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Cardiac muscle tissue engineering by random cellulose acetate nanofibers stacking

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Abstract: A layer-by-layer stacking method approach was developed using random cellulose acetate nanofibers and H9c2 cells for applications on cardiac muscle tissue engineering. Fibrillar architectures can mimic the 3D complex anatomical structure of muscle tissue, which would be beneficial for promoting muscle differentiation [1]. Electrospun nanofibers are an interesting scaffold alternative for muscle precursor cells, as their properties can promote cell adhesion, migration, and cell alignment [2]. H9c2 is a rat cardiomyoblast cell line, capable of differentiating into both skeletal and cardiac muscles [3]. These cells are promising candidates for muscle tissue studies, since they can exhibit the physical and biochemical properties of both muscles [4]. In this study, we introduce a simple method to produce a thick muscle tissue with the use of H9c2 cells on random nanofibrous substrates. Random cellulose acetate nanofibers were fabricated through electrospinning. The cells in random cellulose acetate nanofibers can align without the need for the fibers to be aligned, alignment and elongation happens by fiber contact, without the need for differentiation media. RT-PCR analyses revealed increased cardiac related gene markers, such as Troponin-T, CACNA1C and MYOG on random cellulose acetate scaffold compared to traditional 2D culture (monolayer). H9c2 myotubes cell sheets onto the nanofibers were stacked (up to 4 layers) to form a thick muscle tissue. The ease of manipulation for the formation of thick cardiac tissue by the stacking method and the induction of a H9c2 cell differentiation state, suggest that cellulose acetate nanofibers may be an interesting alternative for application as a scaffold for cardiac muscle tissue engineering.

Key-words: cellulose acetate, nanofiber, stacking, tissue engineering, cardiomyocyte differentiation

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References:

[1] Fernández-Costa JM, Fernández-Garibay X, Velasco-Mallorquí F, Ramón-Azcón J. Bioengineered *in vitro* skeletal muscles as new tools for muscular dystrophies preclinical studies. J Tissue Eng. (2021)

[2] Jun I, Han HS, Edwards JR, Jeon H. Electrospun Fibrous Scaffolds for Tissue Engineering: Viewpoints on Architecture and Fabrication. Int J Mol Sci. (2018)

[3] B. W. Kimes *and* B. L. Brandt, Properties of a clonal muscle cell line from rat heart. Experimental Cell Research. (1976)

[4] A. F. Branco, S. P. Pereira, S. Gonzalez, O. Gusev, A. A. Rizvanov, *and* P. J. Oliveira, Gene Expression Profiling of H9c2 Myoblast Differentiation towards a Cardiac-Like Phenotype. Plos one. (2015)