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Nano-scaffolds: A tailor-made infrastructure for growing tissues

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Nano-scaffolds are one of the important components of tissue engineering and regenerative medicine. A nano-scaffold is a three-dimensional structure that is artificially synthesised whose structure can mimic the natural collagen extracellular matrix (ECM) of a cell, which can induce cell growth in all three dimensions. It is their high surface to volume ratio that enhances cell adhesion and allows proliferation, differentiation, and migration of cells. Self-assembly, electrospinning, and phase separation are some of the major approaches for producing nano-scaffolds. Nanofibres resulting from the phase separation method and the natural collagen fibre of the ECM are similar in diametre. The self-assembly method results in nanofibres with a smaller diametre, which are naturally present in the lower end of the ECM; whereas, the electrospinning method results in fibres with a larger diametre that are naturally present in the upper end of the ECM. Researchers work with different materials to create nano-scaffolds to be used in tissue engineering and regenerative medicine. Some of them include nano-hydroxyapatite polymer composites that are used for scaffolds in bone tissue, biodegradable poly (l-lactic acid) that is used for scaffolds in nerve and bladder tissue, non-woven poly (lactide)- and poly (glycolide)-based (PLGA) fibres that are used for scaffolds in cardiac tissue, and chitosan collagen that is used for scaffolds in skin tissue. Further research on scaffolds with enhanced performance when culturing specific tissue types would lead to assist patients with tissue damage and tissue disorders. Studies are undergoing with many materials (synthetic and natural) that are biocompatible for the fabrication of nano-scaffolds.

Keywords: Nano-scaffolds, Self-assembly, Electrospinning, Phase separation, Tissue engineering, Regenerative medicine

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