REGIONAL CENTRE FOR BIOTECHNOLOGY
Seminar series

Silk Matrix Based Tissue Engineering

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In recent years scientific advances in biomaterials, stem cells in combination with biomimetic environments have created unique opportunities to fabricate tissue/grafts using engineered extracellular matrices called ("scaffolds"), cells, and biologically active molecules. The polymeric scaffold imitates the natural structure of the tissue it is replacing, while also providing a temporary functional support for the 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 adhesion, proliferation, cell phenotype, matrix production, and enzyme activity. We utilized silk as a natural model biopolymer to fabricate various matrix forms including films, macroporous scaffolds, micro beads, hydrogels, and nanoparticles from cocoons and silk glands of mulberry (*Bombyx mori,* Bombycidae) and non-mulberry (*Antheraea mylitta,* Saturniidae) to study and understand the mechanisms related to cell-surface interactions, cell migration, proliferation and stem cell differentiation towards engineering functional tissue grafts and drug delivery systems. Here, I will discuss our recent silk tissue engineering approaches to mimic and reconstruct native like human tissues/organs including human cornea using corneal stem cells, the knee meniscus, Intervertebral disc along with the development of a model system to mimic and regenerate aligned and rotated angle ply laminated tissues. Underlying the role of tissue architecture towards functionality, and as a part of the future studies, we propose to extend our research towards developing tissue engineered *in vitro* disease models for drug screening, vascularised scaffolds, cardiac patches and other vital organ/grafts requiring transplantation. Findings from these studies will have important implications in relation to development of artificial tissue engineered grafts and tissue models towards future *in vivo* transplantations.