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*Abstract*

# A Microsystem for the Study of Vascularization †

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Angiogenesis is the development of new blood vessels from the already existing vasculature [1]. Its course is controlled by many pro- and anti-angiogenic factors. Disorders of the distribution of these agents lead to the development of cancer and cardiovascular diseases qualified by the World Health Organization as the leading causes of death globally. Understanding the mechanisms regulating physiological and pathological angiogenesis will allow for more effective treatment. The simulation of angiogenesis under microflow conditions is a promising alternative to studies on a 2D cell culture [2].

The microsystem consists of two layers. The upper layer contains a mapped network of channels. It is made of PDMS with the use of a micro-milled stamp. The bottom layer (a microscope slide) acts as a seal. The design of the microchip includes three parallel microchannels. Cylindrical microchannels seeded by Human Umbilical Vein Endothelial Cells (HUVECs) were generated using the viscous-finger patterning technique in the two lateral microchannels. Their diameter corresponds to the size of human arteries ($701.5 \pm 3.1$ µm). The ultimate procedure will enable the reconstruction of narrower blood vessels, such as veins and capillaries. The middle microchannel allows for the introduction of a pro-angiogenic factor solution. The influence of Vascular Endothelial Growth Factor (VEGF), with a concentration of 50ng/ml, on the migration of HUVECs was verified. The spatial arrangement of the cells and their morphology was visualized using fluorescence and confocal microscopy. The research conducted so far is the basis for developing more complex vascularized multi-organ-on-a-chip microsystems.

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