Stem cells possess 2 main characteristics:

-Long-term self renewal.

- They give rise to all types of differentiate cells.

Sources of pluripotent stem cells:

-The inner cell mass of the blastocyst.

- Fetal stem cells.

From inside out:

-the inner cell mass – about 30 cells;

-the blastocoel;

- the trophoblast.

The stem cells which have the greatest differentiation capacity are:

1. Totipotent.

2. Pluripotent.

3. Multipotent.

Embryonic stem cells have broader differentiation potentialities. They can give rise to any differentiated cell type.

Adult stem cells, like hematopoietic or nerve stem cells, can only give rise to hematopoietic or nerve cell types, respectively.

Diseases that might be treated by transplanting cells generated from human embryonic stem cells include:

-Parkinson's disease

-Diabetes

-Traumatic spinal cord injury

-Purkinje cell degeneration - Duchenne's muscular dystrophy

-Heart disease

-Vision and hearing loss

Examples of differentiated blood cells:

-red blood cells (erythrocyte)

- white blood cells (lymphocyte T, lymphocyte B, macrophage, neutrophil, etc)

-platelet

Totipotent stem cells are cells that can become any kind of cell in the body.

"Toti" comes from the Latin word "totus" or "total", so you can think of a totipotent stem cell as having "total" potential.

Early embryonic cells are totipotent.

Embryonic stem cells are isolated by transferring the **inner cell mass** into a plastic laboratory culture dish that contains a nutrient broth known as culture medium.

Feeder cells release nutrients and growth factors into the cell culture which 'feed' and support the stem cells.

Three different methods exist :

(1) labelling the cells in a living tissue with molecular markers and then determining the specialized cell types they generate; (2) removing the cells from a living animal, labelling them in cell culture, and transplanting them back into another animal to determine whether the cells repopulate their tissue of origin;

(3) isolating the cells, growing them in cell culture, and manipulating them, often by adding growth factors or introducing new genes, to determine what differentiated cells types they can become.

Examples of adult stem cells:

-Hematopoietic stem cells can be found in the bone marrow and, in less quantities, in the blood stream and give rise to all blood cell types.

- Nerve stem cells are found in the brain.

As embryonic stem cells are undifferentiated and possess a broader spectrum of differentiating capacities they may, when transplanted, give rise to other cell types (e.g., bone, blood, muscle) than the one we expect to regenerate (e.g. nerve); they possess also higher proliferation capacity. When transplanted they may give rise to tumors.

- Neuron
- Glial cell

Pluripotent stem cells can become almost any kind of cell in the body.

"Pluri" comes from the Latin word meaning "more" or "most", so you can think of a pluripotent stem cell as having "more"potential.

Blastocyst inner cell mass cells and Fetal Stem cells are pluripotent.

The umbilical cord contains blood stem cells derived from the newborn (multipotent stem cells) which can be used to regenerate patients' blood cells.

Umbilical cords may be stored frozen in what we call umbilical cord banks.

Patients have to take immunosuppressive drugs to avoid transplant rejection.

NGF (nerve growth factor) and neuron

Erythropoietin and Erythrocyte

Bone stem cells are called osteoblasts.

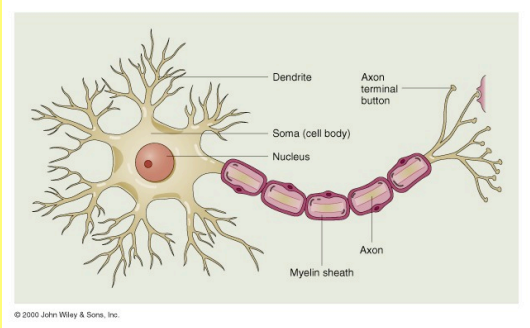
Lymphoblasts are neither of these stem cell types.

Their differentiation capacity is lower than that of multipotent stem cells. They are hematopoietic precursors that can only give rise to lymphocytes (T and B). They are called bipotent.

Transdifferentiation is the capacity of differentiated cell types, in the context of another microenvironment, to become another differentiated type.

Differentiated muscle cells are called myocytes.

We can find blood stem cells in the bone marrow and, in less quantity in the blood stream.



Mulipotent stem cells can differentiate into only a limited range of cell types.

"Multi" comes from the Latin word meaning "many" or much, so you can think of a multipotent stem cell as having "much potential".

Umbilical cord and adult stem cells are multipotent.

"Adult" stem cells have a misleading name, because children also have them. These stem cells reside in already differentiated tissue, directing their growth and maintenance throughout life.

Like umbilical cord cells, adult stem cells are multipotent.

Routine stem cell therapies include:

-Adult stem cell transplant using bone marrow cells;

-Adult stem cell transplant using peripheral blood stem cells;

-Umbilical cord blood cell transplant.

All these are used to treat blood disorders.

Totipotent:

-Early embryonic stem cells

Pluripotent

-Blastocyst inner cell mass embryonic stem cells

-Fetal embryonic stem cells

Multipotent

-Umbilical cord stem cells

-Adult stem cells

The goal of any stem cell therapy is to repair damaged tissue that can't heal itself.

This might be accomplished by transplanting stem cells into the damaged area and directing them to grow new, healthy tissue.

It may also be possible to coax stem cells already in the body to work overtime and produce new tissue.

To date, researchers have been more successful with the first method- stem cell transplants.

In this technique, a nucleus from the patient's somatic cell is inserted into an enucleated oocyte. The resulting embryo is grown in vitro until it has developed an inner cell mass. Cells from the inner cell mass are cultured to generate stem cells that are identical to those of the patient. The result is the production of pluripotent stem cells, not the production of a new child.

-adult blood stem cells (multipotent cells; 1 in every 100,000 cells from the population of bone marrow cells);

-mature and maturing (less than multipotent: tripotent, bipotent, etc.) white and red cells.

-adult stromal stem cells (mesenchymal microenviromental cells which support blood cell production).

-mature stromal cells.

In contrast to somatic cell therapy, which seeks to cure individuals by replacing sick or damaged somatic cells by wild type cells, germ line cell therapy seeks to eliminate bad cells from the individual and from that person's descendants.

It can be accomplished by modifying a germ cell or fertilized egg in such a way that the new genome is in each cell of the body, and is therefore transferred to the next generation.