INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Magnetically Aligned Synthetic ECM Fibers within a Hydrogel

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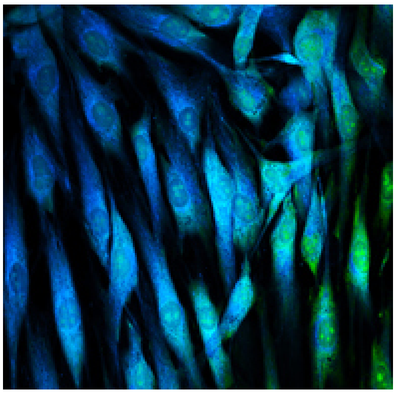

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OVERVIEW

Fibrous extracellular matrix (ECM) provides tissue structure and influences functions

- Biopolymers used to study ECM are limited in reading biophysical cues
- Researchers generated synthetic fiber segments which align by magnetic electrospinning

BACKGROUND

Complex organisms are made up of tissues that are predominately embedded within a fibrous extracellular matrix (ECM) consisting of proteins that provide mechanical structure to resident cells. Beyond its structural properties, this matrix helps to regulate cell functions such as migration, proliferation, and stem cell differentiation. Various methods have been employed to create in vitro alignment of matrix fibers in purified biopolymer hydrogels, including flow-induced alignment, uniaxial tensile deformation, and magnetic particles. Still, purified biopolymers have been limited in their ability to respond to important biophysical cues such as stiffness, fiber density, and fiber alignment.

INNOVATION

Researchers at the University of Michigan have generated synthetic, cell-adhesive fiber segments of the same length as stromal proteins through a process called electrospinning. Superparamagnetic iron oxide nanoparticles are purposely embedded within synthetic fiber segments to provide a means by which to align those fibers within an amorphous bulk hydrogel. The investigators were able to show that this type of fiber alignment was able to prompt invading multicellular strands to separate into disconnected single cells and multicellular clusters. The magnetic fiber strands can also be incorporated into other natural and synthetic hydrogels and aligned with inexpensive and readily accessible rare earth magnets.Given that matrix mechanics influence important cellular behaviors, studying their properties may increase knowledge about fundamental biological processes such as embryogenesis and adult tissue homeostasis as well as diseases such as fibrosis and neoplasia. This technology can provide a laboratory environment where stiffness, fiber density, and fiber alignment can be investigated to provide insights into those morphogenic and pathogenic processes which take place in biological systems.