Mechanobiology of nuclear import of transcription factors modeled within a bioengineered stem cell niche.

Fact Sheet

Project Information

NICHOID

Grant agreement ID: 646990

Project website

DOI
10.3030/646990

Project closed

EC signature date
1 April 2015

Start date
1 May 2015

End date
31 July 2020

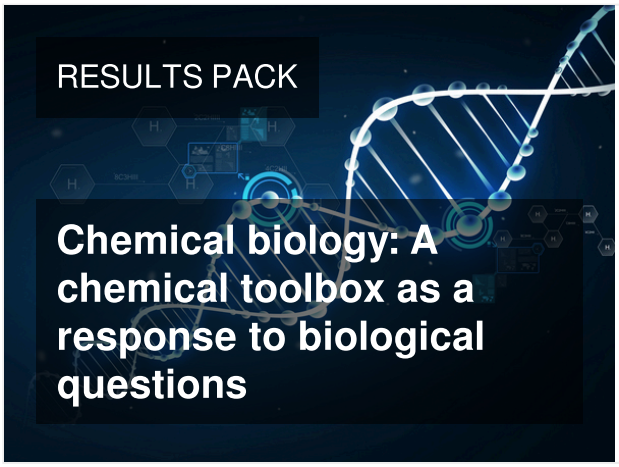
Funded under
EXCELLENT SCIENCE - European Research Council (ERC)

Total cost
€ 1 903 330,00

EU contribution
€ 1 903 330,00

Coordinated by
POLITECNICO DI MILANO
Italy

This project is featured in...



30 June 2020

Objective

Many therapeutic applications of stem cells require accurate control of their differentiation. To this purpose there is a major ongoing effort in the development of advanced culture substrates to be used as “synthetic niches” for the cells, mimicking the native ones. The goal of this project is to use a synthetic niche cell culture model to test my revolutionary hypothesis that in stem cell differentiation, nuclear import of gene-regulating transcription factors is controlled by the stretch of the nuclear pore complexes. If verified, this idea could lead to a breakthrough in biomimetic approaches to engineering stem cell differentiation.
I investigate this question specifically in mesenchymal stem cells (MSC), because they are adherent and highly mechano-sensitive to architectural cues of the microenvironment. To verify my hypothesis I will use a combined experimental-computational model of mechanotransduction. I will a) scale-up an existing three-dimensional synthetic niche culture substrate, fabricated by two-photon laser polymerization, b) characterize the effect of tridimensionality on the differentiation fate of MSC cultured in the niches, c) develop a multiphysics/multiscale computational model of nuclear import of transcription factors within differentially-spread cultured cells, and d) integrate the numerical predictions with experimentally-measured import of fluorescently-labelled transcription factors.
This project requires the synergic combination of several advanced bioengineering technologies, including micro/nano fabrication and biomimetics. The use of two-photon laser polymerization for controlling the geometry of the synthetic cell niches is very innovative and will highly impact the fields of bioengineering and biomaterial technology. A successful outcome will lead to a deeper understanding of bioengineering methods to direct stem cell fate and have therefore a significant impact in tissue repair technologies and regenerative medicine.

Fields of science (EuroSciVoc)

medical and health sciences > medical biotechnology > **tissue engineering**

medical and health sciences > medical biotechnology > cells technologies > **stem cells**

engineering and technology > industrial biotechnology > **biomaterials**

Keywords

mechanobiology | multiphysics | multiscale | mesenchymal | stem cell | differentiation | microfabrication | two-photon polymerization | synthetic niche | substrate | cell culture

Programme(s)

H2020-EU.1.1. - EXCELLENT SCIENCE - European Research Council (ERC) MAIN PROGRAMME

Topic(s)

ERC-CoG-2014 - ERC Consolidator Grant

Call for proposal

ERC-2014-CoG

See other projects for this call

Funding Scheme

ERC-COG - Consolidator Grant

Host institution

POLITECNICO DI MILANO

Net EU contribution

€ 1 802 830,00

Total cost

€ 1 802 830,00

Address

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Italy

Region

Nord-Ovest > Lombardia > Milano

Activity type

Higher or Secondary Education Establishments

Links

Contact the organisation Website
Participation in EU R&I programmes
HORIZON collaboration network

Beneficiaries (2)

POLITECNICO DI MILANO

Italy

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Total cost

€ 1 802 830,00

ISTITUTO DI RICERCHE FARMACOLOGICHE MARIO NEGRI

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Net EU contribution

€ 100 500,00

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Activity type

Research Organisations

Links

Contact the organisation Website
Participation in EU R&I programmes
HORIZON collaboration network

Total cost

€ 100 500,00

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