

# Regenerative medicine: going beyond transplantology

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**ABSTRACT.** Since the possibilities of transplantology are limited, there is a need for tissue engineering and regenerative medicine (RM). Several high-tech approaches are used in RM: the use of soluble molecules, gene therapy, stem cell transplantation, tissue engineering, reprogramming of cells and tissues, etc. As an important component, RM strategies include innovative materials that can imitate the extracellular matrix of tissues, influencing the behavior of cells and regulating the structure and function of the formed tissue, for example, 3D polymer scaffolds, bioglass grafts, and nanofiber meshes. There is also no-scaffold tissue engineering, for example, the formation of cell sheets and the cultivation of cells capable of self-organization into appropriate sub-organ structures (intestinal crypts, kidney nephrons, and lung alveoli). In the direction of cell-free RM, the attention of scientists is attracted by exosomes – microvesicles of cellular origin sized 40-100 nm. They can carry a “cargo” of proteins, lipids, RNA, and DNA. Exosomes have the potential for use in the treatment of neurodegenerative, infectious, musculoskeletal, and cardiovascular diseases. Due to their physiological nature, exosomes have very low immunogenicity and the potential to pass through the blood-brain barrier. For the further development of exosomal therapy, it is necessary to improve the methods of their isolation and purification, as well as research on efficiency, safety, pharmacokinetics and pharmacodynamics. An important source of cells for RM is represented by mesenchymal stem cells, which are able to differentiate into almost any cell line and exert anti-inflammatory, immunoregulatory and immunosuppressive effects.

**KEY WORDS:** regenerative medicine, tissue engineering, exosomes, mesenchymal stem cells.