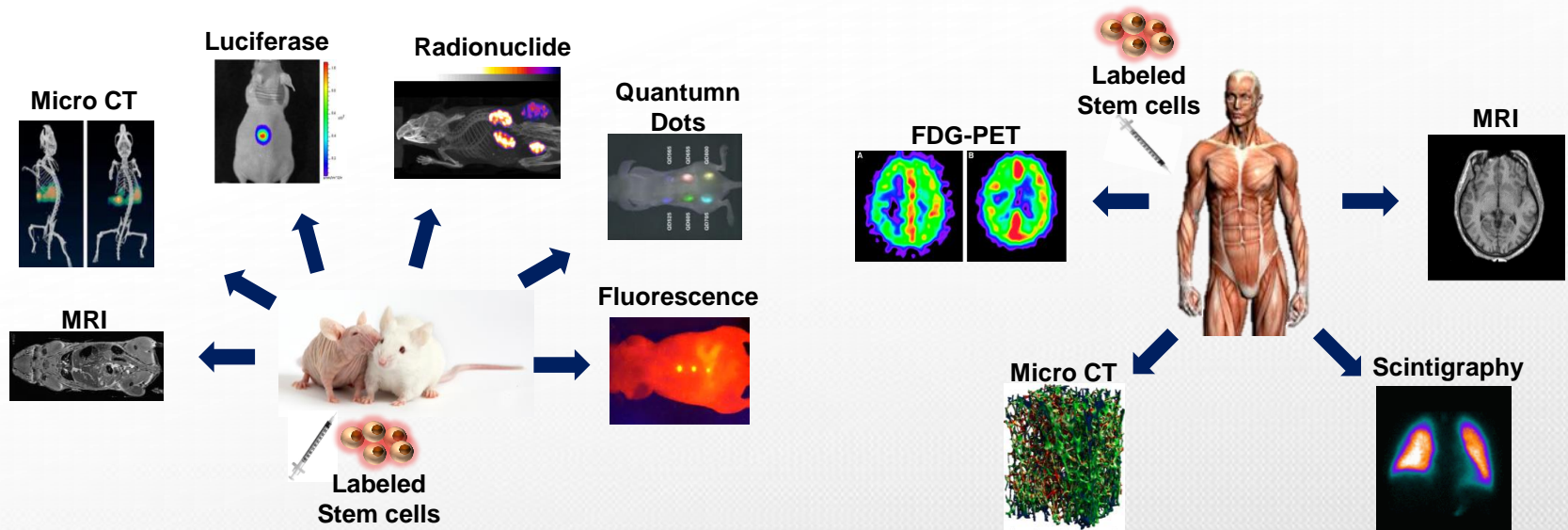


Stem Cell Labeling and Tracking in a Mouse Brain Stroke Model Using Multimodal Glycol Chitosan Nanoparticles

Hong Yeol Yoon, Ph. D

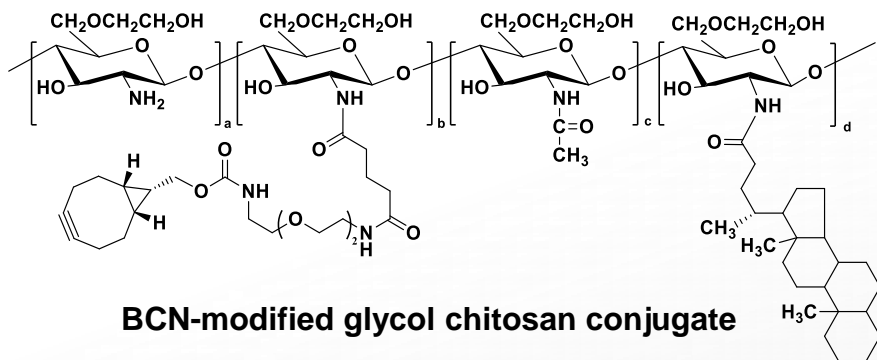
Center for Theragnosis, Biomedical Research Institute
Korea Institute of Science and Technology (KIST)

Stem Cell Labeling and Tracking



Nanotechnology-combined stem cell labeling and tracking technologies are allowing to dynamic evaluation of proliferation, migration and *in vivo* fate of transplanted cells.

