Stem cell

The body's master cells

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Stem cells are cells that can differentiate into other types of cells, and can also divide to form new cells called daughter cells, These daughter cells either become new stem cells (self-renewal) or become specialized cells (differentiation) with a more specific function.

Sources of stem cells

Embryonic stem cells. These stem cells come from embryos that are three to five days old. At this stage, an embryo is called a blastocyst and has about 150 cells. These cells can divide into more stem cells or can become any type of cell in the body. This versatility allows embryonic stem cells to be used to regenerate or repair diseased tissue and organs.

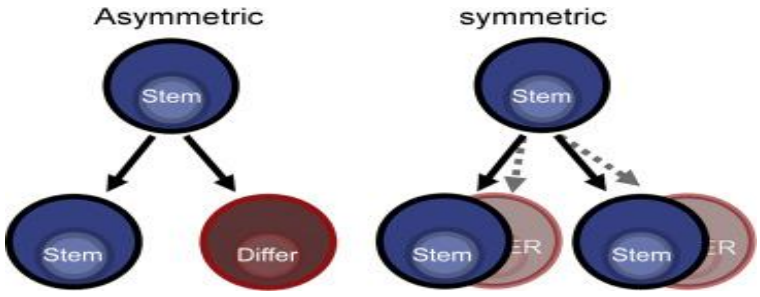
Adult or somatic stem cells. These stem cells are found in small numbers in most adult tissues, such as bone marrow or fat. Adult stem cells have a more limited ability to give rise to various cells of the body.

Stem cells differ from other kinds of cells in the body. All stem cells—regardless of their source—have three general properties: they are capable of dividing and renewing themselves for long periods; they are unspecialized; and they can give rise to specialized cell types.

Stem cells may replicate through two types of cell divisions:

1- symmetric: both daughter cells are identical as parent stem cells

2- Asymmetric, one of two cells is identical to parent stem cells and the second enters differentiation into more specialized cell lineage



Embryonic stem cells

Embryonic stem cells are obtained from the inner cell mass of the *blastocyst*, a mainly hollow ball of cells that, in the human, forms three to five days after an egg cell is fertilized by a sperm. A human blastocyst is about the size of the dot above this "i."

In normal development, the cells inside the inner cell mass will give rise to the more specialized cells that give rise to the entire body—all of our tissues and organs. However, when scientists extract the inner cell mass and grow these cells in special laboratory conditions, they retain the properties of embryonic stem cells.

Somatic or adult stem cells

Also referred to as Tissue-specific stem cells, re more specialized than embryonic stem cells. Typically, these stem cells can generate different cell types for the specific tissue or organ in which they live.

For example, blood-forming (or *hematopoietic*) stem cells in the bone marrow can give rise to red blood cells, white blood cells and platelets. However, blood-forming stem cells don't generate liver or lung or brain cells, and stem cells in other tissues and organs don't generate red or white blood cells or platelets.

Some tissues and organs within your body contain small caches of tissue-specific stem cells whose job it is to replace cells from that tissue that are lost in normal day-to-day living or in injury, such as those in your skin, blood, and the lining of your gut.

What Are the advantage and disadvantages of Stem Cell

Advantages	Disadvantages
• It provides medical benefits in the fields of therapeutic cloning and regenerative medicine. • It provides great potential for discovering treatments and cures to a variety of diseases including Parkinson's disease, schizophrenia, Alzheimer's disease, cancer, spinal cord injuries, diabetes and many more. • Limbs and organs could be grown in a lab from stem cells and then used in transplants or to help treat illnesses. • It will help scientists to learn about human growth and cell development. • Scientists and doctors will be able to test millions of potential drugs and medicine, without the use of animals or human testers. This necessitates a process of simulating the effect the drug has on a specific population of cells. Stem cell research also benefits the study of development stages that cannot be studied directly in a human embryo, which sometimes are linked with major clinical consequences such as birth defects, pregnancy-loss and infertility. A more comprehensive understanding of normal development will ultimately allow the prevention or treatment of abnormal human development. • An advantage of the usage of adult stem cells to treat disease is that a patient's own cells could be used to treat a patient. Risks would be quite reduced because patients' bodies would not reject their own cells. • Embryonic stem cells can develop into any cell types of the body, and may then be more versatile than adult stem cells.	• The use of embryonic stem cells for research involves the destruction of blastocysts formed from laboratory-fertilized human eggs. For those people who believe that life begins at conception, the blastocyst is a human life and to destroy it is immoral and unacceptable. • Like any other new technology, it is also completely unknown what the long-term effects of such an interference with nature could materialize. • Embryonic stem cells may not be the solution for all ailments. • According to a new research, stem cell therapy was used on heart disease patients. It was found that it can make their coronary arteries narrower. • A disadvantage of most adult stem cells is that they are pre-specialized, for instance, blood stem cells make only blood, and brain stem cells make only brain cells. • These are derived from embryos that are not a patient's own and the patient's body may reject them

Applications of Stem Cell

At least three different therapeutic concepts for cell replacement can be envisaged. One therapeutic approach involves direct administration of stem cells. The cells may be injected directly into the damaged organ, where they can differentiate into the desired cell type. Alternatively, stem cells may be injected systemically since they have the capacity to home in on damaged tissues by following gradients of cytokines and chemokines released by the diseased organ.

A second approach involves transplantation of differentiated cells derived from stem cells. For example, pancreatic islet cells can be generated from stem cells before transplantation into diabetic patients, and cardiomyocytes can be generated to treat ischemic heart disease.

A third approach involves stimulation of endogenous stem cells to facilitate repair. This goal might be accomplished by administration of appropriate growth factors and drugs that amplify the number of endogenous stem/progenitor cells and/or direct them to differentiate into the desired cell types. Therapeutic stimulation of precursor cells is already a clinical reality in the hematopoietic system, where factors such as erythropoietin, granulocyte colony-stimulating factor, and granulocyte-macrophage colony-stimulating factor are used to increase production of specific blood elements. In addition to these strategies for cell replacement, a number of other approaches could involve stem cells for ex vivo or in situ generation of tissues, a process termed *tissue engineering*. Stem cells are also excellent candidates as vehicles for cellular gene therapy. Finally, transplanted stem cells may exert paracrine effects on damaged tissues without the differentiation and replacement of lost cells

Application of Stem Cells in Oral Disease

Stem cell therapies become preferred methods for the treatment of multiple diseases. Oral and maxillofacial defect is one kind of the diseases that could be most possibly cured by stem cell therapies

The oral and maxillofacial areas consist of many different types of tissues. It differs one from another and affects not only the functions of breathing, chewing, speech and smell, etc., but also esthetics and have much influence on the patients psychologically especially after accident injuries or tumor section . The defects occurred in oral area can be divided into four main groups: dental hard tissue defect, pulpal disease, periodontal diseases, and maxillofacial defects

Stem Cells

Principles	Application	Process
Stem cells are introduced into a damaged area of the body where, under the right conditions, will replace the damaged area.	The main areas where stem cells have proven their worth is in bone marrow transplants, replacing damaged heart tissue after a heart attack and replacing damaged nerve tissue which gives hope to anyone who has had a spinal cord injury.	Often times stem cells are grown in a lab first to ensure the right conditions and then placed into a sick person.