

## STEM CELLS AND THEIR PRESERVATION AND UTILIZATION

SALMA KHAN

PhD Scholar, JJTU, Ghunjhunu (Raj.)  
Associate Professor, Govt.CON, Bilaspur (C.G.)

### Abstract

*Stem cells are the body's natural reservoir – replenishing stocks of specialized cells that have been used up or damaged. We all have stem cells at work inside us. Right now, inside your bone marrow, stem cells are busy making the 100,000 million new blood cells you need every single day. We need to make new cells all the time, just to keep our body functioning. Some specialized cells, such as blood and muscle cells, are unable to make copies of themselves through cell division. Instead they are replenished from populations of stem cells. Stem cells have the unique ability to produce both copies of themselves (self-renewal) and other more specialized cell types (differentiation) every time they divide. Stem cells, therefore, are essential to the maintenance of tissues such as blood, skin, and gut that undergo continuous turnover (cell replacement), and muscle, which can be built up according to the body's needs and is often damaged during physical exertion.*

### INTRODUCTION

Stem cell is a cell that can become established in an appropriate growing environments, has the ability to multiply, can produce cell types that continue to differentiate and renew itself or ensure the continuation of its own population and can regenerate tissues with functional damage. Stem cell, which have been used for a period of time in the treatment of leukemia and other types of cancer, have recently started to be used in medicine development, and this progress offers us hope for the treatment of diabetes, cardiovascular and neurogenerative disease. (Ballen 2005; Baker & wanger 2003). Stem cells have

remarkable potential to develop into many different cell types in the body during early life and growth. In addition, in many tissues they serve as a sort of internal repairer system,

### DEFINITION

Stem cell can be defined as single cells that are clonal precursor of both more identical stem cells and a defined set of differentiated progeny. (Till and McCulloch 1961, Smith 2001).

Stem cells are young, primitive and unspecialized cells with a remarkable potential to renew, differentiate and develop into any desired tissue or organ of the body. They retain the ability to self –renew and differentiate into a variety of tissues.

stem cells are a group of primordial cells in the body which are capable of multiplying itself, a process known as 'Self-Renewal' to increase the number of cell pool and growing into different types of mature cells which subserve specific functions in the body.(Peter Crosta 2013, National Institute Of Health, U.S 2013, Xia Y,Nivet E 2013)

Stem cells naturally occur in many parts of human body. Some of these locations include the end of tubercular marrow spaces

of long bones dermal layers of skin, intestinal villi, adipose tissues of human body dental pulp human placenta and cord blood, menstrual blood and peripheral blood.

**Types of Stem cells**

Not all stem cells come from an early embryo. In fact, we have stem cells in our bodies all our lives. One way to think about stem cells is to divide them into three categories:

1. Embryonic stem cells: grown in the laboratory from cells found in the early embryo
2. Induced pluripotent stem cells, or 'reprogrammed' stem cells: similar to embryonic stem cells but made from adult specialised cells using a laboratory technique discovered in 2006
3. Tissue stem cells: found in our bodies all our lives.

You can read in detail about the properties of these different types of stem cells and current research work in our other fact sheets.

**SOURCES OF STEM CELLS**

SN	Stem cell type	
	Embryonic Stem Cells	Obtained from the inner cell mass of embryo, has pluripotency
	Adult Stem Cells	Bones marrow, skin, fat cells, dental pulp, placenta and cord, endometrial and menstrual blood

	Umbilical cord stem cell	umbilical cord,
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- 1) **Embryonic stem cells-** These cells are supposedly the most primitive and potentially the best source of the stem cell for treatment of various disorders. They are derived from embryos or to be precise blastocyst, as their inner cell mass. There are numerous ethical issues related to the use of embryonic stem cells.
- 2) **Umbilical stem cells-** umbilical cord stem cells are derived from the umbilical cord during child birth. Once the baby is born the umbilical cord is clamped and the child separated from the mother, after which the blood from umbilical vessels is collected in specialized bag. Umbilical cord blood is readily available source of stem cells for treatment of routinely encountered disorders and now used with increasing frequency as an alternative to bone marrow stem cells for transplantation.
- 3) **Adult stem cells-**
  - A) **Bone marrow-** stem cells derived from bone marrow had been the most widely practice form the transplantation till the advent of the cord derived stem cells. They can be obtained by a procedure called bone marrow puncture from iliac crest of the hip bone. The procedure is painful and invasive as compared umbilical cord blood collection.

B) **Peripheral blood**-the stem cells in this case are collected by a procedure called “apheresis”.it requires the aid of a well programmed cell separator that would provide the desired stem cells from the blood stream. This procedure is generally utilized for autologous use only.

**Adult tissues**- stem cell can also extracted from tissues like skin, cornea, fat, small intestine, and liver. These stem cells would also be generally utilized for self use.

### Unique Properties of Stem Cells

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 are capable of dividing and renewing themselves for long periods.

Unlike muscle cells, blood cells, or nerve cells—which do not normally replicate themselves—stem cells may replicate many times, or **proliferate**. A starting population of stem cells that proliferates for many months in the laboratory can yield millions of cells. If the resulting cells continue to be unspecialized, like the parent stem cells, the cells are said to be capable of **long-term self-renewal**.