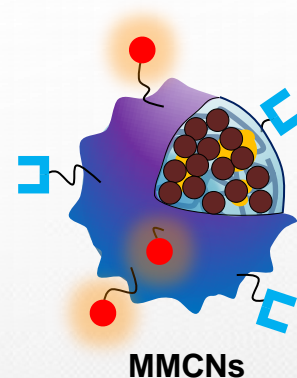
Magnetic Nanoparticle-encapsulated Multi-modal Glycol Chitosan Nanoparticle (MMCNs)



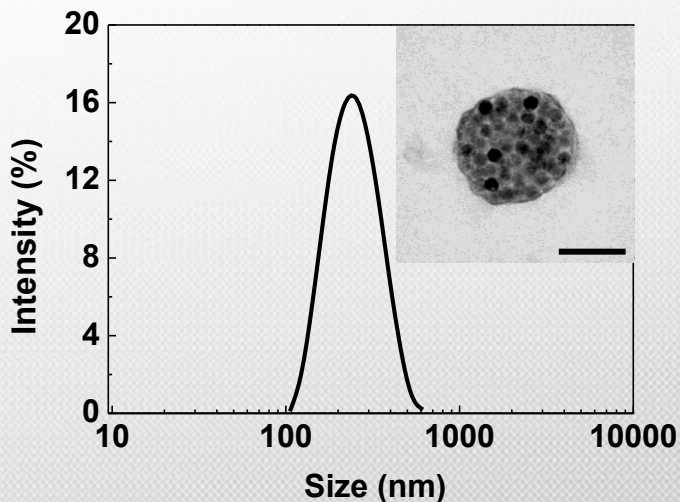
● Cy5.5

● Iron oxide nanoparticle

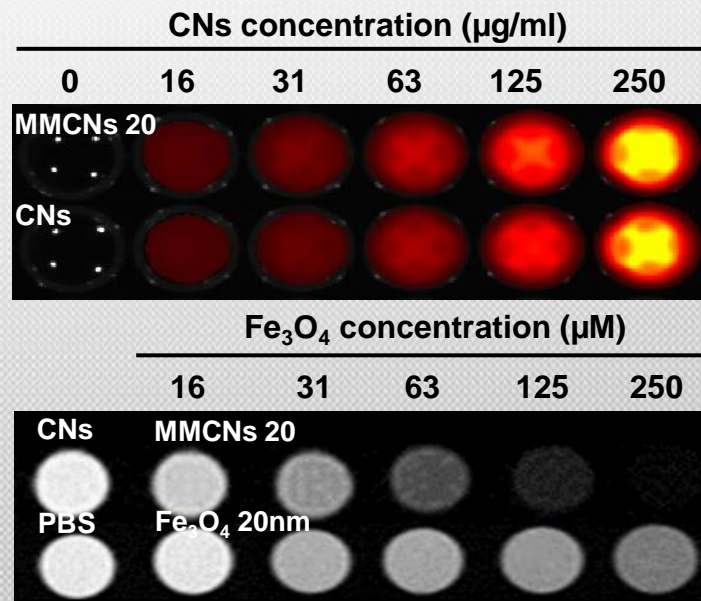
Self-assembled nanoparticles
in aqueous condition



