MichiganEngineering

Manufacturing Research Seminar

Winter 2007

University of Michigan, Ann Arbor | College of Engineering | Refreshments Provided

Suman Das, Associate Professor
Mechanical Engineering Department
Solid Freeform Fabrication Laboratory
University of Michigan, Ann Arbor

Design, Manufacturing, and Testing of Implantable Scaffolds for Bone Tissue Engineering

Tissue engineering combines the life sciences and engineering to enable the restoration, maintenance, or enhancement of living organs and tissues. Most tissue engineering techniques utilize polymeric scaffold structures endowed with complex internal porous architectures and channels that provide sites for cell attachment and proliferation, and facilitate transport of cells, growth factors and biomolecular signals to promote tissue regeneration at an implantation site. The application of tissue engineering concepts for reconstructing complex anatomical structures requires novel approaches for designing and building complex, three-dimensional scaffolds incorporating gradients of biomaterials, growth factors, and porous architectures that can enable the simultaneous growth and regeneration of multiple tissues and tissue interfaces. We have developed such an approach combining an image-based design method and a solid freeform fabrication technique. The image-based design method uses computed tomography (CT) scans to create scaffold designs that replicate anatomy while incorporating interior porous architectures. The solid freeform fabrication technique, based on selective laser sintering of polymeric powders, is then used to create scaffolds in polycaprolactone (PCL), a bioresorbable polymer. Such scaffolds are now being tested in animal models for bone and cartilage regeneration in the temporomandibular joint (TMJ) and in the spine. I will first describe the process for manufacturing geometrically accurate and mechanically strong PCL scaffolds. Next, I will present the results of a recently completed study in which PCL scaffolds for the mandibular condyle were loaded with autologous bone marrow and implanted in young (6-8 months of age) and old (4-8 years of age) minipigs for 1 and 3 months. The study indicates that engineered PCL scaffolds are capable of providing functional mechanical support and guiding tissue regeneration in a large animal model. Finally, I will present preliminary results of a study involving implantation of PCL scaffolds for intervertebral disc regeneration in minipigs.

Thursday, March 29, 2007
4:00—5:00 PM
1017 H. H. Dow Building

For More information, please call Kathy Bishar at (734) 764-3312 or email at kbishar@umich.edu
http://interpro.engin.umich.edu/mfgeng_prog/mfg_w07.htm

Sponsored BY:

NSF ERC for Reconfigurable Manufacturing Systems

InterPro Manufacturing Engineering

S. M. Wu Manufacturing Research Center

Tauber Manufacturing Institute