New hydrogel blend lets researchers 3D-print homes for brain cells

Daniela Espinosa-Hoyos

Huifeng Du

Nicholas X. Fang

Krystyn J. Van Vliet

Video Abstract

Keywords: MRS Advances, Massachusetts Institute of Technology, hexanediol diacrylate (HDDA), poly(HDDA), oligodendrocyte, additive manufacturing, 3D printing, oligodendrocyte progenitor cell (OPC), polyethylene glycol (PEG), biocompatibility, microfabrication, projection microstereolithography (PμSL), starPEG, hydrophilicity, mechanobiology, compliance, stiffness, scaffold, cytocompatibility, materials design

Posted Date: September 20th, 2019

DOI: <https://doi.org/10.21203/rs.2.15028/v1>

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Abstract

A new 3D-printable hydrogel could provide the perfect platform for growing, studying and perhaps even repairing critical brain cells linked to diseases such as multiple sclerosis. This is an oligodendrocyte. Oligodendrocytes pave a protein-rich path along neuronal axons that helps relay and even boost electrical signals. That makes communication across the vast central nervous system possible. Disruption of that critical function can lead to weakness, numbness or even paralysis, hallmarks of diseases like multiple sclerosis. While researchers have slowly gained a better understanding of how and why oligodendrocyte function is compromised, collectively, that work paints a grainy picture of what's really going on. Not only is it virtually impossible to watch these destructive processes unfold inside the body. But also, methods designed to recreate the behavior of these cells in the lab are often too simplistic, offering a 2D view of what is inherently a 3D process. That's where 3D printing comes in. The ability to design and build biocompatible scaffolds at the touch of a button has given researchers an unprecedented peek at the innerworkings of various types of cells and tissues. Unfortunately, even this revolutionary technique has proved limiting in the study of oligodendrocytes. Traditional printing materials are often too stiff to coax cells into maturing as they naturally do. And materials that can pull off the trick are too pliable to actually be printed. Now, researchers reporting in the journal *MRS Advances* have created a material that combines the best of both worlds, producing an environment where oligodendrocytes can thrive. The material, a hydrogel, is composed of hard polymer segments that connect chains of a more pliable polymer. Layers of this binary material could be stacked to form features theoretically about as wide as a neuronal axon. That enabled the team to build structures comfortable enough for oligodendrocytes to stretch out and develop. The properties of the polymer do make for longer print times than for harder, easier-to-print materials. But tweaking the hydrogel's composition and the printing setup could make the process more efficient. Those refinements could help researchers better understand how oligodendrocytes behave in the body and, perhaps more importantly, devise repair strategies for when they stop working.