

Doctoral School of Information and Biomedical Technologies Polish Academy of Sciences (TIB PAN)

SUBJECT: Injectable hydrogel-based nanofibrous scaffolds for tissue engineering

SUPERVISORS: dr hab. Filippo Pierini, email: fpierini@ippt.pan.pl, Institute of Fundamental Technological Research Polish Academy of Sciences, ul. Pawińskiego 5b Warsaw 02-106, Poland.

dr Paweł Nakielski, email: pnakiel@ippt.pan.pl, Institute of Fundamental Technological Research Polish Academy of Sciences, ul. Pawińskiego 5b Warsaw 02-106, Poland.

DESCRIPTION: Injectable biomaterials are revolutionizing medical treatments by making them less invasive and preserving tissue integrity^[1]. These advancements are particularly crucial for treating soft tissues, such as the intervertebral disc (IVD), which plays a vital role in spine function and flexibility by absorbing stress and shock. Lower back pain, often caused by IVD degeneration, impacts millions globally, and the nucleus pulposus (NP) with its 'jelly-like' extracellular matrix (ECM) is central to this issue.

Material scientists are at the forefront of developing nanomaterials for biomedical applications, focusing on minimally invasive approaches^[2]. Our research aims to create advanced injectable biomaterials like hydrogels and nanoparticles to support cell viability, proliferation, and tissue regeneration for various applications, including cartilage, IVD, and wound healing^[3].

The proposed PhD project is focused on designing and developing materials made by biopolymers via electrospinning and laser structuration. The obtained hydrogel-based nanostructures will be extensively studied to prove their superior features and exceptional functionalities. Many articles published in international scientific journals with high impact factors and a few presentations at international conferences are expected to be obtained as the outcomes of this Ph.D. study path.

We invite enthusiastic PhD candidates to join our dynamic research team in a project focused on designing and developing novel biopolymer-based materials for treating IVD degeneration.

REQUIREMENTS:

- Holding an MSc degree in Chemistry, Polymer Science, Physics, Nanotechnology, or any related field of Materials Engineering
- Solid background in polymer material development (expertise in electrospinning as well as hydrogel and conductive polymer nanomaterial fabrication is desirable)
- Keen interest in polymer nanomaterial characterization (e.g., SEM, AFM, FT-IR, XRD, DSC, TGA, Photothermal characterization, etc.)
- Ability to design, execute, and evaluate research experiments
- Excellent collaboration skills as well as the ability to work independently
- Highly capable of communicating scientific results in English, both orally and in writing

BIBLIOGRAPHY:

- [1] Collin E.C. et al., An injectable vehicle for nucleus pulposus cell-based therapy, *Biomaterials*, 32(11) pp.2862-2870, 2011
- [2] Nakielski P. et al., Laser-assisted fabrication of injectable nanofibrous cell carriers, *Small*, 18(2) pp.2104971-1-18, 2022
- [3] Nakielski P. et al., Minimally invasive intradiscal delivery of BM-MSCs via fibrous microscaffold carriers, *ACS Applied Materials and Interfaces*, pp.1-16, 2023