

Body-on-a-Chip Systems for Drug Development

CNF Project Number: 731-98

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Primary CNF Tools Used: VersaLaser cutting and engraving CO₂ laser

Abstract:

This research involved creating a pumpless, unidirectional body-on-a-chip microfluidic device for anti-cancer drug testing. The body-on-a-chip device contains individual organ chambers representing a colon tumor, liver, and bone marrow tissue connected by microfluidic channels in a relevant physiological order. The microfluidic channels were designed with specialized valves to promote fluid flow in only one direction without backflow, mimicking blood circulation in the body.

Summary of Research:

The body-on-a-chip device was fabricated out of poly(methyl methacrylate) (PMMA) and silicone layers using the VersaLaser cutting and engraving CO₂ laser. The layered design consists of a silicone layer for cell culture, a PMMA channel layer, a sealing silicone gasket, and outer PMMA housing units (Figure 1). Once assembled, the device was placed onto a rocker platform for pumpless operation, thereby allowing easier operation and eliminating the need to external tubing and pumps. This work has been submitted for publication in Lab on a Chip [1].

References:

- [1] LaValley DJ, Miller PG, Shuler ML. (2019). Pumpless, unidirectional microphysiological system for testing metabolism-dependent chemotherapeutic toxicity. Submitted to Lab on a Chip.

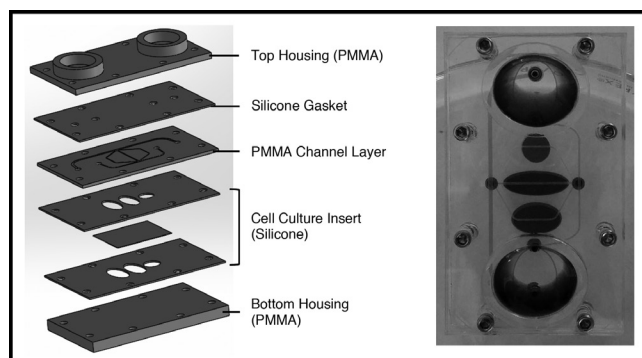


Figure 1: (Left) A schematic of the layered design for the body-on-a-chip device consisting of alternating PMMA and silicone layers. (Right) An image of the assembled device filled with blue dye to visualize the organ chambers and microfluidic channels.

