Cellular Reprogramming Using NIR- and Substrate-Mediated Nanomaterials

KiBum Lee

Dept. of Chemistry & Chemical Biology, Rutgers University
123 Bevier Road, Piscataway, NJ 08854-8087, USA

SUMMARY

This presentation will focus on the interface between nanotechnlogy and cellular reprogramming. Neurological disorders typically result in cellular dysfunctions that may cause severe and permanent paralysis. Given the central nervous system's (CNS) intrinsically limited regenerative abilities and the highly complex inhibitory environment of the damaged tissue, gene- and stem cell-based therapies have great potential for CNS repair by regenerating a robust population of functional neural cells and modulating the neuroinhibitory microenvironment.

To this end, we have overcome the aforementioned challenges in current stem cell therapies by developing three different methods: i) to develop a nonviral and effective genetic manipulation method by mimicking the function of natural transcription factors (TFs), ii) to develop a multifunctional nanomaterial-based bioscaffold methodology for the controlled delivery of therapeutic molecules in vivo, and iii) to incorporate a substrate-based epigenetic modulation to enhance cellular reprogramming.

Since many neurodegenerative disorders and nerve injuries are characterized by disrupted neuronal circuits and neuro-inflammation, the innovative approach that we have developed has the potential to be extensively applied to a wide variety of different indications. *In this presentation, a summary of the most updated results from these efforts and future directions will be discussed.*

KEYWORDS: Bio-inspired Hybrid Nanomaterials, Artificial Transcription Factors, Stem Cell Therapeutics, Stem cell-based regenerative medicine, Personalized Medicine, and CNS repair

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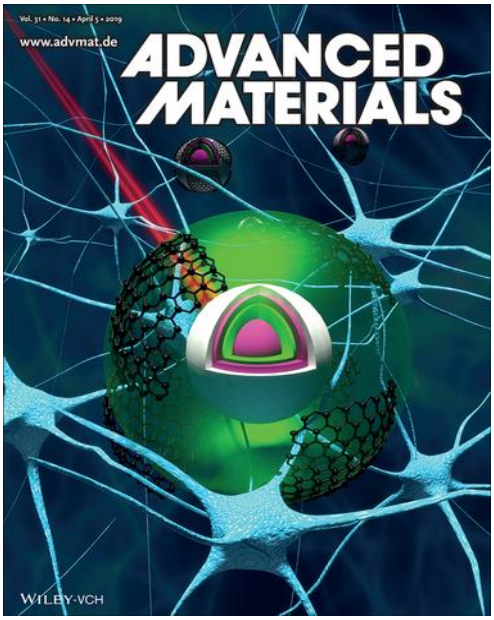


Figure 1: NIR Biosensing of Neurotransmitters in Stem Cell-Derived Neural Interface Using Advanced Core–Shell Upconversion Nanoparticles: to present a unique tool for investigating the single-cell mechanisms associated with dopamine, or other neurotransmitters, and their roles in neurological processes.

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