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TISSUE ENGINEERING - A REVIEW

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ABSTRACT

Tissue engineering is defined as the *in vitro* or *in vivo* creation or regeneration of differentiated tissue for the clinical replacement of a compromised body structure. The ultimate goal of tissue engineering is to reconstruct an organ by taking advantage of recent progress in molecular biology (i.e., mechanisms controlling cell differentiation and gene transfer), materials science (development of "smart" and bioresorbable polymers), and surgical techniques. Tissue engineering is not so much a science in the traditional sense, but an amalgam of technologies from disparate fields that are grouped such that clinically relevant tissue replacement therapies may result.

Current progress in the 'tissue engineering' and molecular biology fields now present the opportunity to 'create' several tissue types and replace functions not previously possible with synthetic material technology alone. In fact, significant progress has been made in developing tissue replacement technologies for the nervous, orthopaedic and cardiovascular fields. The successful regeneration of these tissues requires 'biologically interactive' systems for areas that do not normally regenerate, or, that state-of-the-art material systems are incapable of providing for a therapeutic period of time. These systems provide both short-term support and appropriate cellular signaling agents so that therapeutic tissue regeneration is facilitated.

Industrial and university centers developing tissue engineered structures generally utilize 3-dimensional scaffolds based on degradable polymers or natural matrices like collagen. These are normally seeded with cells that will, after a period of biological conditioning, organize and differentiate within the matrix and create the desired replacement tissue. Also, the degradable matrices are frequently loaded with growth factors or covalently immobilized with receptor specific sequences to further promote growth of the desired replacement tissue. This talk will review the progress to date and difficulties that remain for three tissue types: two- and three- dimensional material systems for nervous system regeneration, small bore vascular grafts, and cartilage replacement technologies.