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Cellular and respiratory biomechanics group

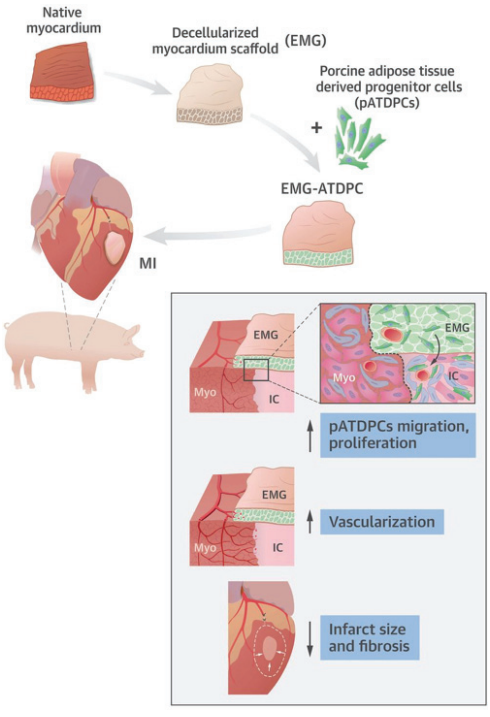
Group leader: Daniel Navajas

Cell-matrix mechanical crosstalk as key factor for improving biofabrication of cardiac patches for heart regeneration

Heart failure due to myocardial infarction (MI) is a major healthcare issue worldwide. The myocardial tissue that is damaged by MI lacks the ability to significantly self-regenerate, which leads to adverse left ventricular remodeling and eventual heart failure.

While total heart transplantation remains the only successful treatment for end-stage post-MI heart failure, this approach is limited by the lack of donors. Thus, tissue engineering strategies to repair and regenerate the infracted area are essential to prevent heart failure post-MI. In particular, application of biomimetic patches fabricated by seeding stem cells into acellular extracellular matrix (ECM) scaffolds shows great potential. However, this approach is currently limited by minimal efficiency. There is compelling evidence that cells sense and respond to mechanical forces and to physical features of their microenvironment. Therefore, achievement of more efficient repopulation of the scaffold requires a thorough knowledge of the mechanical properties of heart ECM and a better understanding of how physical signaling from the microenvironment directs differentiation of stem cells into different cardiac lineages. The objective of the project is to use heart-on-a-chip and 3D-bioprinting techniques to investigate mechanical signaling driving stem cell engraftment and differentiation toward heart lineages aimed at improving post-MI regeneration with cardiac patches.

This is a translational project carried-out in collaboration with the group of Prof. Antoni Bayés-Genis of Hospital Universitari Germans Trias i Pujol.



Perea-Gil, I. et al. J Am Coll Cardiol Basic Trans Science. 2016;1(5):360-72.