BTX Applications

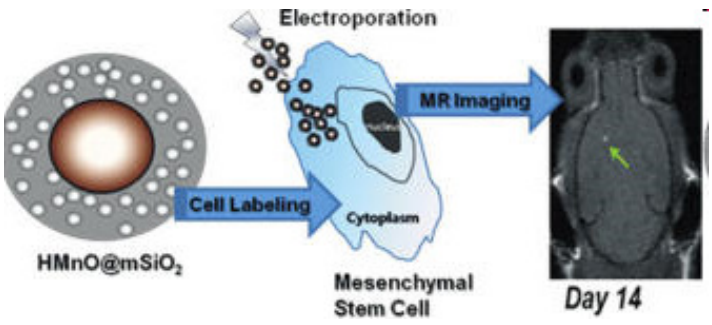
Tech-Trends
Volume 4, Series 3

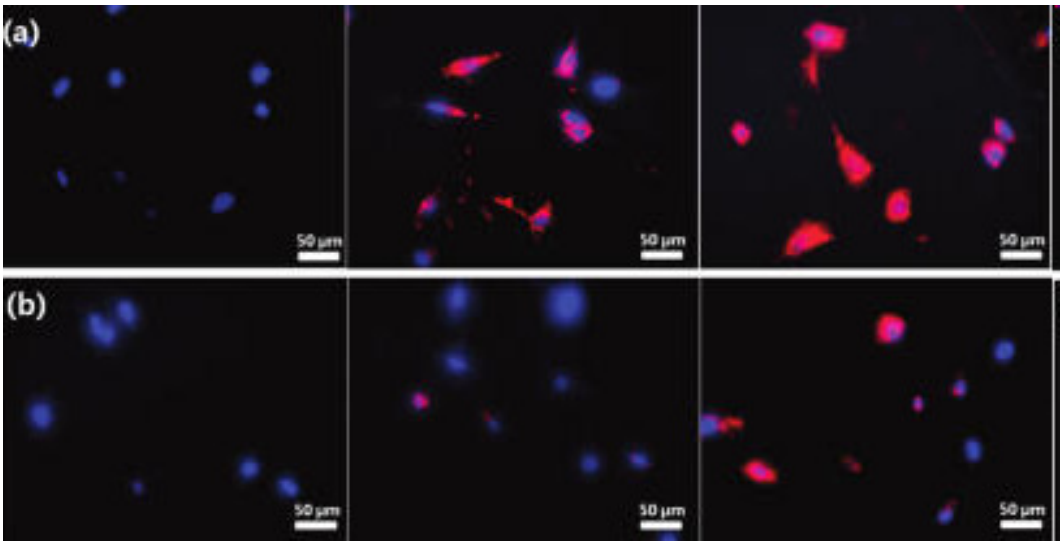
MRI Tracking of Adipose-Derived Mesenchymal stem cells using BTX Electroporation

Mesoporous Silica-Coated Hollow Manganese Oxide Nanoparticles as Positive T1 Contrast Agents for Labeling and MRI Tracking of Adipose-Derived Mesenchymal Stem Cells

Introduction

Electroporation was used to label cells with MnO@mSiO2 nanoparticles. Mouse Mesenchymal Stem cells (MSCs) were cultured in 80 cm^2 flasks overnight to 80-90% confluence. On the next day, cells were suspended using trypsin-ethylene diamine tetraacetic acid (EDTA), washed with PBS, and counted. Cells were resuspended and transferred to sterile 0.4 cm gap electroporation cuvettes. Each cuvette contained 2 x 10^6 cells suspended in 580 µL. Nanoparticles dispersed in PBS were added to the cuvette with a final volume of 700 µL. Cuvettes were kept on ice for one min, and cells were electroporated using a BTX electroporation system (ECM830; Harvard Apparatus).





Fluorescence microscopy images of RITC-$HMnO@mSiO_2$- labeled MSCs, counterstained with Hoechst 33342. Using (a) electroporation or (b) simple incubation with nanoparticles (0, 11.4, and 34.3 µgMn/ mL) (left to right). Cellular uptake of nanoparticles was dose-dependent. Higher nanoparticle uptake was observed in electroporated MSCs.

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Electroporation Protocol

Voltage: 100 V
***N* pulses**: 5
Pulse duration: 5 millisec
Pulse interval: 100 millisec
Post-pulse treatment: After 30 seconds, cells were transferred to ice for 2 min, suspended in culture medium, and transferred to six-well plates. At 24 h following electroporation, cells were washed twice with PBS, harvested using trypsin- EDTA, and counted.

45-0002 ECM 830 Square Wave Electroporation System

Conclusion

Adipose-derived mesenchymal stem cells (MSCs) were efficiently labeled using electroporation, with much shorter T1 values as compared to direct incubation without electroporation, which was also evidenced by signal enhancement on T1-weighted MR images in vitro. Intracranial grafting of HMnO@mSiO_2-labeled MSCs enabled serial MR monitoring of cell transplants over 14 days. These novel nanoparticles may extend the arsenal of currently available nanoparticle MR contrast agents by providing positive contrast on T1-weighted images at high magnetic field strengths.

Source: Taeho Kim, Eric Momin, Jonghoon Choi, Kristy Yuan, Hasan Zaidi, Jaeyun Kim, Mihyun Park, Nohyun Lee, Michael T. McMahon, Alfredo Quinones-Hinojosa, Jeff W. M. Bulte, Taeghwan Hyeon, and Assaf A. Gilad
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