

# STEM CELL

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## **Abstract :**

A stem cells is an immature cell that has the potential to become specialised into different types of cells throughout the body. They can give rise to any tissue found in the body, and provide nearly limitless potential for medical science. Stem cells can be used to prevent or cure diseases and injuries such as Alzheimer's disease, spinal cord injuries, Parkinson's disease, type 1 diabetes, heart disease, stroke, blood cancer, burns, vision and hearing loss.

**Key words :** Stem cell, Bone marrow, Embryonic, Transplant.

Stem cells are mother cells that have the potential to become any type of cell in the body. One of the main characteristics of stem cells is their ability to self renew or multiply while maintaining the potential to develop into other types of cells. Stem cells can become cells of the blood, heart, skin , muscles, brain etc. there are different sources of stem cells but all types of stem cells have the same capacity to develop into multiple types of stem cells. There are two basic types of stem cells -embryonic stem cells and adult stem cells.

Embryonic stem cells are produced when a newly fertilized egg begins to divide. These stem cells can become any type of cell in the body.

Adult stem cells somewhat of a misnomer because they can also be found in infants and children - are stem cells that reside in already developed tissue. These stem cells can act like a repair system, dividing regularly to provide new specialized cells to take the places of those die or are lost. Tissues where adult stem cells have been found include the brain, blood, muscle, skin and bone. Research with adult stem cells has been limited due to the difficulty in growing & differentiating them under laboratory conditions.

**Discovery of stem cells:-** Scientists first studied the potential of stem cells in mouse embryo over two decades ago. over years of research they discovered the properties of these stem cells in 1998. They found methods to isolate stem cells from human embryo and grow the cells in the laboratory.

Early studies utilized embryos created for infertility purposes through in vitro fertilization procedures and when they were no longer needed for that purpose. The use required voluntary donation of the embryos by the owners.

**Potential for use:-** Stem cell research is improving by leaps and bounds . These may soon become the basis for treating diseases such as Parkinson's diseases,diabetes, heart failure, cerebral palsy,heart diseases and host of other chronic ailments.

Stem cells may also be used for screening new drugs and toxins and understanding birth defects without subjecting human volunteers to the toxin and drugs.

#### **Types of stem cells:-**

- (i) **Pluripotent stem cells ( PS cells):** - These possess the capacity to divide for long periods and retain their ability to make all cell types within the organism. The best known type of pluripotent stem cell is the one present in embryos that helps babies grow within the womb. These are termed embryonic stem cells. These cells form at the blastocyst stage of development. A blastocyst is hollow ball of cells that is smaller than a pinhead. The embryonic stem cells lie within this ball of cells. These are termed induced pluripotent cells or IPS cells.
- (ii) **Fetal stem cells:** - These are obtained from tissues of a developing human fetus. These cells have same characteristics of the tissues they are taken from for example; those taken from fetal muscles can make only muscles cells. These are also called progenitor cells.
- (iii) **Adult stem cells:** - These are obtained from some tissues of the adult body. The most commonly used example is the bone marrow. Bone marrow is a rich source of stem cells that can be used to treat same blood diseases and cancers.

#### **Stem cells importance:-**

For decades researchers have been studying the biology of stem cells to figure out how development works and to find new ways of treating health problems. Because stem cells can give rise to any tissue found in the body they provide nearly limitless potential for medical applications.

Current studies are researching how stem cells may be used to prevent or cure diseases and injuries such as Parkinson's disease, type 1 diabetes, heart disease, spinal cord injury,Duchenne's muscular dystrophy, Alzheimer's disease ,strokes,burns, osteoarthritis,rheumatoid arthritis,vision and hearing loss. Stem cells could also be used someday to replace or repair tissue damaged by diseases or injury.

Stem cells procedures currently provide life saving treatment for patients with leukemia, lymphoma, other blood disorders and some solid tumors. The three main technologies in use today are:-

1. **Adult stem cell transplant: -Bone marrow stem cells-**Stem cells technology has been used for more than 20 years in bone marrow transplant, where the patient's bone marrow stem cells are replaced with those from a healthy, matching donor. If the transplant is successful, the stem cells will migrate into the patient's bone marrow and begin producing new healthy leukocytes to replace the abnormal cells.
2. **Adult stem cell transplant: -Peripheral blood stem cells (PBSC) -**while most blood cells reside in the bone marrow a small number are present in the blood stream. PBSCs can be obtained from drawn blood making them easier to collect than bone marrow cells. However PBSCs are sparse in the blood stream so collecting enough to perform a transplant can pose a challenge.
3. **Umbilical Cord blood stem cell transplant: -** Umbilical cords traditionally have been discarded as a by product of the birth process. In recent years however the stem cell rich blood found in the umbilical cord has proven useful in treating the same types of health problems as those treated using bone marrow stem cells & PBSCs.

Adult stem cells can be removed from adult tissue with little harmful effects on the individual while embryonic stem cells are derived from multicellular embryos that have been cultured in the laboratory.

Numerous regulatory and ethical constraints exist for the use of embryos in research. There are also a limited no. of human embryonic cells lines available for research that meet all criteria for federal funding but many scientist remain skeptical over quality of these cells :

Following is a list of current and potential sources of stem cells:-

1. Early embryos created by in vitro fertilization-either those which are not needed for infertility treatment (sometimes called spare embryos) or created specifically for research.
2. Early embryos created by somatic (body) cell nuclear transfer (SCNT) a procedure that bypasses the normal fertilization process by taking the genetic material from a cells in an adults body and fusing it with an empty egg cells. This is a form of therapeutic cloning which would allow cells to be customized for each individual and there by minimize the chances of tissue rejection.
3. Germ cells or organs of an aborted fetus
4. Blood cells of the umbilical cord at the time of birth.

5. Some adult tissues (such as bone marrow)
6. Mature adult tissues cells reprogrammed to behave like stem cells.

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