- Size distribution and morphology of MMCNs

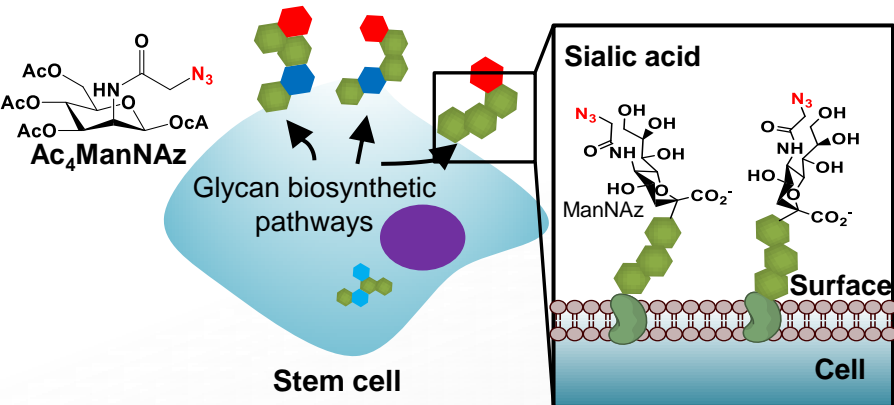


- *In vitro* NIRF, MR phantom images of MMCNs

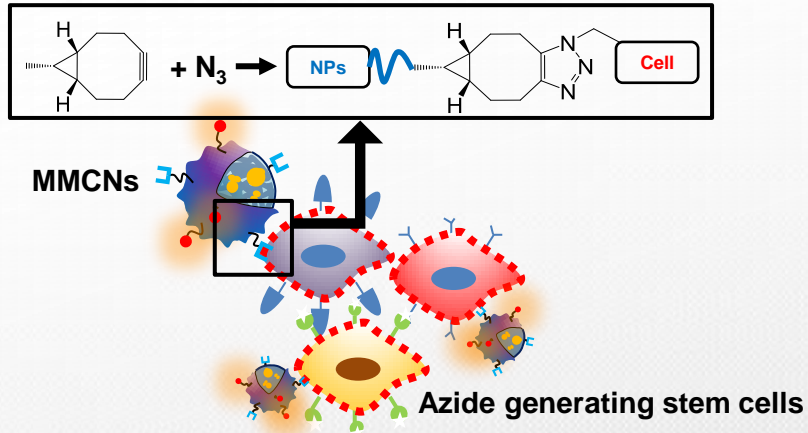


Metabolic Glycoengineering Based Stem Cell Labeling

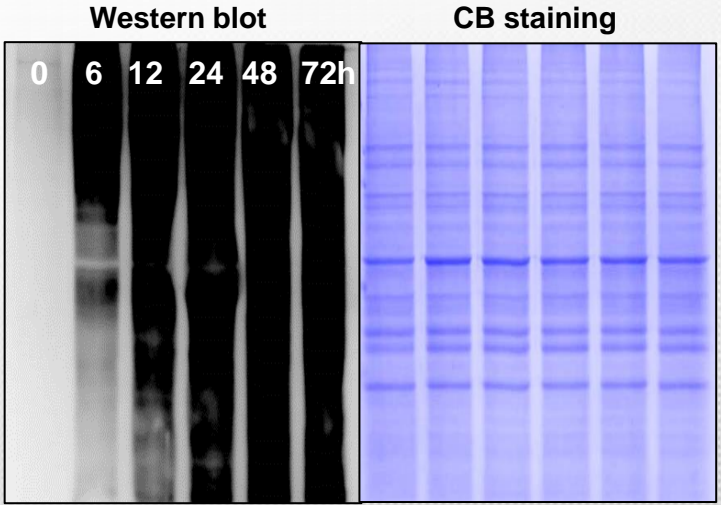
