitochondria or vesicles, stimulation of endogenous stem cells, suppression of apoptosis, and immunomodulation. Recently, the focus of the MSC therapeutics has sifted from a transdifferentiation approaches into a paracrine effects of MSCs. In particular, immunosuppressive properties of MSCs have attracted much research and great discoveries have been made in identifying therapeutically beneficial molecules secreted by MSCs. MSCs can act on both innate and adaptive immune systems by suppressing T cells, suppressing dendritic cell maturation, reducing B cell activation and proliferation, inhibiting proliferation and cytotoxicity of NK cell, and promoting the generation of regulatory T cells. Hence, MSCs have shown promise in both pre-clinical and clinical trials to treat GVHD and myocardial infarction, and support transplantation. Still, much remains unresolved about basic MSC biology and the mechanisms of MSC therapeutics.

Biography

Joni H. Ylostalo received his PhD from Tulane University in Biomedical Sciences in 2008 under the supervision of Dr. Darwin J. Prockop studying human mesenchymal stem/stromal cells (hMSCs) at the Center for Gene Therapy. Since 2008 Dr. Ylostalo has served as a Senior Research Associate at the Institute for Regenerative Medicine at Texas A&M Health Science Center performing translational and basic research with hMSCs. Dr. Ylostalo is also the Director of the Microarray Core Facility at the institute. He has over 30 peer-reviewed publications in various national and international journals concerning MSCs, gene expression analysis, and protein biochemistry.

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