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. Please indicate if you are a MSCA fellow yourself and if you have already been a MSCA Supervisor before. max 300 words

Prof. Monica Mattioli Belmonte holds a PhD degree in Cytomorphology. Full Professor of Histology at the Department of Clinical and Molecular Sciences (DISCLIMO), Università Politecnica delle Marche (UNIVPM), Italy. Head of the MorpHis Lab. 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=43; 6387 citations. ORCID 0000-0002-2087-2776) in the field of morphology, biomaterials, and tissue engineering.

Research activities result from fruitful collaboration with colleagues from UNIVPM and with other Italian Universities and/or National and International Research Institutions. She has collaborated 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), in a biological unit of the ERC – BOOST (GA 681798), PNRR "Vitality" and national PI in PoWer PRIN 2022 (Protocol 20222P2NAJD"). 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 Histology Group (MorpHis Lab), coordinated by Prof. Mattioli Belmonte, is composed of two Associate Professors (Prof M. Orciani and Prof S. Marchi), one technician (Dr G. Lucarini), 5 post-doc and 2 PhD students. One of the group's research skills is 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 Histology lab has laminar flow hoods, incubators, and light and fluorescence microscopes for morphological analyses. Realplex qRT PCR and western blotting equipment are available for molecular biology investigations. 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. Facilities are represented by 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 suitable for studying a wide range of structures.

The project will be carried out in collaboration with Prof. Giovanni Vozzi, Full Professor in Bioengineering, from the University of Pisa, one of Italy's leading experts in biofabrication, with whose research group there has been a fruitful collaboration for years.

Research thematic area

Indicate the MSCA panel and keywords that better describe your field of competence and research thematic area of your interest for a MSCA PF supervision – you may add extra keywords and text if necessary.

MSCA Panel Chemistry (CHE) - Economic sciences (ECO) - Information Sciences and Engineering (ENG) - Environmental and Geosciences (ENV) - Life Sciences (LS) - Mathematics (MAT) - Physics (PHY) - Social Sciences and Humanities (SOC)	MSCA Keywords MSCA Panels & Keywords.pdf Link documento	Free keywords	Free text
	L7- Diagnostic tools, therapies and public health	Tissue engineering	Biomaterials, in vitro models
LS	L3-Cellular and developmental biology	Morphology and functional imaging of cells	In vitro models
		Cell differentiation, physiology and dynamics	Ageing

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

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OPTIONAL:
Title and goals
Provide the title of the topic and a short summary if you already have a project idea.
Projects ideas can also be defined and discussed with potential candidates later.
max 200 words

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*3D in vitro biotechnological models to study gut MicRobiota Influence on bone RemOdeling and Repair (**MIRROR**)*

Human gut microbiota (hGM) is essential for maintaining the host's physiological functions, impacting both the gut and remote organs, including bones. Research shows that dysbiosis (i.e., alterations in hGM composition) can contribute to bone loss or higher fracture risk, leading to bone diseases like osteoporosis and osteoarthritis. These conditions affect millions and pose a serious health risk in an ageing population. The mechanisms and mediators of the hGM-gut-bone axis remain unclear, and the methods and tools for studying it are still being investigated. Multi-tissue culture systems may serve as effective in vitro tools for exploring multi-system human pathophysiological conditions, addressing limitations faced by traditional animal in vivo models.

The MIRROR project aims to develop independent 3D in vitro modules replicating hGM, gut, and bone, intended for use in a modular bioengineered multi-organ in vitro platform (MOP). Each module will include a bioinspired scaffold, produced through advanced biofabrication technologies in collaboration with the Centre Piaggio of the University of Pisa, capable of recreating the appropriate local microenvironment to:
a) maintain the donor-derived hGM composition; b) support the barrier properties of a Caco2-based gut model; c) promote the metabolic balance between osteoblasts and osteoclasts, respectively. The modules will then be fluidically connected.