EuroTech PhD Scholarship Oct 2021

Multi-scale imaging of immunomodulation at the infarcted myocardium by functionalized elastomers

The Vandoorne laboratory (Faculty of Biomedical Engineering) is looking for an excellent PhD student. The first year of the PhD will be funded by the prestigious EuroTech scholarship (Oct 2021- Sept 2022). This prestigious scholarship entails a joint project of the In Vivo Multi-Scale Imaging lab of Dr. Katrien Vandoorne in conjunction with the Matrix regeneration lab of Prof. Carlijn Bouten (at Eindhoven University, The Netherlands). The project will be performed at the Technion.

Description of the project:
Ischemic heart injury is among the most frequent and lethal wounds worldwide. The ischemic core of the infarction becomes necrotic and presents an inflammatory stimulus. In the first four days after myocardial infarction (MI), macrophages remove dead myocytes before tissue repair restores organ integrity. Yet, if the inflammatory response is disproportionate, further damage may occur and inflammation becomes chronic (lasting for several weeks). Long term infarct healing success determines whether a patient will suffer from post-MI heart failure. Exacerbated inflammation induces tissue damage and halts repair. In situ immunomodulating approaches can be used to balance inflammatory responses not just at the stage of acute inflammation, but even at later stages, triggering tissue regeneration by the body itself at the site of implantation[4].

In this project, elastomers, functionalized to harness the innate immune response, will be tested. This new class of injectable materials is based on synthetic peptide chemistry, supramolecular self-assembly, and immobilization of heparin and interleukin 4 (IL-4), which is known to skew the polarization of macrophages into the M2 “wound healing” phenotype. Ureido-pyrimidinone (UPy)-modified chain extended polycaprolactone (CE-UPy-PCL) and UPy-modified heparin binding peptide (UPy-HBP) will be mixed to further immobilize heparin, and functionalize IL-4 via its heparin binding domain[4]. Successful in vitro tests with human monocyte-derived macrophages have demonstrated that the IL-4-heparin functionalization effectively promoted macrophage polarization into an anti-inflammatory phenotype. However, modulating immune responses using functionalized biomaterials in the injured myocardium cannot be probed in an integrated way in vivo in high resolution. To characterize these modulated immune responses, we will develop multi-scale cardiac imaging methods (PET/ CT/MRI) to serially evaluate this immunomodulating regenerative treatments focusing on immune responses.

We are happy with any personal scientific input of the PhD candidates. Interested PhD students can contact Dr. Katrien Vandoorne (k.vandoorne@technion.ac.il).

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