Three-Dimensional Cell Adhesion Matrix

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Technology description

Researchers at the University of California, Davis have invented a series of novel, bioactive, purely synthetic and "made-to-order" cell adhesion matrices which incorporate molecular recognition elements such as cell surface integrin receptor ligands. These biodegradable and biocompatible nanofibrous matrices are advantageous for three-dimensional (3D) tissue culture and tissue engineering. They are comprised of high molecular weight polyvinyl alcohol (PVA) scaffolds functionalized with high-affinity cell adhesion ligands against naturally expressed or cell-transfected integrins, and cross-linked via cyclic complexation of boronic acid crosslinkers with polyhydroxyls on PVA. By using a number of biocompatible modified polymers, researchers can fine-tune the crosslink density and mechanical properties of the matrices. Cell incorporation is achieved by simultaneous encapsulation of cellsin situwithin the forming matrices, which occurs rapidly at room temperature and physiological pH. Alternatively, cells can be seeded and maintained in culture atop a pre-formed matrix. Extracellular matrices suitable for 3D culture of different cell types can be made to order by combinatorially incorporating a number of molecular recognition elements, such as ligands which target cell-expressed integrins, into the matrix. Finally, crosslinking of the bioactive PVA scaffolds is reversible on demand by the addition of a cis-diol competitor such as fructose, facilitating non-enzymatic degradation of the hydrogel matrix and rapid extraction of cells from 3D culture for other biological applications.
A novel cell adhesion matrix incorporating molecular recognition elements for tissue engineering.

Application area

Stem cell maintenance, directed-differentiation, transplant and engraftment
Eliciting morphogenic patterns observed in commercially available laminin-rich chemically undefined extracellular matrices
Stem cell maintenance, directed-differentiation, transplant and engraftment
3D cell culture
Culturing of cognate integrin-expressing tissue types including, but not limited to:
endothelial cells
embryonic stem cells
hematopoietic stem cells and mesenchymal stem cells

both non-malignant and malignant human mammary epithelial cells
human colon adenocarcinoma

Advantages

Synthetic biomaterial scaffolds with defined bioactive molecular recognition elements
Fine-tunable mechanical properties
Purely synthetic and well-characterized
reproducible and localized investigation of cell response to biochemical cues

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