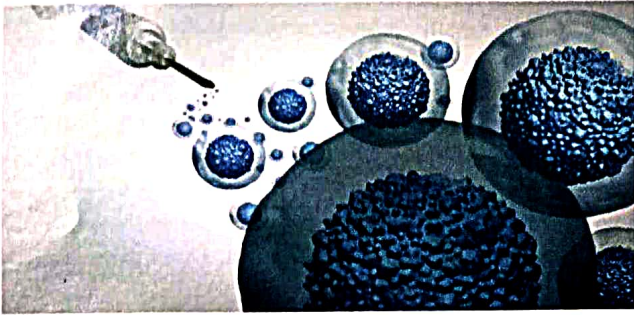


A Way to Heal

STEM CELLS & REGENERATIVE MEDICINE

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Researchers are exploring the fields to unlock their full potential for significant advancements in treating various injuries and diseases.



- **Totipotent stem cells:** can give rise to all types of cells in the body, including the placenta. E.g., Zygote.
- **Pluripotent stem cells:** are like totipotent stem cells, except they can't give rise to the placenta. E.g., Embryonic Stem Cells (ESCs).
- **Multipotent stem cells:** can only give rise to a limited number of cell types. E.g., Hematopoietic Stem Cells (HSCs).

Usually, the stem cells that reside in the adult organs (also known as adult stem cells) of the human body are multipotent. A very well-studied multipotent stem cell type is the hematopoietic stem cells, which can differentiate or give rise to both myeloid and lymphoid types of blood cells. Current research has also discovered stem cells in the tooth known as “Mesenchymal Stem Cells (MSCs)”, and more research is being carried out to uncover the other adult stem cells in the human body.

WE, as human beings, want to heal ourselves from any physical damage or pain imposed on our bodies. Our body itself illustrates this response; for example, when there is a small cut, our body tries to heal the wound. However, there are limits to the extent to which our bodies can heal. For example, if one loses an arm or a limb, the body can't grow back an entire arm or limb. The only known organ that can fully regenerate is the liver. This reflects the limitations of our regenerative capacity, but reptiles like salamanders can regenerate almost every body part, unlike humans. So, what is the speciality of salamander biology that we humans lack or don't express fully? The answer lies in special kinds of cells known as 'stem cells'.

Stem cells are a special group of cells that have the potential to give rise to different cell types in the body, such as muscle, cardiac (heart), neurons (brain), etc. The words 'stem cells' are derived from the German word “Stammzelle” which was coined by the eminent German biologist Ernst Haeckel in the 1800s. Later, stem cells were referred to as unique cells in the embryo that can give rise to specialised cells, which in turn lead to the formation of fully functioning organs in an organism. As we all know, an organism mainly consists of two principal types of cells — the somatic (comprising all cells other than gametes) cells and the germ cells (gametes); it was mainly the germ cells that were considered to be stem cells.

However, recent studies have shown that it's not true. We now know that even somatic cells can also be stem cells of different 'potency' than germ cells. So, what is defined as the 'potency' of stem cells? Simply put, potency refers to the ability of a stem cell to give rise to specialised cell types. For example, a stem cell can give rise to both neurons and muscles, whereas another stem cell can give rise to only muscles. As a result, stem cells can be classified into three types based on their 'potency':

A recent discovery by a Japanese scientist, Shinya Yamanaka, is “induced pluripotent stem cells” or iPSCs, which led him to win the Nobel Prize in Physiology in 2012, along with Sir John Gurdon. As is evident from the phrase, iPSCs are non-stem cells; however, they are induced/modified to pluripotent stem cells. This complex scenario is achieved by injecting some “special factors (proteins)” inside non-stem cells obtained from adults. The iPSCs produced by this method have properties similar to embryonic stem cells; however, the efficiency of this method was very low. Also, another drawback of iPSCs is that they are highly tumorigenic or cancer-causing. As a result, iPSCs are still not considered a perfect replacement for ESCs and hence cannot be used for therapeutic purposes. This brings us to a very important question: What are stem cell's therapeutic or medicinal purposes?

