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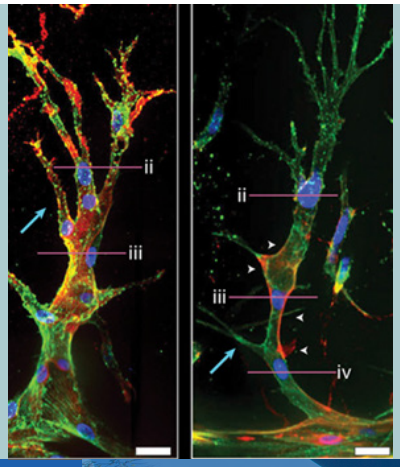

Hydrogel-based tissue engineering scaffold that supports angiogenesis and rapid vascularization

Brief Description

Bioactive hydrogels microengineered from step-growth derived PEG-peptide macromers

INVENTOR

Christopher Chen, Professor of Bioengineering

STATE OF DEVELOPMENT

- *In vitro* testing

INTELLECTUAL PROPERTY

UP application (US20120202263 A1)

REFERENCE MEDIA

Stevens et al. J Biomed Mater Res Part A, 2015, 103(10), p. 3331-3338.

Galie et al. PNAS, 2014, 111(22), p. 7968-7973.

Li et al. J Biomed Opt, 2014, 19(1), e016006.

Nguyen et al. PNAS, 2013, 110(17), p. 6712-6717.

Miller et al. Biomaterials, 2010, 31, p. 3736-3743.

DESIRED PARTNERSHIPS

- License
- Co-development

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Docket #W5599

Problem

Angiogenesis is the process by which new capillary vessels form from existing vasculature and is involved in wound healing and embryonic development. The dysregulation of angiogenesis has been implicated in cancer, inflammation, and ischemic diseases. Examining the physical process of angiogenesis requires experimental systems that can readily manipulate the formation of capillary vessels. A severe limitation in expanding the field of engineered biomaterials is the lack of adequate vasculature for nutrient delivery and the elimination of metabolic waste products. Synthetic hydrogels based on polyethylene glycol (PEG) have historically used multi-arm precursors that are challenging and expensive to synthesize and purify.

Solution

The Chen lab has designed an inexpensive, robust synthetic route to bioactive PEG-based hydrogels that can be implemented as scaffolds with inherent pathways for the formation of new vasculature. Because of PEG's neutral charge, hydrophilicity, and resistance to protein adsorption, it is biocompatible for *in vitro* and *in vivo* experiments. The researchers implemented a step-growth polymerization of bis-cysteine matrix metalloprotease (MMP)-sensitive peptides and PEG-diacrylate to generate high molecular weight photoactive polymers, followed by crosslinking into hydrogels via radical-mediated photopolymerization. As the first 3D biomimetic model to reconstitute angiogenic sprouting, this system can elucidate the molecular mechanisms underlying vascularization and wound healing, as well as aid in the design of materials for tissue engineering applications.

Advantages

- Inexpensive, readily available PEG precursors
- Straightforward chemical synthesis
- Biocompatible material

Applications

- Tissue engineering
- Wound healing
- Modulation of angiogenic sprouting
- Promote vascularization in synthetic materials

(Image, Top Left) Characterization of late sprouts via confocal immunofluorescence images shown in z-projection. On left, mature sprout stained for podocalyxin, with blue arrow marking cell invading out from stalk, in cross-sections of tip cell. On right, mature sprout stained for laminin, with blue arrow marking stalk cell filopodia.
Adapted from Miller et al, 2010.