

MAE-ECE Joint Distinguished Seminar

Mechanical Circulatory Support: Design Considerations & Clinical Engineering

Dr. Harvey S. Borovetz
Department of Bioengineering
University of Pittsburgh

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Abstract: Heart failure remains the number one “killer” of Americans in spite of remarkable advances in pharmacologic and medical therapies over the years. For patients who fail to respond, the therapeutic options are few, with cardiac transplantation being the gold standard of care for ~2,000 – 2,500 patients/year in the United States. It is within this setting that mechanical circulatory support devices can fill and have filled an enormous void for many thousands of patients who are in refractory heart failure and who have no realistic therapeutic options. Industry continues to develop innovative mechanical circulatory support devices which are expected to be introduced in the United States over the course of the current decade.

This talk will present design considerations for these mechanical circulatory support devices from the points of view of stakeholders to this technology, i.e., the patients and their families, physicians and allied health personnel and the clinical engineers. The strengths and limitations of current mechanical circulatory support devices will be discussed, along with possible improvements to address current limitations. The role of the bioengineer in the clinical utilization of these devices will be discussed, using the Mechanical Circulatory Support Program at the University of Pittsburgh as an example of this partnership. The need for engineering expertise in the R&D of next generation mechanical circulatory support devices will also be highlighted.

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Dr. Harvey Borovetz is distinguished professor and former chair (2002-2013) in the Department of Bioengineering, Swanson School of Engineering at the University of Pittsburgh and, the Robert L. Hardesty Professor in the Department of Surgery, Univ. of Pittsburgh School of Medicine.

After receiving his BA in Physics from Brandeis University in 1969, Dr. Borovetz went on to earn an MS and a PhD degree, both in bioengineering, from Carnegie Mellon University in 1973 and 1976, respectively. He joined the faculty at the University of Pittsburgh in January, 1976.

Dr. Borovetz's current research interests are focused on the design and clinical utilization of cardiovascular organ replacements for both adult and pediatric patients. Since 1986, Borovetz has served as the academic liaison for the University's Clinical Bioengineering Program in Mechanical Circulatory Support. This program supports patients who are implanted with a left ventricular assist device, or bi-ventricular assist devices, as a bridge to cardiac transplantation or bridge to recovery. This work in mechanical circulatory support follows Dr. Borovetz's early efforts in which he helped cardiac surgeons apply extracorporeal membrane oxygenation (ECMO) to treat successfully a large series of neonates in respiratory distress.

Dr. Borovetz is a Fellow of the American Institute for Medical and Biological Engineering and Inaugural Fellow of the Biomedical Engineering Society. He is a past member of the Board of Trustees of the American Society for Artificial Internal Organs (ASAIO), and a past member of the Board of Directors of The Biomedical Engineering Society.

Host: M. Simaan

