Tissue Engineering: Integration of nanotechnology & animal tissue culture

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Abstract: Tissue engineering is an interdisciplinary field involving life sciences, medicine, material science and engineering. Principle of tissue engineering involves the integrated approach in the use of suitable cells, bioreactors, nano-scaffolds (polymers) and signal molecules (growth regulators) to create functional tissues capable of restoring parts of diseased or damaged organs. Ideally the source of cells for tissue engineering should be analogous of cells with proliferative capacity. These cells can often be harvested from the patient and expanded. For cells with limited capacity to proliferate like cardiomyocytes, pluripotent stem cells represent a potential source.

Suitable bioactive degradable scaffold materials (obtained by electro-spinning) guide the differentiation and assembly of cells into functional 3-D tissues. Custom designed bioreactors support growth of tissues in vitro and develop predictive models that describe tissue properties as a function of growth time. They are used in such a way as to enable the tissues to gain specialized/ appropriate function(s) like: contractile function or mechanical stability, during *in vivo* cultivation.

Tissue engineered products are being utilized to replace damaged organ in human in order to illustrate the promise this new field holds. This include: successfully engineered trachea, urinary bladder, cartilage, blood vessels, heart valves and skin. Successful cases of *in vitro* tissue engineering are also plenty like: Bone, hepatic, muscle, tendon, follicle and neural cells. Repair of infracted myocardium using cardiac tissues is a possibility.

There are many issues related to tissue engineering which are to be studied for successful implementations like: Hydro-gel encapsulation, mechanical stimulation and matrix-free approaches. There is need to know how bioactive molecules, different cell types and engineered tissues can accelerate healing processes once surgically implanted with injured tissues as well as device optimal implantation strategies and time.

The biomaterials and bioreactors must be designed with cost and safety in mind. Integrating Animal tissue culture techniques with nanotechnology is going to create revolution together in material sciences and biomedical sciences.

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