3D PRINTED HYDROGELS FOR MICROFLUDICI BARRIER MODELS

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Placental tissue secures the survival and development of the fetus as it represents the connection between mother and fetus, regulating endogenous and exogenous transport. The blood of both organisms is thereby separated by the so-called placental barrier. [1] The placental barrier is a complex three layered structure consisting of trophoblastic syncytium, basal membrane and fetal capillary wall. [2] Current *in-vitro* methods are not sufficient to mimic this multifaceted barrier. Therefore, this project aimed to simulate the placental transport in order to study underlying mechanisms controlling development and malfunctions more precisely. The basal membrane was replicated using modified gelatin type B (gel-MOD-AEMA) were 97% of primary amines were modified into methacrylamides. To enhance the crosslinking capacity amino-ethyl methacrylates (AEMA) were subsequently introduced onto 56% of the carboxylic acids present in gelatin. The material was polymerized by two-photon polymerization in the presence of 1 mM sodium dipropanoate-based photoinitiator (P2CK). Thus, high resolution structures with nanometer precision were structured within a customized microfluidic-device thereby separating the chip in two different compartments (Figure 1). The fetal compartment was seeded with HUVEC cells while BeWo B30 cells mimicked the maternal syncytium. [3] This microfluidic approach in combination with native flow profiles can be used to model different clinical and biological scenarios such as studying effects of altered nutrient balance *in-utero*.

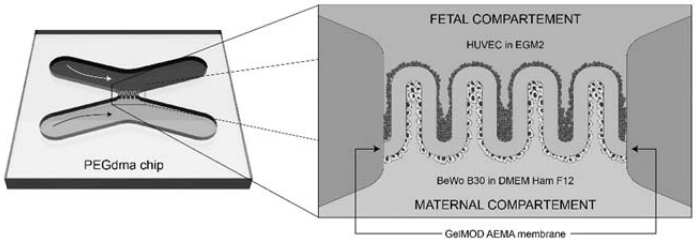

Figure 1 –Micro device set-up used to study placental transport. A 5-loop gel-MOD-AEMA membrane was structured in the intersection of an x-shaped PEGdma Chip, separating the cultivation chamber in two channels. The fetal compartment (HUVECs), mimicking fetal endothelial cells and the maternal compartment (BeWo B30) to remodel the syncytiotrophoblast. Cells were cultivated under constant flow in the respective cell culture media, EGM2 (HUVEC) and DMEM Ham-F12 (BeWo B30). The flow direction is indicated by arrows in the left image.

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