

## **Electrospun Piezoelectric Nanofibers for Tissue Engineering Applications**

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**Abstract:** The aim of tissue engineering is to combine cells, scaffolds and growth factors in order to repair, regenerate or replace damaged tissues and organs. Recent advances in biomaterials research have led to the development of smart scaffold systems with controllable and responsive biological functions. Among these systems, piezoelectric materials have attracted particular interest because of their ability to transform mechanical energy into electrical signals. Several load bearing tissues, including bone, tendon and cartilage, that contain large amounts of collagen, exhibit intrinsic piezoelectric behaviour, which enables the generation of electrical signals in response to applying strain and deformation. It is now well recognised that electrically active microenvironments play an important role in regulating cell behaviour and tissue regeneration. Electrospun nanofibrous scaffolds have attracted increasing attention in tissue engineering because they provide a fibrous structure that mimics the native extracellular matrix. Electrospun nanofibers exhibiting piezoelectric behaviour are increasingly being investigated as scaffold materials for tissue engineering, as they combine an extracellular matrix like fibrous structure with the ability to generate electrical stimuli, which plays significant roles in regeneration of defected tissues. This presentation focuses on piezoelectric electrospun nanofibers as functional scaffolds for tissue regeneration. The basic mechanisms responsible for piezoelectricity in polymeric nanofibers are briefly outlined, followed by a discussion of how mechanically induced electrical signals influence cell adhesion, proliferation and differentiation. Recent studies are reviewed to demonstrate the response of particularly bone, neural and musculoskeletal cells to piezoelectric scaffolds, which highlight the potential of piezoelectric electrospun nanofibers as bioactive systems for guiding tissue regeneration.

**Keywords:** Electrospinning, Scaffold, Piezoelectric materials, Tissue engineering

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