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Use of nanoscaffolds in regenerative medicine

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Tissue engineering aims at regenerating damaged tissues by combining cells with scaffolds that act as templates for tissue regeneration. Using nanomaterials for this purpose makes it a more attractive alternative as it offers many advantages for stimulating cell growth and promoting tissue regeneration. Medical technology uses 3D microstructures that are made of ultrafine polymer fibres (10−9 m) called nanoscaffolds, which help in rebuilding damaged tissues and other complex structures. These nanoscaffolds are fabricated from both organic and inorganic materials with adjustable physical and mechanical properties that provide a biomimetic environment to the cells to promote cellular adhesion, proliferation, differentiation and migration. For engineering different tissues, different nanoscaffolds are manufactured. When the tissue grows, these nanoscaffolds get absorbed into the body and disappear completely if they are biodegradable. A few examples of biodegradable materials include fibrin, collagen, poly(lactic acid) (PLA), poly(lactic-co-glycolic acid) (PLGA), etc. The polymeric nanoscaffolds exhibit excellent mechanical properties along with a good degradation profile. In addition, they also influence cell behaviour, modulate the local microenvironment and control key features at the molecular and cellular levels. As a consequence, nano-based regenerative medicine has become a promising application of tissue engineering for the reconstruction of bone defects, muscular defects and other tissue damages. The potential of nanomaterial scaffolds in tissue engineering is not only limited to the regeneration of damaged tissues but is also witnessed in the controlled and targeted release of bioactive agents.

Keywords: Biodegradable nanoscaffolds, Tissue engineering, Nanomaterials, Scaffolds, Regenerative medicine, Nanoscaffolds

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