Scientists isolate new population of pluripotent stem cells in fat removed during liposuction

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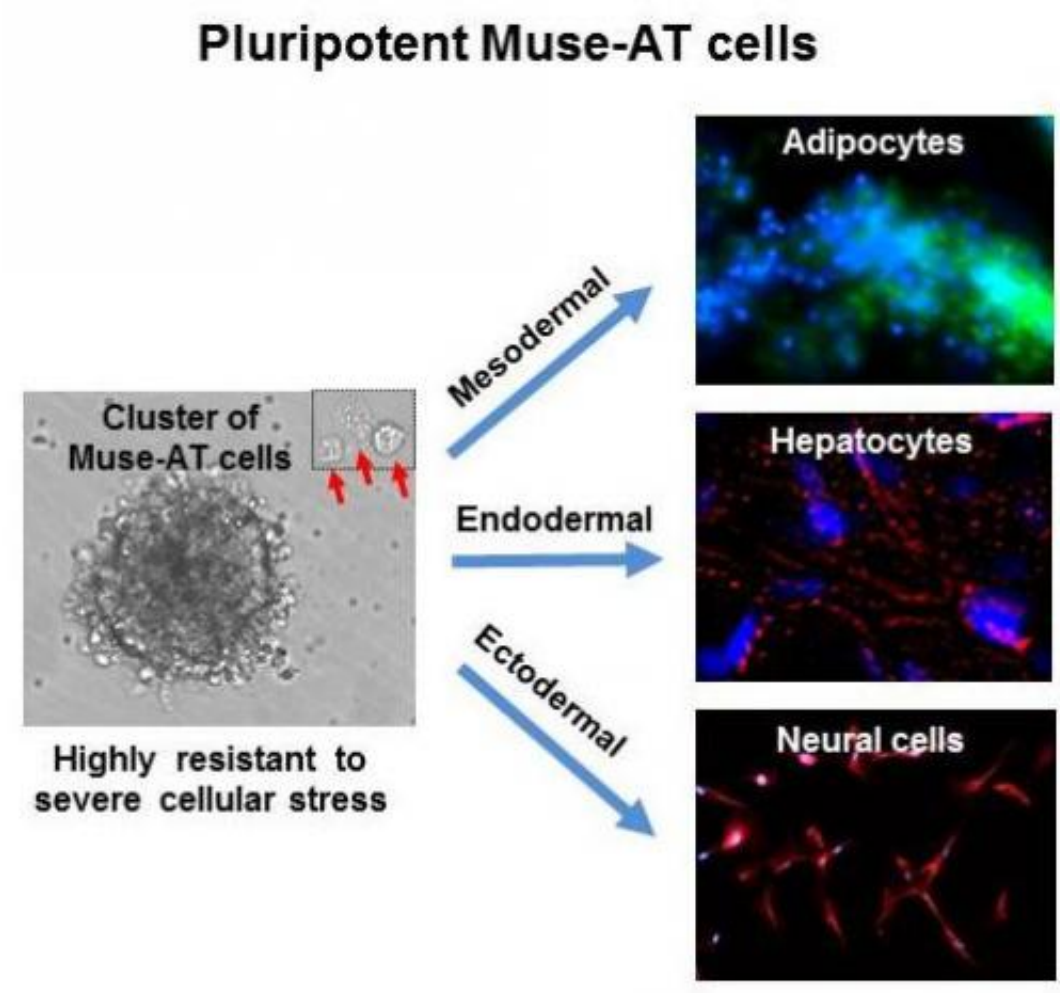

These pluripotent cells, isolated from fat tissue removed during liposuction, expressed many embryonic stem cell markers and were able to differentiate into muscle, bone, fat, cardiac, neuronal and liver cells. Credit: UCLA

Researchers from the UCLA Department of Obstetrics and Gynecology have isolated a new population of primitive, stress-resistant human pluripotent stem cells easily derived from fat tissue that are able to differentiate into virtually every cell type in the human body without genetic modification.

The cells, called Multi-lineage Stress-Enduring (Muse-AT) stem cells from fat, or adipose, tissue, were discovered by "scientific accident" when a piece of equipment failed in the lab, killing all the stem cells in the experiment except for the Muse-AT cells. The research team further discovered that not only are Muse-AT cells able to survive severe stress, they may even be activated by it, said study senior author Gregorio Chazenbalk, an associate researcher with UCLA Obstetrics and Gynecology.

These pluripotent cells, isolated from fat tissue removed during liposuction, expressed many embryonic stem cell markers and were able to differentiate into muscle, bone, fat, cardiac, neuronal and liver cells. An examination of their genetic characteristics confirmed their specialized functions, as well as their capacity to regenerate tissue when transplanted back into the body following their "awakening."

"This population of cells lies dormant in the fat tissue until it is subjected to very harsh conditions. These cells can survive in conditions in which usually only cancer cells can live," Chazenbalk said. "Upon further investigation and clinical trials, these cells could prove a revolutionary treatment option for numerous diseases, including heart disease, stroke and for tissue damage and neural regeneration."

The results of the two-year study are published June 5, 2013 in the peer-reviewed journal *PLOS ONE*.

Purifying and isolating Muse-AT cells does not require the use of a cell

sorter or other specialized, high-tech devices. They are able to grow either in suspension, forming cell spheres, or as adherent cells, forming cell aggregates very similar to human embryonic stem cell-derived embryoid bodies.

"We have been able to isolate these cells using a simple and efficient method that takes about six hours from the time the fat tissue is harvested," Chazenbalk said. "This research offers a new and exciting source of fat stem cells with pluripotent characteristics, as well as a new method for quickly isolating them. These cells also appear to be more primitive than the average fat stem cells, making them potentially superior sources for regenerative medicine."

Currently, embryonic stem cells and induced pluripotent stem cells - skin cells turned into embryonic-like cells - are the two main sources of pluripotent cells. However, both types can exhibit an uncontrolled capacity for differentiation and proliferation, leading to the formation of unwanted teratoma, or tumors. Little progress has been made in resolving that defect, Chazenbalk said.

Muse cells originally were discovered by a research group at Tokohu University in Japan and were derived from bone marrow and skin, rather than fat. That research group showed that Muse cells did not produce teratomas in animal models. Further research on the Muse-AT cells isolated at UCLA will need to be done to determine whether that cell population avoids production of teratomas.

In addition to providing a potential source of cells for regenerative medicine, Chazenbalk said the Muse-AT cells may provide a better understanding of cancer cells, the only other cells known to display such stress resistance.

Going forward, Chazenbalk and his team will use Muse-AT cells in

animal models to regenerate damaged or dysfunctional tissue to determine how efficiently they grow and perform in the body and to gauge their potential for future clinical use.

"Because lipoaspiration is a safe and non-invasive procedure and Muse-AT cell isolation requires a simple yet highly efficient purification technique, Muse-AT cells could provide an ideal source of pluripotent-like stem cells," the study states. "Muse-AT cells have the potential to make a critical impact on the field of regenerative medicine."

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