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Microfluidics: A powerful tool for the fabrication of tailored scaffolds

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Abstract

The main goal of Tissue Engineering is to create biological substitutes aimed at restoring or replacing damaged tissues or organs. The research on the manufacture of scaffolds for tissue engineering applications has taken in recent years a definite direction. Those fabrication techniques (e.g. rapid prototyping) that allow exerting, according to *a priori* design, a high degree of control over the scaffold morphological features are becoming privileged with respect to traditional ones. The reason of this trend is that scaffolds with a uniform and customized porous texture guarantee an equal probability of colonization from seeded cells, an uniform degradation rates through space and the matching of pores and interconnects to cell dimension.

New methods of production of highly uniform and ordered scaffolds rely on the formation of an emulsion or gas-in-liquid foam inside a microfluidic device. The generation of droplets or bubbles inside the micro channels of a microfluidic chip takes place in a constant and extremely reproducible way. These discrete, monodisperse elements act as the templates of the porous structure that develops when the continuous phase is cured by either physical or chemical means.

The main advantages offered by such an approach are: i) high reproducibility of the experiments, ii) a wide variety of monomers and biopolymers can be used as the scaffold constituents, iii) possibility to tune within wide ranges, both the dimensions of scaffold pores through the dimension of the precursor bubbles or droplets and, the scaffold porosity through the percentage of the dispersed phase.

Biography

Andrea Barbetta has completed his Ph.D. 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 36 papers in reputed journals and 1 patent. His research interests are focused mainly in the research of methods for the fabrication of scaffolds for tissue engineering and in the application of advanced techniques for the characterization of porous materials.