3D printed nervous system on a chip

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Abstract
Bioinspired organ-level in vitro platforms are emerging as effective technologies for fundamental research, drug discovery, and personalized healthcare. In particular, models for nervous system research are especially important, due to the complexity of neurological phenomena and challenges associated with developing targeted treatment of neurological disorders. Here we introduce an additive manufacturing-based approach in the form of a bioinspired, customizable 3D printed nervous system on a chip (3DNSC) for the study of viral infection in the nervous system. Micro-extrusion 3D printing strategies enabled the assembly of biomimetic scaffold components (microchannels and compartmented chambers) for the alignment of axonal networks and spatial organization of cellular components. Physiologically relevant studies of nervous system infection using the multiscale biomimetic device demonstrated the functionality of the in vitro platform. We found that Schwann cells participate in axon-to-cell viral spread but appear refractory to infection, exhibiting a multiplicity of infection (MOI) of 1.4 genomes per cell. These results suggest that 3D printing is a valuable approach for the prototyping of a customized model nervous system on a chip technology.

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