

BIOENGINEERING ORGANS AND TISSUES FOR HUMAN TRANSPLANTATION

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Abstract:

Every year, millions of patients suffer loss or failure of an organ or tissue as a result of accidents or disease. Tissue or organ transplantation is a commonly accepted norm under these circumstances. However, constant shortage of donor tissue and organ transplants coupled with high morbidity and mortality has spurred great interest for lab grown tissues/organs as promising substitute. Recent scientific advancement in biomaterials, stem cells in combination with biomimetic environments have made this possible through tissue engineering. In a tissue engineering approach, fabricated polymeric 3D scaffold imitates the native tissue/organ it is replacing, while also providing a temporary functional support for the residing cells. In comparison to synthetic, biologically derived polymeric scaffolds being natural, biodegradable and biocompatible offer resident cells a wide variety of biofunctional motifs that help to regulate cell adhesion, proliferation, phenotype, matrix production and enzyme activity. In our laboratory at IIT Guwahati, we utilize silk as a natural model biopolymer to fabricate various tissue forms to study and understand the mechanisms related to cell-surface interactions, stem cell differentiation towards functionality. In my presentation, I would discuss our recent findings to reconstruct native tissues/organs including smart human skin, cornea, intervertebral disc, engineered bone, cartilage, blood vessel, bioartificial pancreas, injectable hydrogels for drug delivery etc. Findings from these studies have very important implications in relation to development of artificial tissues and grafts towards future *in vivo* human transplantation.