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Tissue and organ fabrication for the heart

Treatment of cardiovascular disorders remains a major medical challenge. Pharmacological interventions, mechanical assist devices and heart transplantation have provided life saving options. While heart transplantation has been the most successful treatment modality for end stage heart failure, chronic shortage of donor organs has limited widespread applicability. Tissue engineering has tremendous potential to provide alternative treatment modalities that could help alleviate the donor heart crisis. Cardiac tissue engineering strategies are focused on the development of functional 3-dimensional (3D) patches, fabricated by culturing cells within a natural or synthetic scaffold. Applied to a clinical scenario, 3D heart muscle could be sutured onto the surface of injured left ventricular tissue to support/augment contractile function.

Research at the Artificial Heart Laboratory (AHL) is focused on the development of 3D cardiovascular tissue constructs. We have projects focused on the development of heart muscle, blood vessels, tri-leaflet valves, cell based cardiac pumps, bioartificial ventricles and hearts. In addition, we have projects focused on supporting technologies. These include perfusion systems to support long-term culture and bioreactors for electromechanical stimulation. During the past several years, we have developed the building blocks required for the fabrication and culture of cardiovascular tissue constructs – in this presentation, we will provide an overview of platform technology required to bioengineer functional 3D cardiovascular tissue constructs.

Biography

Ravi Birla has completed his PhD from the University of Michigan, Ann Arbor and is currently with the Department of Biomedical Engineering at the University of Houston, where he also serves as Director of the Artificial Heart Laboratory. His research is in Cardiovascular Tissue Engineering and he has published over 40 peer reviewed scientific. He has extensive experience in the development of 3D models for heart muscle, blood vessels, tri-leaflet heart valves, heart pumps, bioartificial ventricles and bioartificial hearts. Dr. Birla holds several patents in the area of cardiovascular tissue engineering. He is also actively engaged in education and teaching related activities and has recently published a comprehensive textbook in the area of functional tissue engineering.

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