

Can we grow valves inside the heart?

Perspectives on material-based *in situ* heart valve tissue engineering.

Abstract

We investigate and design *in situ* heart valve tissue engineering technologies using instructive, cell-free, biodegradable scaffolds as an approach to create living valves inside the human heart. This lecture addresses the challenges to develop scaffolds that i) function upon implantation and with time of tissue formation and scaffold degradation, ii) are capable of harnessing the natural host response, and iii) provide the necessary cues for a stable and organized load-bearing extracellular matrix *in vivo*. I will address how biomimetic *in vitro* models and computational analyses are used in direct comparison with preclinical studies to optimize scaffold biochemical, biophysical, and degradation properties. The resulting scaffolds have demonstrated sustained mechanical and biological functionality during long-term orthotopic (12 month FU) and transcatheter (6 month FU) implantations as pulmonary valve in large animals. These results offer new perspectives for endogenous heart valve replacement starting from readily-available synthetic grafts.