Title: **Targeting Recovery Neurobiology Mechanisms to Improve Function after Spinal Cord Injury**

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Abstract:
We and our collaborators pioneered the platform technology of 3-dimensional polymer scaffolding to investigate mechanistic events of human neural stem cells (hNSCs) and mesenchymal stromal stem cells (hMSCs) for neural repair *in vitro* and *in vivo*. Through utilizing uniquely designed polymer-scaffolded hNSC or hMSC implant, controlled drug release, and genetic modification of host microenvironment, we have uncovered key mechanisms to induce functional improvement after spinal cord injury (SCI). The findings comprehensively elucidate *Recovery Neurobiology* — i.e., the injured adult spinal cord under proper treatment can deploy polysynaptic neural circuits that are different from neurophysiological pathways for neurological restoration. Thus, following SCI, rescuing neurons that play important roles in the intraspinal cord neurocircuitry is pivotal for preserving neurobiological integrity. In a recent study, thermoreversible hydrogel was functionalized *in vitro* with a broad-spectrum oxidant scavenger before being microinjected into the lesion epicenter in an experimental model of SCI. The treatment significantly augmented sensorimotor performance, compared to controls by reducing gray and white matter loss, neuronal death, excessive reactive gliosis, and cystic cavity. Fulfilling a heretofore unmet pharmacological demand, the regimen has demonstrated high translational potential for treating acute neurotrauma.