- Metabolic glycoengineering



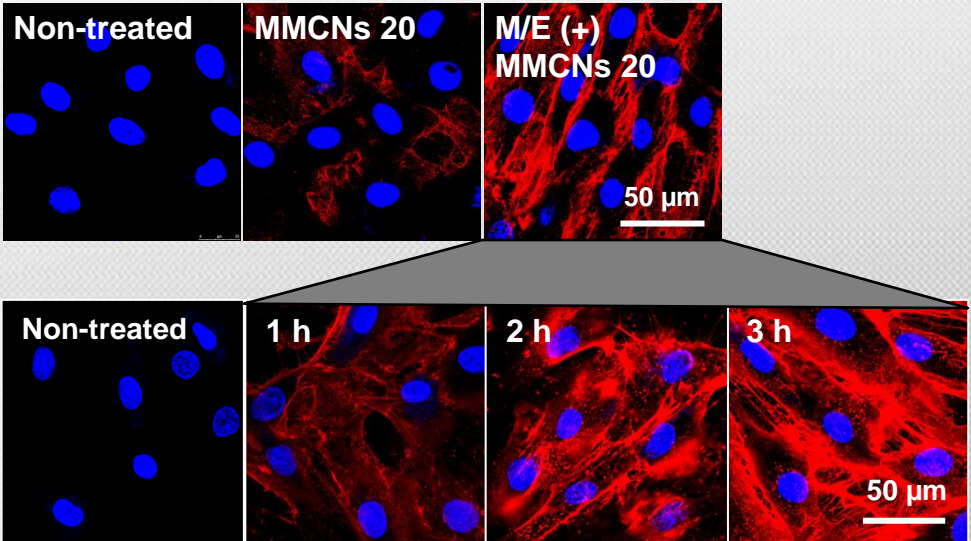
- Bioorthogonal click reaction



- Azide generation analysis



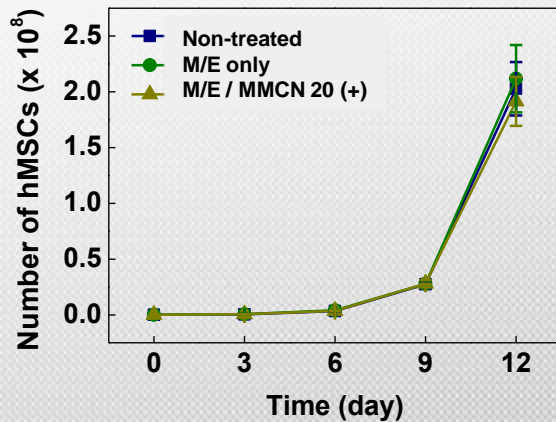
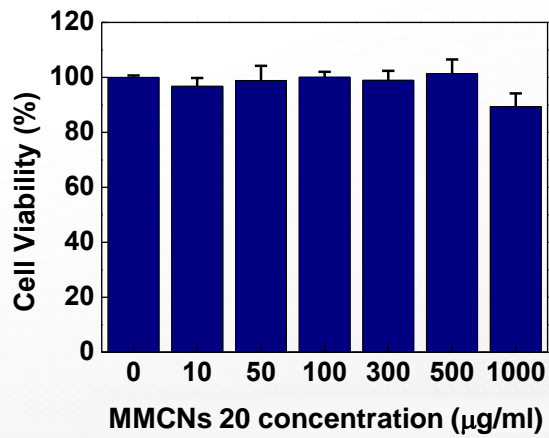
- Stem cell labeling analysis (hAD-MSCs)



