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Review

Mesenchymal stem cells: building blocks for molecular medicine in the 21st century

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Abstract

Mesenchymal stem cells (MSCs) are present in a variety of tissues during human development, and in adults they are prevalent in bone marrow. From that readily available source, MSCs can be isolated, expanded in culture, and stimulated to differentiate into bone, cartilage, muscle, marrow stroma, tendon, fat and a variety of other connective tissues. Because large numbers of MSCs can be generated in culture, tissue-engineered constructs principally composed of these cells could be re-introduced into the *in vivo* setting. This approach is now being explored to regenerate tissues that the body cannot naturally repair or regenerate when challenged. Moreover, MSCs can be transduced with retroviral and other vectors and are, thus, potential candidates to deliver somatic gene therapies for local or systemic pathologies. Untapped applications include both diagnostic and prognostic uses of MSCs and their descendants in healthcare

management. Finally, by understanding the complex, multistep and multifactorial differentiation pathway from MSC to functional tissues, it might be possible to manipulate MSCs directly *in vivo* to cue the formation of elaborate, composite tissues *in situ*.



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Keywords

stem cells; tissue engineering; gene therapy; diagnostic tools; differentiation; orthopaedics; bioactive factors; prognostic indicators

Keywords

Molecular Medicine; Development; Cell biology

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