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Bioreactors for tissue engineering

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Many advances have been made in tissue regeneration in last two decades including development of bioreactors of various shapes and flow-patterns. In addition to improving the nutrient distribution, fluid flow also applies shear force on the cells, which is important for certain tissues. Different types of bioreactors have been designed to regenerate tissues while applying mechanical stimuli. Recent efforts have focused on developing design principles using an integrated approach of experiments and computational fluid dynamic modeling. Determining governing equations for fluid flow through porous scaffolds are important to design bioreactors and develop parameters that can be used in non-invasive monitoring of tissues. Tissue regeneration is a dynamic process where the porous characteristics change due to cell growth, assembly of newly secreted matrix components, and degradation of the porous architecture. Understanding the relationship between pressure drop across the scaffold under various flow rates at varying scaffold permeability helps in monitoring tissue growth. Since pressure can be monitored continuously, this could be used as a non-invasive tool. Also, integrating scaffold properties such as elastic properties, and pore size distribution helps in understanding fluid induced deformation and optimize bioreactor operation during the regenerative process. This presentation will discuss these recent advances and considerations for improved operation/monitoring of bioreactors.

Biography

Sundararajan V. Madihally is an Associate Professor (with tenure), Graduate Program Coordinator at Oklahoma State University and holds Edward Joullian Chairin Engineering. He received his Ph.D. from Wayne State University and held a research fellow position at Massachusetts General Hospital/Harvard Medical School/Shriners Hospital for Children. His research interests are in tissue regeneration and delivery options for therapeutic agents (oral, or transdermal). In particular, his research is focused on in vitro functional tissue engineering by mimicking *in vivo* microenvironmentsand understanding the cellular behavior (stem cells, co-cultures) in three-dimensional porous structure. He uses a number of polymers to form scaffolds, delivering growth factors using nanoparticles, and bioreactor designs. He is the author of the textbook "Principles of Biomedical Engineering" and currently writing another textbook on Tissue Engineering. He has published 55 peer-reviewed articles, 30 conference proceedings and presented more than 170 times (invited and conference). He served as a member of the International Editorial Board of Biomaterials Journal and on the Editorial Board of many other open access journals. He has served as reviewer for more than 75 journals and various organizations. He has organized more than 35 sessions in national and international conferences including one in the 2004 World Biomaterials Congress. He has received numerous awards including Undergraduate Student Teacher of the Year in School of Chemical Engineering, Advisor of the Year from College of Engineering Architecture and Technology, Advisor of the year from Oklahoma State University, and Advisor of the Year from National American Institute of Chemical Engineers Organization.

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