VIDEO ARTICLE

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A Fully 3D Interconnected Graphene-Carbon Nanotube Web Allows the Study of Glioma Infiltration in Bioengineered 3D Cortex-Like Networks

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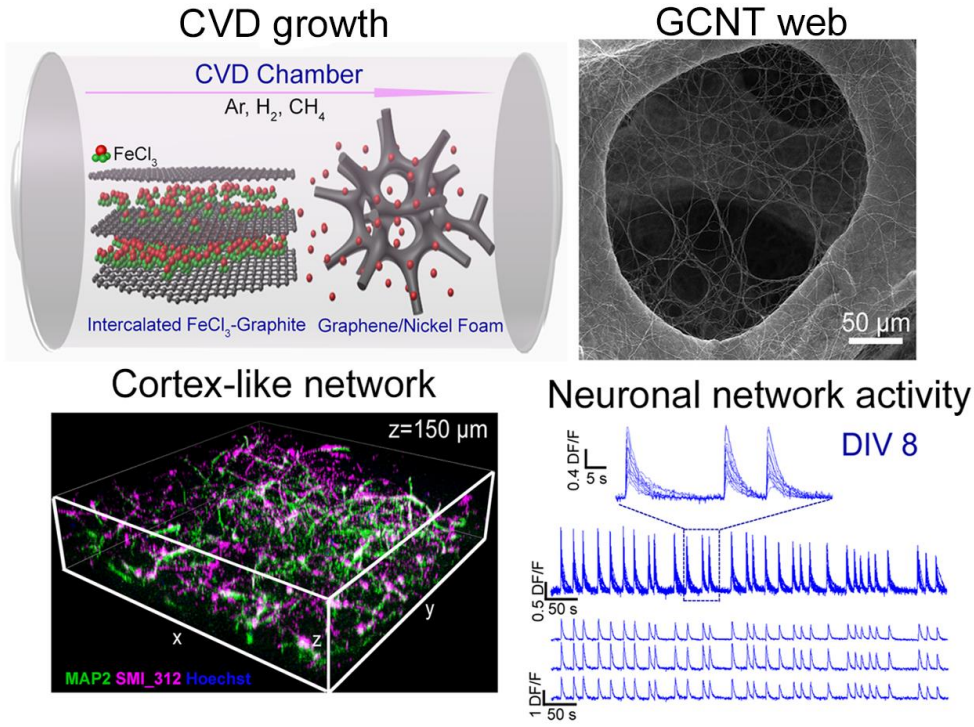
Graphical Abstract



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Abstract

Currently available three-dimensional (3D) assemblies based on carbon nanotubes (CNTs) lag far behind their two-dimensional CNT-based bricks and require major improvements for biological applications. By using Fe nanoparticles confined to the interlamination of graphite as catalyst, we have obtained a fully 3D interconnected CNT web through the pores of graphene foam (GCNT web) by in situ chemical vapor deposition. This 3D GCNT web has a thickness up to 1.5 mm and a completely geometric, mechanical and electrical interconnectivity. Dissociated cortical cells cultured inside the GCNT web form a functional 3D cortex-like network exhibiting a spontaneous electrical activity that is closer to what is observed in vivo. By co-culturing and fluorescently labelling glioma and healthy cortical cells with different colours, a new in vitro model is obtained to investigate malignant glioma infiltration. This model allows to reconstruct the 3D trajectories and velocity distribution of individual infiltrating glioma with an unprecedented precision. The model is cost-effective and allows a quantitative and rigorous screening of anti-cancer drugs. Our fully 3D interconnected GCNT web is biocompatible and is an ideal tool to study 3D biological processes in vitro representing a pivotal step towards precise and personalized medicine.

Keywords: 3D GCNT web, neuronal network, malignant glioma infiltration.

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Reference

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Biography of Presenting Author

Miao Xiao is a lecturer in Soochow University, Suzhou, China. He got his PhD from International School for Advanced Studies (SISSA), Italy under the supervision of Prof. Vincent Torre. His research interests focus on 3D carbon-based material assemblies and their applications in Neurobiology and cancer researches. Related works have been published as insider cover in Advanced Materials (2018, 30 (52),1806132) and Advanced Functional Materials (2015, 25 (39), 6150) and also Biomaterials (2016, 106, 193-204). Now he has joined in Soochow University and work in Institute for Cardiovascular Science. His focus is on the study of 3D carbon-based material's application in human induced pluripotent stem cell-derived cardiomyocytes (hiPSC-CMs).

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