

## Harvesting Stem Cells from “Trash”

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Medical science has resolved tones of health-related issues, still a huge population across the globe suffers from devastating disease conditions. In this distress, stem cells have come to rescue suffering humanity as they are believed, even in many cases successfully experimented, for their potential to heal the diseased and degenerating tissues and organs.

As stem cells are involved in the embryonic development of human and animals, that is why these cells have gained so much attention. In recent years, stem cells have been successfully used for their therapeutic prospective. Their involvement in the treatment of numerous diseases raised their demand of these cells. These cells are attributed because of their regenerative, self-renewal and differentiation potential. Briefly describing, a stem cell is an undifferentiated cell and is not specialized to perform any specific function, however, is capable to differentiate into any cell type, depending upon the type of induction. There are more than 200 types of cells in an individual's body and each cell has a specialized function. Stem cell, theoretically, can be converted into any of these cell types, and practically, has successfully been converted into many of them. This is why these cells may be used to regenerate the degenerated and dying cells and tissues.

Stem cells can be obtained from almost any tissue at any age of an individual, however, it is evident from the research output that the younger the stem cell donor, the better the results. Stem cells can be obtained from an adult individual, classically from the bone marrow, and recently from adipose tissues. Most recently, all parts of an embryo at any stage of development and fetal adnexa; including placenta, fetal membranes, amniotic fluid, Wharton's jelly and cord blood are successfully used. If not used, all the fetal adnexa are, otherwise, discarded. Placenta, that is known to form a close association between maternal and fetal blood, plays its role not only in exchange of gases, nutrients and waste products between mother and fetus, but also serve as a source of hormones and some growth factors that are necessary to sustain pregnancy and immunologically protect the fetus from mother immune reaction and contra wise. Now this tissue is subjected to retrieve stem cells, therefore, this “trash” can be converted into valuable “treasure”. After careful and programmed manipulation, these cells are injected into the patient tissue or blood.

Another addition in the source of stem cells are induced pluripotent stem cells. This discovery lead to the award of Nobel Prize in 2012. In adults, as we know, there are more than 200 cell types. They are differentiated cells to perform their specific function. They are made to change into undifferentiated cells, stem cells, so that they may be employed to convert into a specifically desired cell type on giving appropriate stimulation. These cell are autologous, that is they belong to the patient's own body, hence there are fewer to no chances of cell rejection by the patient's body as is observed in organ transplantation. Induced pluripotent stem cells are potentially able to be used for cell based therapies and clinical applications like in regenerative medicine. Therefore, stem cells from genetically preferred animals could be used to raise the desired progeny with higher production potentials. The use of fetal adnexa offers almost no ethical concerns and is relatively easier and quicker than somatic cell nuclear transfer. Drug discovery and testing becomes lot easier stem cells. Regardless of stem cells source, cell transplantation technology addresses the impairment in cell structure and function in the body. The thorough investigation of the molecular changes and underlying mechanisms could help in understanding disease occurrence and propagation.

AIDS has been claimed a few weeks ago to be treated by using stem cell technology. Similarly, chronic disease like cardio-vascular conditions, cancer and other degenerative disorder are being addressed. The commercial sector has come into play to mercenary stem cell products. It has been estimated that market for stem cell therapy will earn a revenue around \$15 billion by 2025. Currently, the biggest market is North-America that shared 41.5% of the global market last year, followed by Asia Pacific with 20% share. The biggest earner in stem cell revenue is oncology with 37% contribution. However, the highest growing market is autologous stem cell therapy with approximately 10% annual growth rate.

Some potential area of stem cell research and marketing includes wound care (burns, ulcers), ophthalmological uses, including corneal defects. Rheumatoid arthritis is a very painful condition of joints that originates because of an autoimmune condition. The self-defence system wrongly assaults the self-cells and tissues that leads to pain, swelling as well as stiffness of joints. Stem cell therapy is showing promising results in rheumatoid arthritis and similar auto-immune conditions. After successful understanding of development of heart during early embryonic stages, the scientists are now able repair and reprogramme damaged tissue of heart. Another issue in human is the loss of hair follicle in head scalp. Stem cell scientist are providing facility to produce naturally-looking hair. This development is another big boost for commercialization and marketing of this technology. One of the highest achievement in stem cell field so far is the development of organoids, specially lab-grown "cerebral organoids". They look like very small sized brains of stem cell origin, although they show some cerebral activity, yet, they seem unable to think. However, think of a condition where doctors have accepted that a specific organs' cells are dead and degenerated and are no longer able to perform their normal physiological function and stem cells rescue such patients. Similarly, kidney patients will be glad to know that mini-sized functioning kidney has been grown in animal models. With the advent of this new procedure, millions of renal patients will be saved. Stem cells found in the brain also help to understand aging which offers a solution not only to stop aging but also to reverse it. One may have encountered difficult situation where he has to find blood for his loved-ones, but could not do so. Now, such times are about to end as there may a limitless supply of blood by the magic of this technology. The list goes on and on and one finds new horizons of developments and success. With the advent of stem cell, there may remain no area where people would suffer from their lost cellular structure and function.

Having said that, there are many challenges that need to cope with and mysteries that need to be revealed, however, we know that stem cells are the reservoirs of healthy propagating cells with immense therapeutic importance. It is need of the hour to make the most of available resources and convert some “trash” into “treasure”. It's worth mentioning here that donating stem cell does not harm the donor at all, yet someone's life is saved. Donating stem cells must be promoted as there are few chances to find the best match for the patients. Stem cell banks may be established where characterized stem cells may be stored and are readily available on demand. There is also an emergent need to regulate this technology and its application nationally as well as internationally as rogue stem cell therapy may lead to health related complications.

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