Scalable 3D Bioreactor Increases Efficiency of Tissue Engineering

TITLE

Continuous Flow Bioreactor for Magnetically Stabilized Three-Dimensional Tissue Culture

INVENTORS

Christopher R. Lambert

Grant W. McGimpsey

Raymond L. Page

Tanya Dominiko

PATENT STATUS:

PCT/US2011/027579

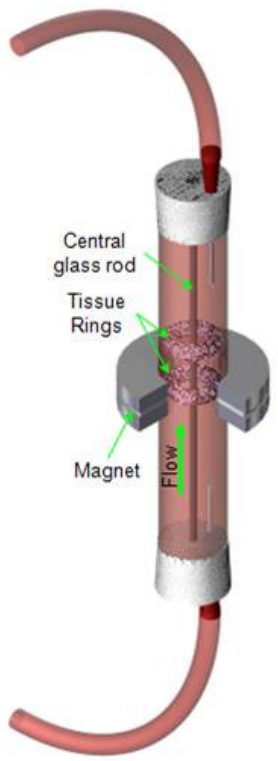
LICENSING STATUS:

Worldwide rights available

Contact:

Todd Keiller, Director
Technology Transfer
WPI
100 Institute Rd
Worcester, MA 01609
tkeiller@wpi.edu
+1 508 831 4907

Continuous Flow Bioreactor



BACKGROUND

Cell culture is typically performed on flat 2D surfaces for practical reasons. Although the coating of such surfaces can mimic the biochemical environment of the extracellular matrix of live tissues, the geometry of such a system confines both the ability to directly compare the behavior of these cells with those in living tissue and the ability to generate tissue. Cells growing on a 2D surface cannot interact with other cells in all directions as they would in any tissue of a living organism.

Tissue engineering has become increasingly important in the replacement of damaged tissues and organs of patients resulting from injury or disease. However growing cells on a 3D porous substrate or scaffold has its own limitations. Building of the scaffold either from processed natural products or biomaterials is challenging. Once such a solid scaffold is exposed to the cells, tissue growth or generation is practically left on its own with no outside control, most probably leading to unexpected and unwanted results. Thus, a need exist for tissue engineering without the need for scaffolding that allows for scalable, efficient, costs reduced production of cells, tissues and their products.

SUMMARY

- The invention pertains to bioreactor systems, systems for culturing cells and methods of utilizing a bioreactor for bioengineering methodologies such as tissue reconstruction, production of biofuel and bioproducts, production of cell products, and cell amplification without the use of a solid support or scaffolding.
- The use of magnetic beads and magnetic field allows for 3D manipulation of cell amplification into tissue and/or the production of desired cellular products from cells.
- Cells attached to a magnetic support can be mechanically stimulated by varying the magnetic field allowing for the replication of stress forces experienced by certain cell types, such as heart muscle cells. The magnetic field is varied to produce desired predetermined structure of the cells into tissue.

ADVANTAGES

- increased efficiency via reduction of costs and use of materials
- Use of continuous feed minimizes down time in running, harvesting and maintaining the system
- If desired, the need to have a support or scaffolding is avoided
- Magnetically stabilized tissue in the bioreactor can be shaped to a desired structure by controlling the magnetic field and also the flow of the culture medium.
- The ability to vary the magnetic field allows for control of the growth and proliferation of the cells.