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Bioprinted 3D vascularised network tissue constructs using cell-laden bioink

Andrea Barbetta, Cristina Colosi, Marco Costantini and Mariella Dentini
Sapienza University of Rome, Italy

Microfabrication technologies have been proposed as methods to create vascularized tissues. However, despite significant advances, insufficient aligned cellular organization and limited hierarchical architecture has impeded progress toward mimicking the highly vascularized tissue in 3D. To address these challenges, we introduce a new paradigm of vascularization that uses bioprinting as a robust method for fabricating 3D tissues constructs. This approach is based on a cell-laden fiber deposition technique that uses low-viscous solutions of biocompatible materials and cells and can form 3D, interconnected hydrogel fiber grids with high fidelity and reproducibility. The described method uses calcium-alginate as sacrificial templating polymer during the 3D printing process and produces methacrylated gelatin cell-laden constructs with features in the order of 100 micrometer. We used this technology to produce 3D pre-vascular networks to be used as scaffold for a second, post-seeded cellular type. Endothelial cells (HUVECs) have been 3D printed in interconnected fiber meshes and spread and matured in tubular structures. Cardiomyocytes have been seeded on top of the endothelial network giving rise to a pre-vascularized, 3D cellular construct that showed strong spontaneous beating behavior. This methodology that combines bioprinting and scaffold-based approaches can represent a new paradigm for the *in vitro* vascularization of 3D tissues.

Biography

Andrea Barbetta has completed his PhD in 2001 from University of Durham (UK) and Postdoctoral studies from University of Kyoto (Japan) and Sapienza University of Rome. At present, he is lecturer at the Department of Chemistry of Sapienza University of Rome. He has published 40 papers in reputed journals and 1 patent. His research interests are focused mainly in the development of methods for the fabrication of scaffolds for tissue engineering, in particular by means of microfluidics and rapid prototyping.

andrea.barbetta@uniroma1.it

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