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Letter to Editor

Towards Novel Ideas in the Design of Active Field-Driven Implants and Scaffolds Based on PVDF and Related Materials for Electroactive Tissue Regeneration

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In the practice of using polyvinylidene fluoride (PVDF) and a number of its copolymers as materials for the manufacture of systems for magnetic and electrical stimulation of tissues [1], capable of an electrical response to nanomechanical influence, as well as a response to the pulsating electromagnetic field of scaffolds [2] (as usually fibrous - obtained by electrospinning technologies, including nanofibrous [3]; less often - 3D-printed composite [4]) the main inductive-biophysical function is performed by the electrophysics of the β-phase, which provides high pyro- and piezoelectric properties PVDF (due to maximum dipole moment). Ferroelectric polymers based on PVDF, having a polycrystalline texture, after polarization exhibit piezoelectricity with a non-classical mechanism that persists for a long time.

This allows us to consider the β-PVDF scaffold simultaneously as a sensor and a sonar - an actuator that implements both electrical (electrophysiological) and acoustic and (or) electroacoustic stimulation of tissue, as well as recording its own signals, which translates controlled tissue regeneration using PVDF into a section of a special kind of theranostics, where the scaffold itself is a source of descriptors for the tissue regeneration it supports.

And if for the applicability of PVDF in bone tissue regeneration [5,6] this encounters difficulties in intraosteal signal registration, then for such excitable systems as: cardiomyocytes [7,8]; gland cells [9]; nervous tissue [10] (including Schwann cells [11]), bladder myocytes [12,13], this is not impossible. Engineering of nervous tissue with induced orientation is carried out on electrospun microfiber PVDF scaffolds [14,15].

The electrical and (or) magnetoelectric [16] response of excitable tissue can be the subject of non-contact non-invasive measurements - such as electromyography (including with cutaneous electrodes), ECG and EEG, as well as their magnetic equivalents: magnetomyography, magnetocardiography and magnetoencephalography. Implement this principle to analyze the response, taking into account the contribution of the reactivity of the “smart” PVDF scaffold (PVDF, as defined by the “Encyclopedia of Smart Materials” ([17], belongs to the “smart materials” class), from the standpoint of modern metrology , is quite simple and rational, as shown in this reports / papers [18-20].

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Conflict of Interest

No Conflict of interest.

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