ABOUT STEM CELLS

Stem cells are everywhere...In embrionic tissue, fetal tissue, and in all adult tissues – in a great or lesser number. The most important sources of stem cells are:

1. Bone marrow
2. Periosteum
3. The connective tissue of muscles
4. The umbilical cord
5. Subcutaneous adipose tissue

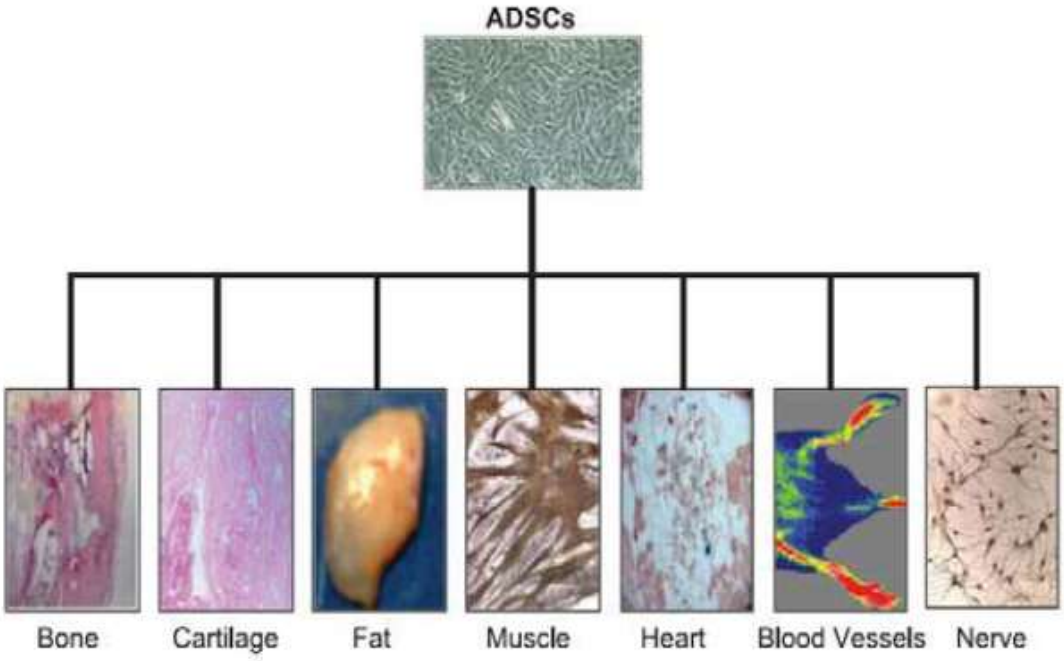

Figure Adipose Tissue-Derived Stem Cells are multipotent, extending beyond the traditional mesenchymal lineages.

Stem cells are low differentiated cells and they are able to transform into highly differentiated tissue cells. Because of that ability they are able to heal damaged tissue, migrating to the position of the damage, multiplying itself, and transforming to the damaged tissue cells, filling the defects with healthy functional cells.

In animals two main sources used to obtain stem cells – bone marrow and adipose tissue. So far, it was shown that adipose tissue has an adventage as a source over bone marrow. It contains five hundred times more stem cells than bone marrow. The sample process of taking the adipose tissue is much easier, less invasive and safer. Pain that occurs during the puncture of the sternum, as well as possible damage to the line of the heart, make bone marrow less valuable as a source. Also a small number of stem cells which require more weeks of breeding and reproduction, further indicate to use the fat as a source. For many years the injures of tendons and ligaments are treated with a freshly taken bone marrow. Now we konow that so administrated bone marrow contains a low number of stem cells and they are swimming in a large quantity of blood.