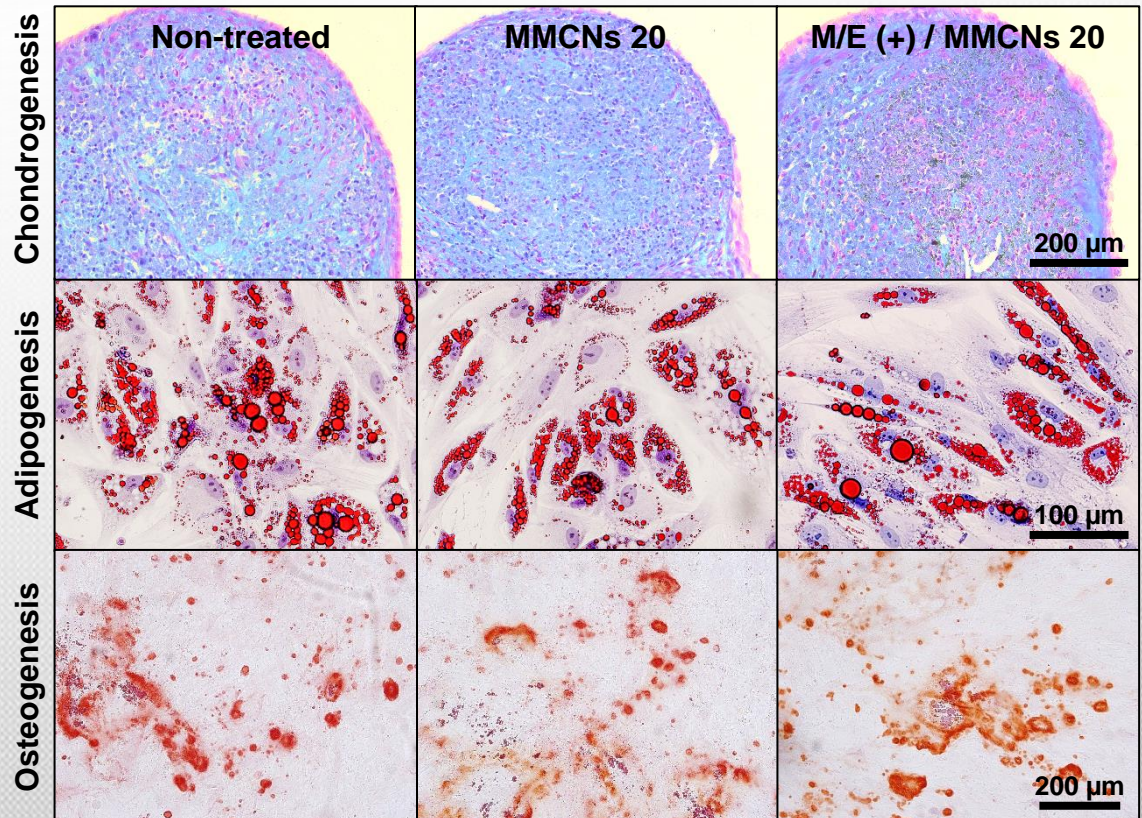
In Vitro Toxicity And Differentiation

In vitro toxicity and differentiation assessment of MMCNs 20-labeled hAD-MSCs showed that metabolic glycoengineering-based cell labeling method could effectively label hAD-MSCs without toxicity and phenotype change.

