Supervisor Project Idea

Supervisor

Insert a brief CV and/or external link, the total number of publications, the ORCID link, 5 of the most significant/recent publications, and a list of funded projects and awards. max 300 words

Prof. Monica Mattioli Belmonte holds a PhD degree in and at present is a Full Professor of Histology at the Department of Clinical and Molecular Sciences (DISCLIMO), Università Politecnica delle Marche (UNIVPM), Italy. Her research concerned morpho-functional studies of cell and tissue response (extracellular and microenvironmental components) induced by 2D and 3D scaffolds for tissue regeneration and polymeric coatings with controlled release of drugs for osseointegration and/or prevention of associated degenerative phenomena. More recently the interest focuses on tissue regeneration in ageing and in the development of multi-tissue culture systems or modular bioengineered multi-organ in vitro platforms (MOP) as in vitro tools to study multi-system human pathophysiological conditions.
She is a co-author of more than 200 publications (Scopus H Index=41; 5897 citations; ORCID 0000-0002-2087-2776) in the field of morphology, biomaterials, and tissue engineering.
Research activities are the result of fruitful collaboration with colleagues from UNIVPM and with other Italian Universities and/or National and International Research Institutions. She collaborates on several national projects since 1999. In 2010, she received a grant award for Best Lecturer and Researcher at UNIVPM. She has been PI of a Research Unit of the national "MIND" PRIN 2010-2011 project (Protocol 2010J8RYS7) and in a biological unit of the ERC – BOOST (GA 681798). She also actively participates in CHETCH European Project in the 7th European Framework (MARIE CURIE ACTIONS - International Research Staff Exchange.

1. Scalzone, A. et al. Advanced Healthcare Materials (2023) doi 10.1002/adhm.202202030
2. Cerqueni et al. Materials Science and Engineering C (2021) doi 10.1016/j.msec.2021.112433
3. Biagini, F. et al. Scientific Reports (2020) doi 10.1038/s41598-020-78591-w
4. Mattei, G. et al. Scientific Reports (2015) doi 10.1038/srep10778
5. Mattioli-Belmonte, M et al . Frontiers in Physiology (2015) doi 10.3389/fphys.2015.00266

Research Group Description

Provide the name the reference department and a brief description of the research group, including external links, and available instrumentations and infrastructures. max 300 words

The reference department is DISCLIMO at the School of Medicine of UNIVPM. Within the DISCLIMO, the MorpHis Group, coordinated by Prof. Mattioli-Belmonte, is composed of two Associate Professors, one technician, four post-doc and 4 PhD students. Group's research skills are based on toxicity and/or biocompatibility evaluations of materials and 3D structures, using continuous cell lines, primary cells or adult mesenchymal stem cells (harvested from different anatomical districts), monolayer and co-cultural approaches, morphological (light and electron microscopy) and molecular biology (qRT-PCR, WB) techniques are used. The Lab is equipped with laminar flow hoods, incubators, and light and fluorescence microscopes, Realplex qRT PCR and western blotting equipments A Tomographic Microscope 3D Cell Explorer-FLUO by Nanolive, which combines 3D refractive index analysis with a fully integrated 3-channel epifluorescence module to image cells (and their alterations) in living for extended periods is also available.
Activities will be performed in close collaboration with:
- research group of the Orthopedic Clinic at of the *Azienda Universitaria Ospedali Riuniti* of Ancona directed by Prof. Antonio Gigante (Scopus H Index=35; 4252 citations; https://orcid.org/0000-0003-0772-563X), who is also Director of the Biomechanics and Biomaterials at DISCLIMO ,
- group of Physics of Condensed Matter at the Department of Science and Engineering of Materials, Environment and Urban Planning (SIMAU), under the supervision of Prof. Paolo Mengucci (Scopus H Index=27; 2503 citations; ORCID 0000-0001-9049-8524), who has long and well-established experience on material and structure characterization at the nanoscale. At SIMAU, equipment available for research includes an X-ray diffractometer, High resolution scanning electron microscope (HRSEM) Zeiss Supra 40 field emission with EDS, Variable pressure scanning electron microscope (VPSEM) Tescan Vega 3 with EDS microanalysis EDAX, Transmission electron microscope (TEM) Philips CM20 Twin, and a SkyScan Bruker 1174 benchtop microtomograph-System.
This proven collaborations are strategic for the development of regenerative approaches.

Title and goals

Provide the title of the topic and a short summary of the project idea. max 200 words

StrategIes for the developmeNt oF custOmized 3D meNIscAl substitutes (SINFONIA)

Meniscal injury reduces its capability to act for shock absorption, load distribution, proprioception, and protection of the cartilage from accelerated degeneration and meniscus surgery is one of the most performed orthopaedic procedures worldwide even if meniscectomy always alters normal joint biomechanics and can lead to the development and/or progression of osteoarthritis.
Since current commercially available meniscal substitutes have not been convincing according to clinical feedback, the project aims to validate *in vitro* customized 3D meniscal substitute(s) replicating the biomechanical and biochemical properties of the meniscus.
Three are the pillars on which the research project is built:

- Clinical study analyzing MRI scans obtained from the PACS database to select appropriate patients cohort and identify the main characteristics for the production of the meniscal structure
- Additive manufacturing and in-depth structural, physicochemical, and mechanical characterization of the obtained structures
- *In vitro* evaluation with appropriate cell models. The physic-chemical data will be key elements to get insight in structure capability to modulate the cell population in terms of the expression of genes/proteins involved in cell differentiation and mutual crosstalk.

Contact details (*including email address of the supervisor*)

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