

## Call for Applications

### PhD Program Regenerative Medicine

#### **Immune-regulatory capacity of mesenchymal stem cells (MSCs)**

##### **1. Background**

Mesenchymal stem cells (MSCs) are the key players in organizing regeneration and dampening inflammation by their immune-regulatory capacity, thereby significantly contributing to the reconstitution of physiological conditions.

In this basic research project we will investigate the mechanisms how mesenchymal stem cells facilitate their immune-regulatory capacity. We will follow the hypothesis that mesenchymal stem cells can be used successfully in the clinic to modulate the inflammatory response that accompanies degenerative processes in tissue and organs. A prerequisite for a safe and successful use of MSCs in the clinical setting is to unravel the molecular, cellular and physical requirements for their action. Here we will investigate the molecular, cellular and physical features of MSCs under different culture conditions, the influence of extracellular matrices composition on intracellular actin fibers, the interaction and binding capability of MSCs to the endothelium dependent on activation as well as different locomotion strategies MSCs use to migrate through physiological and artificial matrices. Unraveling molecular, cellular and physical properties of MSC in the context of their immune-regulatory capacity is the prerequisite for a safe and successful clinical use.

##### **2. Goals**

The main objective of this PhD Study is to perform design, arrangement and testing of opto-fluidic platform equipped with fiber-optic sensors:

First, the PHD student will perform modeling and simulation of microfluidic micro-channels for transportation of the subjected bio-fluid. Based on the results of modeling an opto-fluidic platform will be set. In addition the PhD student will investigate different fiber-optic sensing configurations mostly based on the low-coherence interferometry. The most promising sensing configuration will be interrogated with the opto-fluidic platform and thoroughly tested in terms of measurement of physical parameters of MSCs. Finally, the PHD student should perform signal processing of raw experimental data, critically analyze the obtained results following up with report preparation, writing of scientific publications and their presentation.

### 3. Application Requirements

A prospective PhD student should possess a Master Degree in a relevant discipline such as Electrical Engineering, Chemical Engineering, Biochemical Engineering, Biomedical Engineering and Physics and to have a broad knowledge in the engineering, especially in optics, fiber-optics and opto-electronics. Furthermore excellent skills and experience in modeling and simulation using different FEM platforms, e.g. ANSYS, COMSOL, ZEMAX, MATLAB, LabVIEW, etc. are required. In addition he/she should be familiar with microsystem techniques (MST) such as micro-electro-mechanical systems (MEMS) and micro-fluidic platforms, such as Lab-on-a-Chip (LOC). Finally, applicants have to be ready to work experimentally with tiny devices such as fiber-optic waveguides.

The PhD Study will be performed in cooperation with the Austrian Center for Medical Innovation and Technology, ACMIT GmbH, based in Wiener Neustadt, Lower Austria. The prospective student will perform research there.

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