Washington University in St. Louis
Office of Technology Management

TISSUE ENGINEERING SCAFFOLD FOR CELL DIFFERENTIATION AND DELIVERY TO INTERVERTEBRAL DISC FOR TREATING LOWER BACK PAIN

Barcellona, Marcos, Setton, Lori, Speer, Julie

Weilbaecher, Craig

T-019297

Background:

Severe low back pain and disability can result from intervertebral disc (IVD) degeneration caused by cell phenotype changes in the nucleus pulposus (NP) region. While autologous stem cells have be used to treat lower back pain, currently there are no tools to control differentiation of these cells toward targeted and biosynthetically active NP cells.

Technology:

Researchers in Prof. Lori Setton's laboratory engineered a peptide-functionalized hydrogel polymer that can promote NP cell synthesis and a healthy phenotype from stem cells. This polymer could be used for a variety of tissue engineering applications such as coating tissue culture surfaces, making cell-polymer culture constructs in vitro, and delivering cells [induced pluripotent stem cells (iPSC) or adult NP cells] to the IVD to treat back pain caused by IVD degeneration.

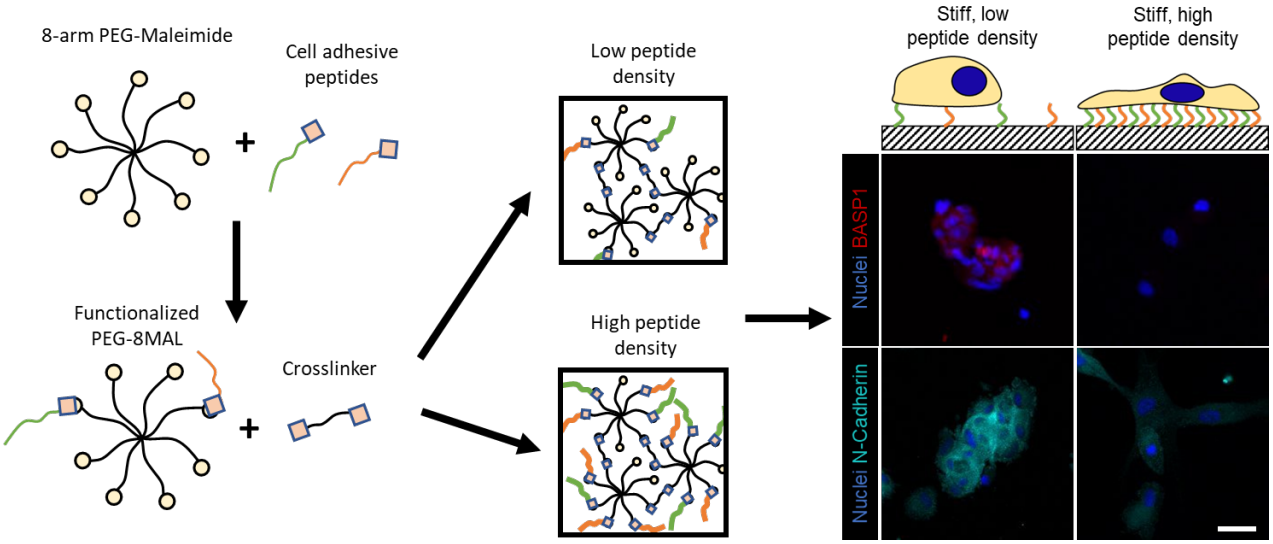
Value proposition:

- Promotes cell attachment and differentiation toward a juvenile NP phenotype
- Tunable stiffness in the range of 5 to 50 KPa to support the load-bearing function of IVD
- Controllable reaction kinetics enables a range of cell phenotype changes
- Materials-based approach to restore the mechanical properties of the disc as well as cellular bioactivity

Stage of development:

The inventors conducted in vitro proof-of-concept studies with primary human cells from pathogenic NP tissues. They identified an optimal formulation of hydrogel stiffness and peptide concentration. (Publication)

Creation of a polymer-peptide hydrogel scaffold with tunable stiffness and adhesive group presentation to mimic healthy NP cell environment



Related Web Links: Setton Lab

Patent status: Application pending

Publication: Barcellona, M. N., Speer, J. E., Fearing, B. V., Jing, L., Pathak, A., Gupta, M. C., ... & Setton, L. A. (2020). Control of adhesive ligand density for modulation of nucleus pulposus cell phenotype. *Biomaterials,* 120057.