Biomedical Engineering Wallace H. Coulter Foundation Lecture Series presents Heart Month

Biologically-Engineered Tubular Heart Valves

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Lecture: Friday, February 22, 2019
9:00AM-10:00AM
Room EC 1104
10555 West Flagler Street
Miami, FL 33174

FIU Engineering & Computing
Biomedical Engineering

Biography

Bob Tranquillo received his Ph.D. in Chemical Engineering in 1986 from the University of Pennsylvania. He was a NATO Postdoctoral Fellow at the Center for Mathematical Biology at Oxford for one year before beginning his appointment in the Department of Chemical Engineering & Materials Science at the University of Minnesota in 1987. He has served as the head of the Department of Biomedical Engineering since its inception in 2000. Prof. Tranquillo has used a combined modeling and experimental approach to understand cell behavior, in particular, directed cell migration, and cell-matrix mechanical interactions. More recently, his research program has focused on the role of these cell behaviors in cardiovascular and neural tissue engineering applications. His research program has resulted in over 100 peer-reviewed original research publications as first or senior author among 120 total, being recognized with his selection for the TERMIS-AM Senior Scientist Award in 2015. Prof. Tranquillo is a Fellow of the American Institute of Medical and Biological Engineering, International Academy of Medical and Biological Engineering, and the Biomedical Engineering Society, and he is also a Distinguished McKnight University Professor.

Abstract

We have developed a biologically-engineered tissue tube, which is allogeneic upon a decellularization performed prior to implantation and thus "off-the-shelf." It is grown from remodeling of dermal fibroblasts entrapped in a sacrificial fibrin gel into tissue tube that is then decellularized using sequential detergent treatments. The resulting cell-produced matrix tube possesses physiological strength, compliance, and alignment (circumferential). Using the concept of a tubular heart valve, where the tube collapses inward with back-pressure between 3 equi-spaced constraints placed around the periphery to create one-way valve action, we have reported unprecedented results implanting valves fabricated from these tubes mounted on 3-prong crown frames into the sheep aortic position for 6 months (Syedain et al, 2015). A transcatheter aortic valve based on this principle, with the tissue also grown directly on the stent, is presented. We have also used the tubular heart valve principle to innovate a tubular pediatric heart valve based on tube-in-tube design with degradable suture to provide the 3 constraints (Reimer et al, 2015) and developed initial experience in a young lamb model (Reimer et al, 2016). A novel tri-tube design with more durable commissures is presented along with initial results in the growing lamb model.

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