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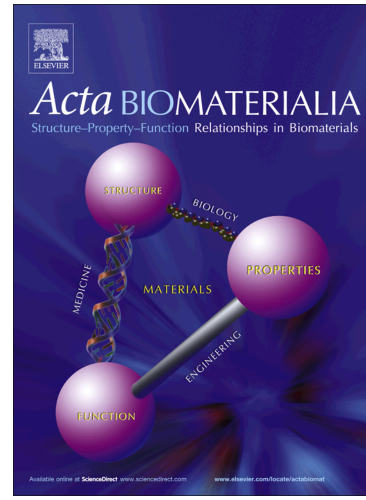

Full length article

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Additive manufacturing of hierarchical injectable scaffolds for tissue engineering

A. Béduer[a,b], N. Piacentini[b], L. Aeberli[b], A. Da Silva[c], C.A. Verheyen[b], F. Bonini[a], A. Rochat[d], A. Filippova[a], L. Serex[b], P. Renaud[b], T. Braschler[a]

[a]Department of pathology and Immunology, Faculty of Medicine, University of Geneva, CMU, Rue Michel-Servet 1, 1211 Genève 4, Switzerland

[b]Laboratory of Microsystems 4, STI-IMT, Station 17, EPFL, 1015 Lausanne, Switzerland

[c]Center for Biomedical Imaging CIBM, ENT-R, Station 6, EPFL, 1015 Lausanne, Switzerland

[d]Department of Experimental Surgery, Pavillon 4, Lausanne University Hospital (CHUV), 1011 Lausanne, Switzerland

Abstract

We present a 3D-printing technology allowing free-form fabrication of centimetre-scale injectable structures for minimally invasive delivery. They result from the combination of 3D printing onto a cryogenic substrate and optimisation of carboxymethylcellulose-based cryogel inks. The resulting highly porous and elastic cryogels are biocompatible, and allow for protection of cell viability during compression for injection. Implanted into the murine subcutaneous space, they are colonized with a loose fibrovascular tissue with minimal signs of inflammation and remain encapsulation-free at three months. Finally, we vary local pore size through control of the substrate temperature during cryogenic printing. This enables control over local cell seeding density *in-vitro* and over vascularization density in cell-free scaffolds *in-vivo*. In sum, we address the need for 3D-bioprinting of large, yet injectable and highly biocompatible scaffolds and show modulation of the local response through control over local pore size.

Keywords

3D printing, hydrogel, biocompatible, injectable, implantation, carboxymethylcellulose

1. Introduction