Stem cells are unspecialized. One of the fundamental properties of a stem cell is that

it does not have any tissue-specific structures that allow it to perform specialized functions. For example, a stem cell cannot work with its neighbors to pump blood through the body (like a heart muscle cell), and it cannot carry oxygen molecules through the bloodstream (like a red blood cell). However, unspecialized stem cells can give rise to specialized cells, including heart muscle cells, blood cells, or nerve cells.

#### Stem cells can give rise to specialized cells.

When unspecialized stem cells give rise to specialized cells, the process is called **differentiation**. While differentiating, the cell usually goes through several stages, becoming more specialized at each step. Scientists are just beginning to understand the signals inside and outside cells that trigger each step of the differentiation process. The internal **signals** are controlled by a cell's **genes**, which are interspersed across long strands of DNA and carry coded instructions for all cellular structures and functions. The external signals for cell differentiation include chemicals secreted by other cells, physical contact with neighboring cells, and certain molecules in the **microenvironment**. The interaction of signals during differentiation causes the cell's DNA to acquire **epigenetic** marks that restrict DNA expression in the cell and can be passed on through cell division.

#### **Stem Cells Preservation Or Banking.**

Cord Blood Banking Is A Misnomer.” The relevant term should be stem cell banking. The reason for this is that the cord blood (or any other source of stem cells ) is essentially processed after collection and stem cells that are isolated are stored or “banked”, under

cryogenic conditions with the help of an adequate liquid nitrogen backup system. Most cord blood banks store the stem cells for twenty one years after processing. However research has given sample evidence in suggesting that stem cells can be stored beyond twenty one years, even indefinitely, provided they are processed and stored under appropriate storage conditions.

**Preservation-** the stem cells are currently preserved for a period of 21 years.

**Quantity of collected cord and cord blood-** there is a minimum quantity required, which is about 20 ml of cord blood and inch of cord.

**When how is the collect-** after delivery the umbilical cord clamped and cut. The cord is cleaned with alcohol and betadine to prevent bacterial and fungal contamination and needle end of the collection bag inserted into the umbilical cord. This procedure is safe, painless and does not harm the mother and baby.

**Who will collect the cord-**Gynecologist and trained nurses

**Stem cell Banking Facilities:-** there are two types of stem cell banking

- Public banking

-private banking

**Which Diseases Can Be Treated By Stem Cell Therapy:-** The Stem cells may provide numerous benefits to the baby its siblings and the family. Saving stem cell would be useful in treating a host of ailments, ranging from innocuous to ominous and life

threatening. If child ever needs to use their cord blood as part of life saving treatment, his/her stem cell shall provide an exact match. Sibling has up to 50% chance of becoming a match. The following disease can be treated with the help of stem cell therapy-

Vascular disorder--chronic heart failure-Acute myocardial infarction-Cardiomyopathy-Buerger's disease-Liver Disorders-Liver cirrhosis-Bone and Cartilage Disorders-Osteoarthritis-non-healing fractures- osteogenesis imperfect-Neuromuscular disorder-cerebral palsy--parkinson's disease-- spinal cord injury--Alzheimer;s disease-Hematological disorder--acute leukemia-chronic leukemia-Thalassemia-Plasma cell disorder-Cancer-Diabetes-Eye Disorder.

### **SIGNIFICANCE OF THE RESEARCH, IMPORTANCE & UTILITY OF THE RESEARCH**

Recent advances in science have demonstrated that umbilical cord blood is a rich source of stem cells, making it a valuable tissue resource in the clinical field of stem cell therapy and transplantation. In spite of many benefits of the stem cells obtained from cord blood, the umbilical cord was considered medical waste and disposed of following delivery along with the placenta due to the lack of knowledge about its the benefits and uses .This study is conducted to improve antenatal women's knowledge regarding stem cells preservation collection and its utilization by applying an educational intervention.educational intervention helps to improve the knowledge and awareness of antenatal women's related to stem cell

collection or preservation and utilization. the use of educational intervention will be more economical interns of time ,mony and interpersonal relation

## CONCLUSION

The science of the stem cells is a with great potential for treating injury and disease. Stem cells are undoubtedly, most promising for cell based therapy thereby provides a powerful and flexible option for physician to restore function and improve human health through the novel techniques. The pursuit and production of knowledge through scientific research is an undertaking that offers enormous intellectual rewards for researchers while also performing an important social function. The advancement of science has transformed our lives in ways that would have been unpredictable just a half-century ago. Whether stem cell research will have a similar effect remains to be determined, but the promise is so great that it seems wise to consider seriously how best to further such research in a manner that is sensitive to public sensibilities. Public conversations about research and use of human stem cells are well underway. This report is intended to contribute to and inform this ongoing dialogue.

We recognize that science does not exist in isolation from the larger community that feels its effects, whether perceived as good or bad. The work of scientists is, and should be, conditioned and directed by consideration of broader human values. This means that the development of public policy, especially where highly controversial matters are involved, must take all interested sectors of the public into account. It is only through broad-based participation that the values of all stakeholders in the research enterprise can be carefully considered and weighed. We hope that this report has offered an

approach that balances the promise of human stem cell research with the public's genuine concerns about such research in a manner that will lead to a consensus on how best to proceed.

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