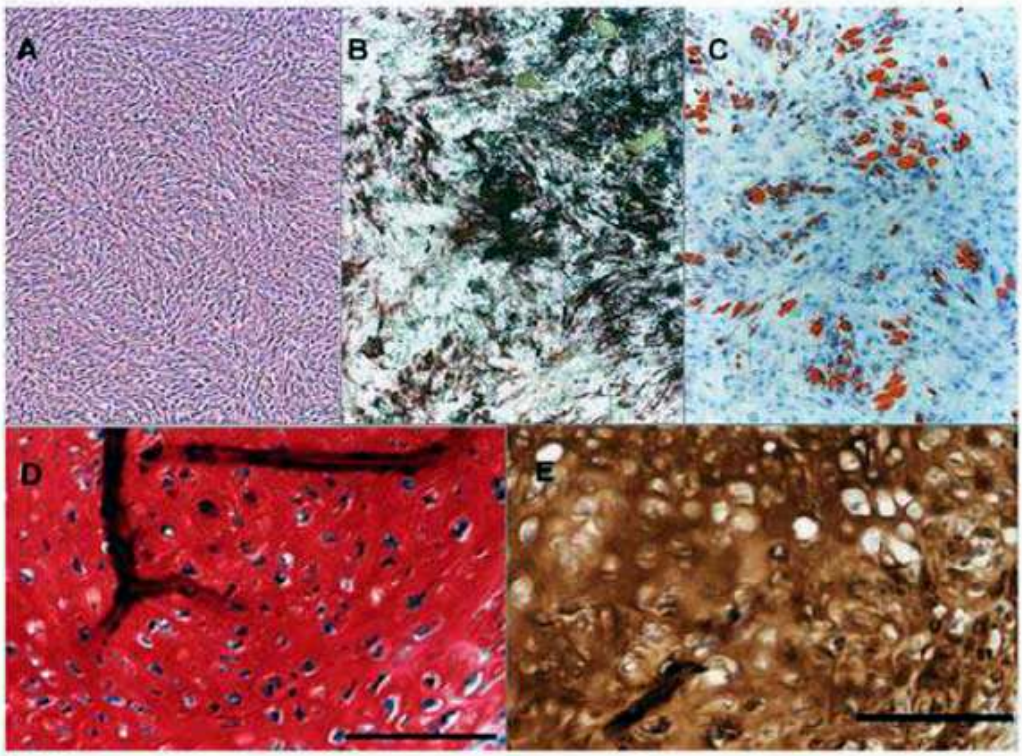

Fig. 1. Undifferentiated MSCs grown in monolayer culture (A) and after differentiation along the osteogenic (B), adipogenic (C) and chondrogenic pathways (D) and (E). Cell differentiation is these cultures was observed following staining with von Kossa (B), Nile red O (C), Safranin O (D) and by immunostaining with an antibody specific for type II collagen (E).

In the meantime, the vitality of the cells taken from fat tissue, showed an enormous potential: after numerous of passages, they have retained their undifferentiated status, but able to turn immediately into the damaged tissue cells, even after freezing. The potential to transform into any cell line were demonstrated in the laboratory, through the inducers for specific cell lineage. It was even measured, it is possible to get around 500.000 of stem cells from 400-600mg of adipose tissue, and after 14 days of cultivation these cells retain their phenotype, high proliferation capacity, and differentiation potential even after 25 passages. These cells have been shown in the laboratory with the antigens tipical for adult mesenchymal stem cells (CD13, CD29, CD44, CD105, CD166), with no gene expression of red blood cells (CD34, CD45), and white blood cells as well (HLA-DR).

Stem cells have the ability to synthesize a lot of anabolic factors such as growth factors (IGF1, TGFβ1), and antiapoptoic factor. Also, they are able to synthesize an extracellular matrix. In addition they have the ability to attract endogenous cells into the damaged site, and stimulate a differentiation of the cells in the growing residential lineages. They somehow "communicate" with the neighboring cells so they can suppress immune and inflammatory response, and reduce cell death and decay. It so happens through synthesizing and secreting of interleukin-1 receptor antagonist (IL-1ra). The latest research suggests that stem cells can "deliver" new mitochondria to the damaged cells, and save their aerobic metabolism, and stop the deterioration on that way.