

# Engineering Stem Cells for Tissue Repair and Cancer Therapy

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## Abstract

**Synthetic Matrix for 3D Culture:** Hydrogel-based 3D stem cell cultures have received increasing attentions on various biomedical applications such as tumor modeling, organogenesis, drug screening and tissue engineering. By mimicking the biofunctions and organizations of native extracellular matrix, the designated synthetic hydrogels could provide 3D environments to regulate cell behaviors and cell-matrix interactions. In this presentation, our recent works on fabricating 3D bio-printed stem cells-laden hydrogel constructs and applications on would repair will be discussed. **Nanomaterials for Stem cells Engineering:** Effective drug delivery deep into tumors remains a major challenge for cancer therapy. Stem cells possess strong tumor tropism, an ability of actively migrating toward tumors. To effectively construct genetically engineered stem cells, efficient and nontoxic gene delivery materials are still highly required. In this study, a magnetic ternary nanohybrid (MTN) system comprising biodegradable cationic materials, nucleic acids, and hyaluronic acid-decorated superparamagnetic iron oxide nanoparticles was successfully developed to construct stem cells expressing the tumor necrosis factor-related apoptosis-inducing ligand (TRAIL). In an orthotopic xenograft cancer model, MTN-transfected TRAIL-expressing hMSCs significantly suppressed the progression of human glioma (U87MG) and prolonged the survival of the animal.

## Short Bio

Dr. Chang received his Ph.D. degree under the supervision of Prof. Sung Wan Kim from the Department of Pharmaceutics and Pharmaceutical Chemistry at the University of Utah, USA. From 2007 to 2009, he received CNSI (California Nano System Institute) Pioneer Postdoctoral Fellowship and worked with Prof. Heather Maynard (UCLA/Chemistry) on designing polymer-protein bioconjugates. From 2009 to 2010, he received CIRM (California Institute of Regenerative Medicine) Postdoctoral Fellowship and worked with Prof. Shyni Varghese (UCSD/Bioengineering) on biomaterial-based stem cell engineering. He is currently an Associate Professor at the Department of Biomedical Engineering & Environmental Sciences, National Tsing Hua University. He has published 40 papers in SCI journals including: *Journal of Controlled Release*, *Biomaterials*, *Theranostics*, *Chem Comm* and *ACS Applied Materials & Interfaces*. His research interests include gene delivery, drug delivery, polymers/hydrogels for stem cell engineering.

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