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MicroRNAs and mesenchymal stem cells

Federica Collino [1], Stefania Bruno, Maria Chiara Deregibus, Ciro Tetta, Giovanni Camussi

Affiliations + expand

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Abstract

In the adult body, mesenchymal stem cells (MSCs) represent a population with self-renewal ability and multipotent differentiation capabilities. The phenotype of these cells is modulated by a dynamic interplay of signals within a defined microenvironment. Recent studies indicate that microRNAs (miRNAs) act as regulatory signals for maintaining of stemless, self-renewal, and differentiation in embryonic and adult stem cells. miRNAs are noncoding RNAs with pleiotropic effect dependent on posttranscriptional regulation of gene expression. In the stem cell biology, miRNAs by repressing translation of specific mRNAs, may determine the fate of these cells. The characterization of miRNAs present in MSCs may be relevant not only as signature of the cell type but also for the understanding of their biological activities. Recent studies indicate also that the exchange of miRNAs between neighboring cells is an integral part of MSC communication with tissue-injured cells. The transport of miRNAs within biological fluids is guaranteed by microvesicles (MVs) that after release from the cell of origin may enter into a target cell delivering their cargo. MVs may allow a bidirectional exchange of miRNAs between injured cells and MSCs. The exchange of genetic information may on one hand, reprogram the phenotype of MSCs, to acquire features of the injured tissues. On the other hand, MVs derived from stem cells may activate regenerative programs in cells survived to injury. The study of miRNAs, their biological function, and their transfer opens a new dimension on the fate and behavior of MSCs and on their potential application in regenerative medicine.