In vitro models of human cardiac fibrotic tissue on ‘bioartificial’ scaffolds

# *In vitro* models of human cardiac fibrotic tissue on 'bioartificial' scaffolds

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## Abstract

Cardiac infarction is a global burden worldwide that leads to fibrotic and not contractile myocardial tissue. In this work, *in vitro* models of infarcted tissue were developed as tools to test novel therapies for cardiac regeneration in the future. Human cardiac fibroblasts were cultured on scaffolds, with different compositions and architectures, as to mimic structural and chemical features of infarcted cardiac tissue. Early findings from in vitro cell tests were reported, showing an enhancement of cell attachment and proliferation in the case of "bioartificial" scaffolds, *i.e.* scaffolds based on a synthetic and a bioactive polymer.

## Introduction

Heart failure is a global pathological condition affecting approximately 26 million people worldwide.[1] Myocardial infarction causes the death of billions of cardiomyocytes followed by the progressive formation of a fibrotic scar mainly populated by cardiac fibroblasts. Fibrotic tissue is mechanically stiffer than healthy cardiac tissue and unable to undergo contraction.[2] *In vitro* models of infarcted tissue represent a key tool to evaluate new therapies for cardiac regeneration. In this work, a model of fibrotic heart was designed and fabricated by culturing human cardiac fibroblasts (HCFs) on bioartificial scaffolds with different morphology, mimicking structural and chemical features of infarcted cardiac tissue.

## Materials and Methods

Synthetic polymer scaffolds were prepared by different techniques and, then, functionalised with an adhesive protein. HCFs isolated from human ventricle were cultured onto the scaffolds. Their survival, adhesion, proliferation and morphology were studied by biochemical assays and fluorescence microscopy, as a function of scaffold structure and surface composition.

## Results

SEM analysis allowed to demonstrate the correct design of scaffolds. Functionalised scaffolds showed superior cell attachment and proliferation compared to non-functionalized scaffolds.

## Conclusions

Bioartificial scaffolds were able to support the viability and proliferation of HCFs. The study will allow the modelling of different degrees of human cardiac fibrosis by specific constructs, which will be useful for the *in vitro* testing of advanced therapies.

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