

Constructing multilayer cell coated and branched vascular networks through click chemistry and DNA assembly based on bionic chip

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Blood vessel construction is a very significant and difficult research aspect in tissue engineering field. In this paper, we present a method for producing vascular networks which assembled multi-layer of cells onto silicified tubular chip taking from mouse or other animals. For mimicking the complex tissue structure *in vitro*, there are already some outstanding works have been reported. For example, Xinyu Jiang's group has reported a method for stepwise formation of 2D multicellular structures through the biotin-streptavidin (SA) interaction and further construction of controlled, 3D, multilayered, tissue-like structures using the stress-induced rolling membrane (SIRM) technique [1], and Zev J Gartner's group described a DNA-programmed assembly of cells method to programmed synthesize three-dimensional tissues[2].

Here, in order to form vascular networks *in vitro*, we first obtain a multi-branched tubular tissue from the body as scaffold, and converting it into silica materials through silica deposition after acellular treating the tissue by detergents. The click chemistry and DNA assembly method were used to construct cell layer on the surface of the silica-tubular, and by repeating the DNA assembly procedure we have successfully assembled multilayer cells. Furthermore, we implanted them into collagen to produce *in vitro* vascular network induced by vascular endothelial growth factor, finally a complex, multilayer cell coated and branched vascular network has been constructed in collagen.

A schematic view of the experiment is shown in Figure 1. The resulting silicified vascular shown in Figure 2 holds a high hardness for operation and topological structures which benefits the cell growth and proliferation. In summary, a vascular network has been constructed by our method and we believe other tissues can also be assembled in this way.

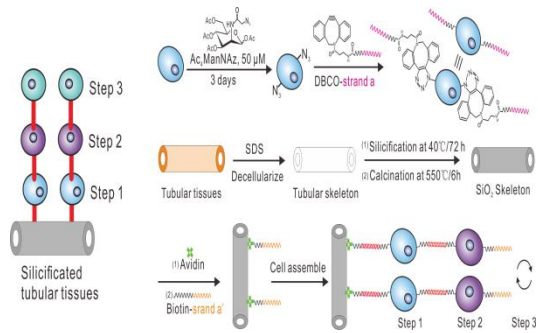


Fig.1 Schematics diagram of pretreatment of blood vessels and cells.

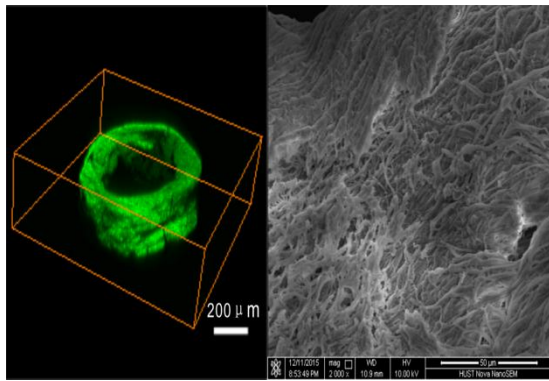


Fig.2 Tubular structure displayed by confocal image, and SEM image show the topological structures of the silica-tubular surface.

REFERENCES:

- [1]Peiyuan Gong ; et al. “A Strategy for the Construction of Controlled, Three-Dimensional, Multilayered, Tissue-Like Structures , ”*Adv. Funct. Mater***2013**, 23, 42–46.
- [2]Michael E Todhunter ; et al.“Programmed synthesis of three-dimensional tissues, ”*nature methods***2015**, 9, 75-81.