Programming cells to home to specific tissues may enable more effective cell-based therapies

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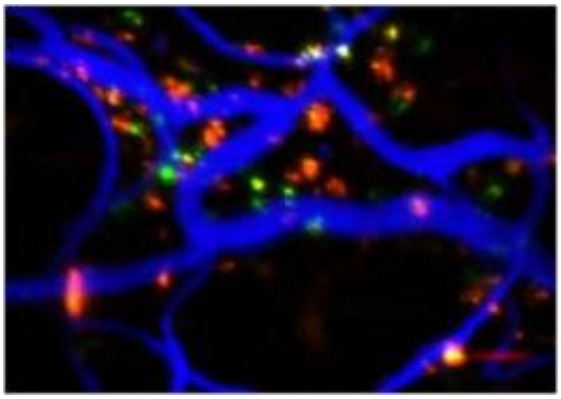

This is a fluorescent image of modified stem cells (red) and unmodified cells (green) localized within inflamed tissue 24 hours after injection. Blood vessels are labeled blue. Credit: Brigham and Women's Hospital

Stem cell therapies hold enormous potential to address some of the most tragic illnesses, diseases, and tissue defects world-wide. However, the inability to target cells to tissues of interest poses a significant barrier to effective cell therapy. To address this hurdle, researchers at Brigham and Women's Hospital (BWH) have developed a platform approach to chemically incorporate homing receptors onto the surface of cells. This simple approach has the potential to improve the efficacy of many types of cell therapies by increasing the concentrations of cells at target locations in the body. These findings are published online in the journal

Blood on Oct. 27, 2011.

For this new platform, researchers engineered the surface of cells to include receptors that act as a homing device. "The central hypothesis of our work is that the ability of cells to home to specific tissues can be enhanced, without otherwise altering cell function," said corresponding author Jeffrey M. Karp, PhD, co-director of the Regenerative Therapeutics Center at BWH and a principal faculty member of the Harvard Stem Cell Institute. "By knowing the 'zip code' of the blood vessels in specific tissues, we can program the 'address' onto the surface of the cells to potentially target them with high efficiencies."

While conventional cell therapies that include local administration of cells can be useful, they are typically more invasive with limited potential for multiple doses. "You can imagine, that when the targeted tissue is cardiac muscle, for example to treat heart attacks or heart failure, injecting the cells directly into the heart can be an invasive procedure and typically this approach can only be performed once," said Dr. Karp, also an assistant professor at Harvard Medical School and affiliate faculty Harvard-MIT Division of Health Sciences and Technology.

Using the platform the researchers created, the cells are prepared to travel directly to the area of interest after being injected through a common and much less invasive intravenous infusion method. "These engineered cells may also be more effective because multiple doses can be administered" stated Debanjan Sarkar, PhD, previously a postdoctoral fellow in Dr. Karp's lab and now an Assistant Professor of Biomedical Engineering at the State University of New York, University at Buffalo.

"The necessity for a more effective delivery approach stems from the potential diseases cell therapy may address," said Dr. Karp, noting that the approach can be used to systemically target bone producing cells to

the bone marrow to treat osteoporosis, cardiomyocytes to the heart to treat ischemic tissue, neural stem cells to the brain to treat parkinson's disease, or endothelial progenitor cells to sites of peripheral vascular disease to promote formation of new blood vessels.

The researchers concluded that, as the understanding of the mechanisms of cell trafficking grows, the ability to improve homing to specific tissues through engineered approaches should significantly enhance cell therapy by reducing the invasiveness of local administration, permitting repeat dosing, and potentially reducing the number of cells required to achieve a therapeutic effect, ultimately providing better outcomes for patients.

Provided by Brigham and Women's Hospital