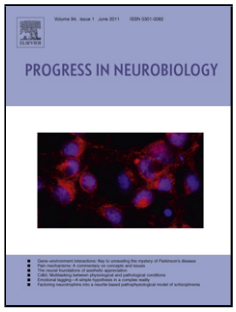

Title: 3D *in vitro* modeling of the central nervous system

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3D *in vitro* modeling of the central nervous system

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Abstract

There are currently more than 600 diseases characterized as affecting the central nervous system (CNS) which inflict neural damage. Unfortunately, few of these conditions have effective treatments available. Although significant efforts have been put into developing new therapeutics, drugs which were promising in the developmental phase have high attrition rates in late stage clinical trials. These failures could be circumvented if current 2D *in vitro* and *in vivo* models were improved. 3D, tissue-engineered *in vitro* systems can address this need and enhance clinical translation through two approaches: (1) bottom-up, and (2) top-down (developmental/regenerative) strategies to reproduce the structure and function of human tissues. Critical challenges remain including biomaterials capable of matching the mechanical properties and extracellular matrix (ECM) composition of neural tissues, compartmentalized scaffolds that support heterogeneous tissue architectures reflective of brain organization and structure, and robust functional assays for *in vitro* tissue validation. The unique design parameters defined by the complex physiology of the CNS for construction and validation of 3D *in vitro* neural systems are reviewed here.

Keywords: Tissue engineering, Central nervous systems, Blood brain barrier, 3D *in vitro* model