UCLA Engineering
HENRY SAMUELI SCHOOL OF
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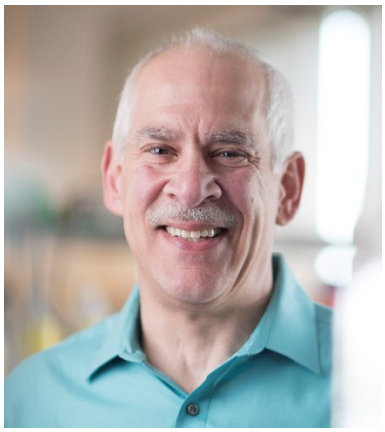
BIOENGINEERING

PRESENTS

Vascular Grafts and Tubular Heart Valves that Heal and Grow



THURSDAY, April 5, 2018
12:00 – 1:00 PM
2101 ENGINEERING V

Robert T. Tranquillo, Ph.D.
University of Minnesota
Distinguished McKnight University Professor,
Department Head,
Department of Biomedical Engineering

ABSTRACT:

We have developed a novel tissue-engineered vascular graft, 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).

We have shown promising results implanting these tubes into the sheep femoral position at 6 months, including complete recellularization and positive remodeling) without mineralization, dilatation, or immune response (Syedain et al, 2015). Similar results have recently been obtained in a pivotal preclinical model as an AV graft for 6 months, including periodic access with a dialysis needle (Syedain et al, 2017). We have also recently shown somatic growth of these tubes implanted into the pulmonary of young lambs for almost 50 weeks, through adulthood (Syedain et al, 2016).

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-pronged crown frames into the sheep aortic position for 6 months (Syedain et al, 2015). We have also used the principle of a tubular heart valve to innovate a tubular pediatric heart valve based on attaching two tubes together with degradable suture to provide the constraints (Reimer et al, 2015) and developed initial experience in a young lamb model (Reimer et al, 2016).

Some of the science and engineering extending back 25 years and underlying these recent translation efforts will be included, particularly how cells sense fibril alignment, which results in contact guidance and the circumferential alignment of the tissue tube.

BIOGRAPHY:

Prof. 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, 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.