- Toxicity and proliferation assay

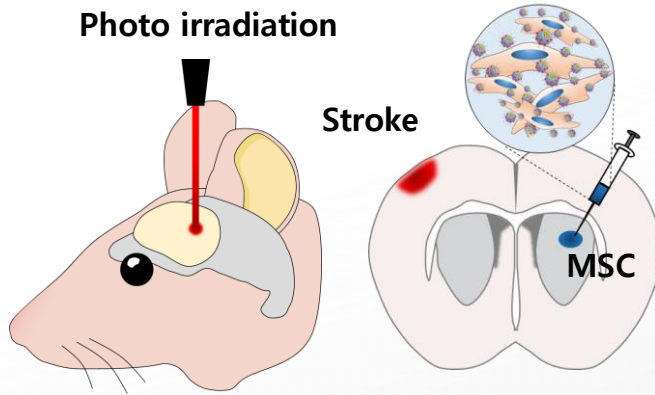


- Differentiation of hAD-MSCs

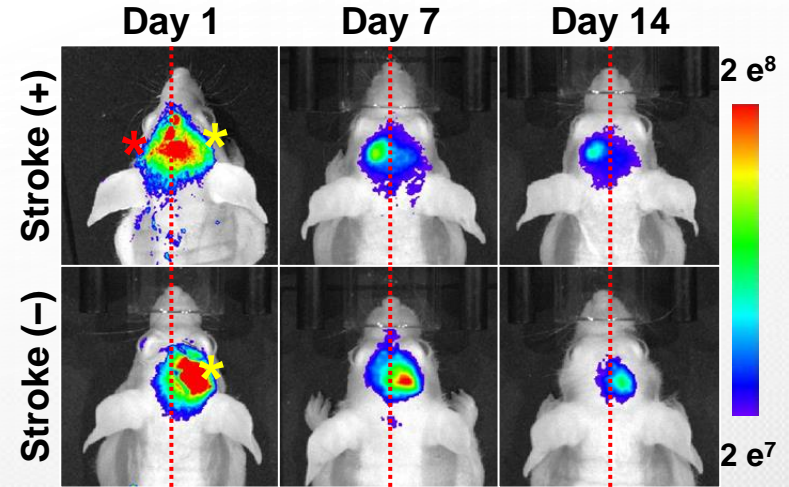


In vivo Stem Cell Tracking Using NIRF/MR Imaging

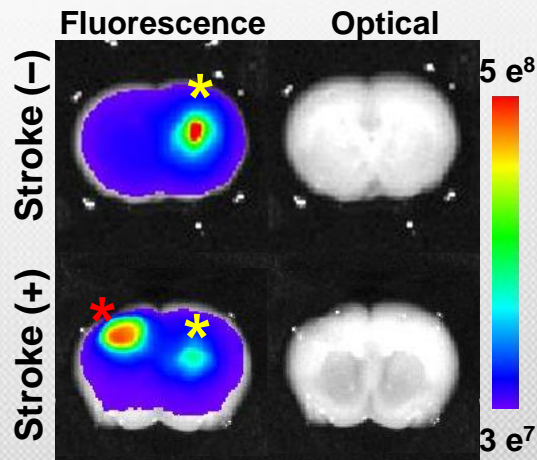
- Photothrombotic stroke model



- NIRF imaging (* Stroke lesion, * Implantation site)

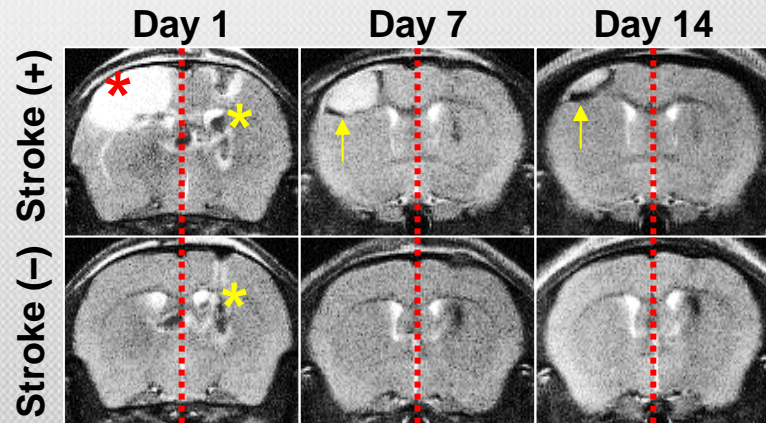


- Ex vivo NIRF imaging (Day 14)



