Harnessing the Host Response for *In Situ* Cardiovascular Tissue Engineering – the Challenge of Elastogenesis

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Abstract

The use of acellular resorbable synthetic scaffolds for replacing diseased cardiovascular tissues is an attractive strategy that has shown great promise in recent preclinical studies and ongoing clinical trials. These scaffolds are designed to instantaneously take over the functionality of the replaced tissue upon implantation, and maintain functionality while they are gradually resorbed and replaced by autologous new tissue by infiltrating cells, directly *in situ*. This process of *in situ* tissue engineering is poorly understood to date, leading to unpredictable variability in outcome. Moreover, one of the biggest unmet challenges is the *in situ* regeneration of a functional, native-like elastin network, which is critical for sustaining long-term functionality of cardiovascular tissues. In this talk, I will present our efforts in the understanding and controlling of the *in situ* formation of functional new cardiovascular tissues (i.e. blood vessels and heart valves) by modulating the host immune response using resorbable supramolecular elastomers. Specifically, I will elaborate on our recent results on the influence of biomechanical loads on the inflammatory and regenerative processes to such scaffolds, and how these may dictate tissue formation and elastin deposition in particular, both *in vitro* and *in vivo*.

Biography

Dr.ir. Anthal Smits was appointed Assistant Professor at Eindhoven University of Technology in 2016, where he since initiated and leads the ImmunoRegeneration Group as one of the main research pillars of the Department of Biomedical Engineering and the Institute for Complex Molecular Systems (ICMS). His research is aimed at modulating the immune response using biomaterials in order to induce functional, homeostatic tissue regeneration. His group performs interdisciplinary work, dedicated to gaining a mechanistic understanding of the interactions between immune cell behavior, biomaterial design, and biomechanical loads, in conditions of health and disease. The main target applications are cardiovascular replacements (e.g. heart valves and blood vessels), yet the research is curiosity-driven, and applicable to a wide variety of clinical applications. Dr. Smits is a member of the Heart Valve Society and the *Tissue Engineering* Young Investigator Council, among others. He is a leading researcher in various international research programs and public-private partnerships, such as the Materials-Driven Regeneration program (NWO Gravitation; 25 M€) and the Cardiac Moonshot within the RegMed-XB program (800,000 €).