A new optical imaging strategy to reveal the fate of transplanted stem cells

With the support by the National Natural Science Foundation of China and the Chinese Academy of Sciences, the research group led by Prof. Wang QiangBin (王强斌) at the CAS Key Laboratory of Nano-Bio Interface, Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, developed a new optical imaging strategy to *in situ* visualize the fate of transplanted stem cells *in vivo*, which was published in *Small* (2018, 14(3): 1702679).

Stem cell-based regenerative medicine holds great promising in clinic practices. However, the stem cells after transplantation experience a very different microenvironment from *in vitro* and their viability *in vivo* is critical to the therapeutic effect. Till now, the fate of transplanted stem cells, including the distribution, viability and the cell clearance by the immune system, has not been fully understood yet. Thus, a non-invasive *in vivo* imaging technique that can monitor the fate of transplanted stem cells is urgently needed for deeply understanding the role of stem cells played in regenerative medicine and therefore speeding up the clinical translation of stem cell-based therapeutics.

Recently, Wang's group developed a dual-labeling strategy to *in situ* visualize the fate of transplanted stem cells *in vivo* by combining the exogeneous near-infrared fluorescence imaging (NIRFI) of Ag_2S quantum dots (Ag_2S QDs, emitting at 1200 nm) and endogenous bioluminescence imaging (BLI) of red-emitting firefly luciferase (RfLuc, emitting at 613 nm). The NIR-II fluorescence of Ag_2S quantum dots is employed to dynamically monitor the trafficking and distribution of all transplanted stem cells *in vivo* due to the deep tissue penetration and high spatiotemporal resolution of NIRFI, while BLI of RfLuc identifies the living stem cells after transplantation *in vivo* because only the living stem cells express RfLuc. For the first time, they have successfully traced the dynamic translocation of mouse mesenchymal stem cells (mMSCs) *in vivo*, differentiated the living cells and dead cell components *in situ*, and further clarified the regenerative mechanism of living mMSCs involved in the healing of the acute liver failure by using the RfLuc/Ag_2S QDs dual-label method. The distinct features of the dual-imaging method encourge a broad range of further applications, such as *in vivo* stem cell intervention, imaging-guided cell therapeutics, and so on.

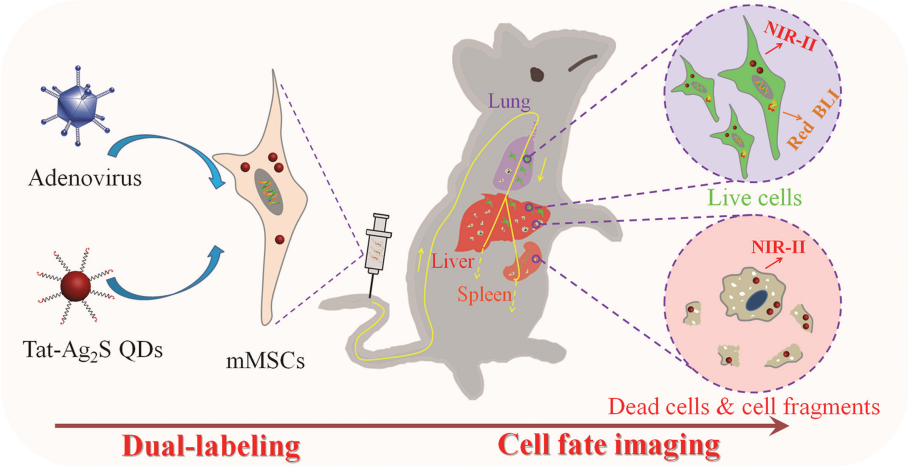

Figure Schematic illustration of the dual-labeling strategy for *in vivo* tracking the fate of transplanted stem cells by combining the exogenous Tat-Ag_2S QDs and endogenous RfLuc.

Due to the important role of the stem cell fate research in the development of safe and efficient stem cell therapy, the novel finding reported in the *Small* paper can inspire to future stem cell research and this novel noninvasive imaging method is promising in future biomedicine studies and will provide us more fundamental understanding on the *in vivo* biological activities.