Bioactive Film Scaffolds Based on Elastin-Like Recombinamers

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Introduction

Elastin-like recombinamers (ELRs) are genetically engineered protein based polymers that are inspired on the extracellular matrix protein elastin and can be designed to exhibit specific amino acid sequences including desired bioactive epitopes. While their potential as self-assembling biomaterials is recognized, their novelty still requires further exploration and characterization. Here, we report on the development of ELR-based films as potential scaffolds for tissue engineering and regenerative medicine.

Materials and Methods

ELRs containing the cell adhesive epitope arginine-glycine-aspartic acid-serine (RGDS) were synthesized using standard recombinant protein production techniques, cross-linked with Tris(hydroxyl-methyl)phosphine (THP), and assembled over smooth or lithographically patterned surfaces. Peptide concentration, pH, temperature, drying time, and wettability of the underlying substrate were optimized to permit uniform ELR deposition and subsequent release of the films. These films were then used as culture substrates for rat mesenchymal stem cells (MSCs) in order to evaluate their cell adhesive properties and biocompatibility.

Results

Scanning electron microscopy observations revealed that films were 10-100 µm thick, depending on the fabrication conditions, and exhibited sufficient structural integrity to be handled by tweezers and serve as in vitro cell culture substrates. Optical and immunofluorescence microscopy demonstrated that MSCs adhered on the ELR films, exhibiting a spread morphology and well-defined actin cytoskeleton. Films were also fabricated comprising topographical features with heights ranging between 500 nm and up to 10 µm.

Discussion and Conclusions

We have developed cell adhesive thin film scaffolds based on a bioactive, biomimetic, and biodegradable ELR material. This fabrication processes combines lithography (top-down) and peptide self-assembly (bottom-up) and could be used to craft thin “bioactive patches” that exhibit both biomolecular and physical signals with potential use in a variety of regenerative applications.

References