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Liposuctioned fat stem cells to repair bodies

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Expanding waistlines, unsightly bulges: people will gladly remove excess body fat to improve their looks. But unwanted fat also contains stem cells with the potential to repair defects and heal injuries in the body. A team led by Philippe Collas at the University of Oslo in Norway has identified certain chemical marks that allow him to predict which, among the hundreds of millions of stem cells in liposuctioned fat, are best at regenerating tissue.

Uncovering the nature and location of these molecular tags could allow scientists to pull off the ultimate trick of taking a patient's own fat cells and using them for therapy, Collas told researchers gathered at the EuroSTELLS Workshop 'Exploring Chromatin in Stem Cells' held on January 23-24, in Montpellier, France.

"Fat tissue is an underappreciated source of stem cells," Collas pointed out. Unlike other sources of adult stem cells, such as bone marrow, fat is abundant and there is no shortage of donors. "It's wonderful, we have litres and litres of material from cosmetic surgery clinics and end up with bucketfuls of stem cells to work with," he notes.

EuroSTELLS Project Leader Cesare Galli, from the University of Bologna, Italy has high hopes that transplanted fat stem cells will restore injured sports horses to their former glory. "Our aim is to regenerate the tendon structure that does not repair spontaneously," says Galli. Once scar tissue is formed, it hinders the animal's recovery. "If you intervene, with cell transplants, within one week, you can repair the lesion," Galli notes.

Like horses, humans are also vulnerable to joint injuries, and rehabilitations are long and costly. Now experience with horses is paving the way to cell therapies for sport-related tendon injuries in humans. Therapies using bone marrow stem cells, similar to fat stem cells, have achieved some successes, but the focus is shifting to fat, since the tissue is easier to access and extract than the bone marrow.
That fat-based methods work is not surprising, perhaps, because adipose tissue is closely related to bone, cartilage, muscle and other connective tissue. But some say it is impossible to re-programme adult cells to become nerve or liver cells, for example, without using embryos. Adult stem cells, such as those from fat, are thought to have more limited potential.

Collas insists that the transformation is possible. The hurdle lies not with the genes but with a cell's epigenetic status, the subtle chemical modifications of DNA and its surrounding histone proteins. Epigenetic marks contribute to switching genes on and off, and stem cells rely on them heavily as they divide and mature. The Oslo team has found that low rates of DNA methylation, for instance, boost the chances of transforming fat stem cells from one cell type into another. "Look at a cell's epigenetic profile," says Collas, "and you may be able to predict what that cell is likely to turn into."

These epigenetic signatures have grabbed everyone's attention, acknowledges Ernest Arenas, a EuroSTELLS researcher at the Karolinska Institute in Stockholm, Sweden. "Scientists in the stem cell field are starting to realise that for cell manipulations to succeed they need to pay attention to their epigenetic marks. Cells can't be pushed along to become a different cell type unless they start out with the right set of [epigenetic] conditions."

It is a complex area but one that is loaded with promise. "Everyone is talking about epigenetics," says Collas. If he has his way, people may soon be visiting plastic surgeons not just for cosmetic reasons, but for therapy.

Source: European Science Foundation

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