3D scaffold

Although traditional 3D scaffolds or biomimetic hydrogels have been used for tissue engineering and regenerative medicine, soft tissue microenvironment usually has a highly anisotropic structure and a dynamically controllable deformation with various biomolecule distribution.

Chiang et al. developed a hierarchical hybrid gelatin methacrylate-microcapsule hydrogel (HGMH) with Neurotrophin-3(NT-3)-loaded PLGA microcapsules to fabricate anisotropic structure with patterned NT-3 distribution (demonstrated as striped and triangular patterns) by dielectrophoresis (DEP). The HGMH provides a dynamic biomimetic sinuate-microwrinkles change with NT-3 spatial gradient and 2-stage time-dependent distribution, which was further simulated using a 3D finite element model. As demonstrated, in comparison with striped-patterned hydrogel, the triangular-patterned HGMH with highly anisotropic array of microcapsules exhibits remarkably spatial NT-3 gradient distributions that can not only guide neural stem cells (NSCs) migration but also facilitate spinal cord injury regeneration. This approach to construct hierarchical 4D hydrogel system via an electromicrofluidic platform demonstrates the potential for building various biomimetic soft scaffolds in vitro tailed to real soft tissues [1)]

1)
Chiang MY, Cheng HW, Lo YC, Wang WC, Chang SJ, Cheng CH, Lin YC, Lu HE, Sue MW, Tsou NT, Lo YC, Li SJ, Kuo CH, Chen YY, Huang WC, Chen SY. 4D spatiotemporal modulation of biomolecules distribution in anisotropic corrugated microwrinkles via electrically manipulated microcapsules within hierarchical hydrogel for spinal cord regeneration. Biomaterials. 2021 Mar 20;271:120762. doi: 10.1016/j.biomaterials.2021.120762. Epub ahead of print. PMID: 33773400.