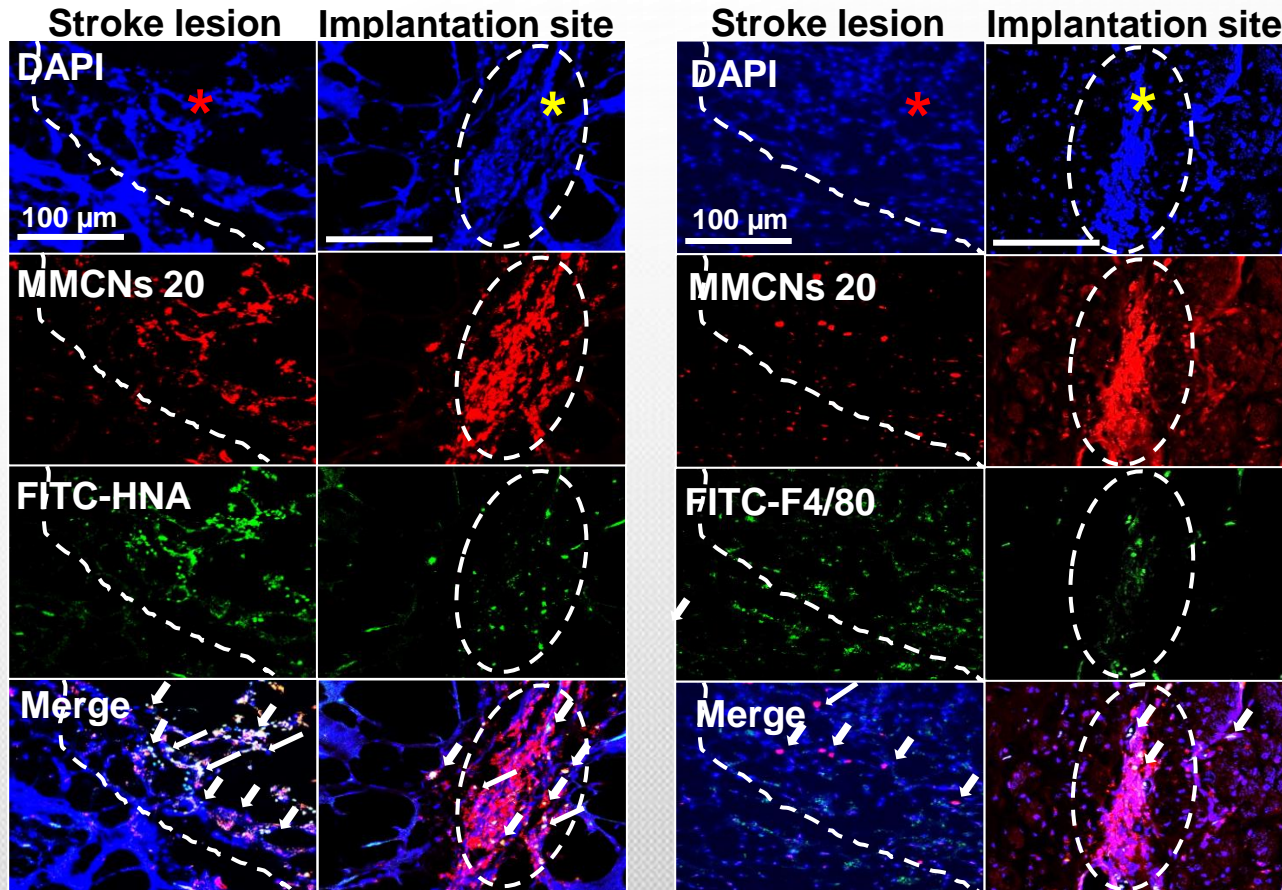
(* Stroke lesion, * Implantation site)

- MR imaging (* Stroke lesion, * Implantation site)



Ex Vivo Stem Cell Tracking

MMCNs 20-labeled hAD-MSCs were successfully observed in a stroke lesion as well as implantation site without false signals by phagocytosis of macrophages.



HNA: Human nuclei
(* Stroke lesion, * Implantation site)

F4/80: Macrophage
(* Stroke lesion, * Implantation site)

Conclusions

We successfully generated azide groups on the surface of hAD-MSCs via metabolic glycoengineering. And these azide groups were chemically labeled with MMCNs 20 via bioorthogonal click chemistry.

MMCNs 20 and metabolic glycoengineering-based cell labeling method could effectively label hAD-MSCs without toxicity and phenotype change.

Finally, we implanted MMCNs 20-labeled hAD-MSCs in the brain of mouse PTS model and successfully tracked MMCNs 20-labeled hAD-MSCs by dual-NIRF and T₂-weighted MR imaging for 14 days.

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