Stem cells found in adult hair follicles may provide alternative to embryonic stem cells

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Having recently identified the molecular signature of these epidermal neural crest stem cells in the mouse, their research resolves conflicting scientific opinions by showing that these cells are distinctly different from other types of skin-resident stem cells/progenitors. Their work provides a valuable resource for future mouse neural crest stem cell research.

A report on the research from Dr. Maya Sieber-Blum's laboratory, co-authored by Yao Fei Hu, Ph.D., and Zhi-Jian Zhang, Ph.D., researchers in cell biology, neurobiology and anatomy at the Medical College, was published in a recent issue of Stem Cells: The International Journal of Cell Differentiation and Proliferation.

Epidermal neural crest stem cells are found in the bulge of hair follicles and have characteristics that combine some advantages of embryonic and adult stem cells, according to lead researcher, Maya Sieber-Blum, Ph.D., professor of cell biology, neurobiology & anatomy. Similar to embryonic stem cells, they have a high degree of plasticity, can be isolated at high levels of purity, and can be expanded in culture. Similar to other types of adult stem cells, they are readily accessible through a minimally invasive procedure and could lead to using a patient's own hair as a source for therapy without the controversy or medical issues of embryonic stem cells.

"We see the potential for cell replacement therapy in which patients can be their own donors, which would avoid ethical issues and reduce the

possibility of tissue incompatibility," says Dr. Sieber-Blum.

The Medical College team in collaboration with Prof. Martin Schwab, director of the Brain Research Institute of the University of Zürich, recently injected these cells in mice with spinal cord injuries. According to the study, when grafted into the spine, the cells not only survived, but also demonstrated several desirable characteristics that could lead to local nerve replacement and re-myelination (restoration of nerve pathways and sheaths).

Neural crest stem cells generate a wide array of cell types and tissues and actually give rise to the autonomic and enteric nervous systems along with endocrine cells, bone and smooth muscle cells. The cells can be isolated from the hair follicle bulge as multipotent stem cells, and then expanded in culture into millions of cells without losing stem cell markers.

"We grafted the cells into mice that have spinal cord injuries and were encouraged by the results. The cells survived and integrated into the spinal cord, remaining at the site of transplantation and not forming tumors," Dr. Sieber-Blum says.

According to Dr. Sieber-Blum, subsets of the epidermal neural crest stem cells express markers for oligodendrocytes, the nerve-supporting cells that are essential for proper neuron function. She has been awarded a grant from the Biomedical Technology Alliance, a Milwaukee inter-institutional research group, to determine in collaboration with Brian Schmit, Ph.D., associate professor of biomedical engineering at Marquette University, if the grafts lead to an improvement of spinal reflexes in the injured spinal cord of mice.

Dr. Sieber-Blum points out that the cells may also be useful to treat Parkinson's disease, multiple sclerosis, Hirschsprung's disease, stroke,

peripheral neuropathies and ALS. Certain defects of the heart, and bone defects (degeneration, craniofacial birth defects) could also be treated through neural crest stem cell replacement therapy. Together, these conditions affect over 11 million people today in the US and are estimated to annually cost more than $170 billion.

Source: Medical College of Wisconsin