

## Mesenchymal Stem Cells Fact Sheet

### What are stem cells?

Stem cells are a unique type of biological cell that have the remarkable ability to undergo self-renewal (make exact copies of themselves) as well transform, or differentiate, into other cell types with specialized functions, such as blood cells, muscle cells, and so on. Stem cells give rise to the cells of the body during early development, and are involved in maintaining and repairing certain tissues during growth and adulthood. See the Appendix for a breakdown of the different types of stem cells being used in research.

### What is stem cell therapy?

Stem cell therapy is a treatment that uses stem cells to either repair or replace tissues damaged by disease or trauma, or to prevent tissue damage from occurring altogether. Carrying out a stem cell transplant is a complex process, but fundamentally involves collecting stem cells from tissue, such as bone marrow or blood, and transplanting the cells into the body of the recipient. In some cases, the stem cells may be multiplied in a laboratory before transplantation (known as culturing).

Hematopoietic stem cell therapy has been used to treat certain cancers of the blood, such as leukemia, for decades. Other kinds of stem cell therapy, such as mesenchymal stem cell therapy, are still considered experimental and can only be provided through clinical trials approved by Health Canada.

### What are mesenchymal stem cells?

Mesenchymal stem cells (MSC) are adult stem cells that can give rise to specific tissues such as bone, cartilage and fat (unlike embryonic stem cells which can give rise to all cells and tissue types in the body). MSCs were originally discovered in the bone marrow, although there is evidence that these cells can exist in other tissues of the body, including skin, fat and umbilical cord blood. Pioneering studies on MSCs have demonstrated their capacity to suppress inflammation and repair damaged tissue, and encouraging results have been seen in the treatment of such diseases as myocardial infarction, liver cirrhosis, Crohn's disease and amyotrophic lateral sclerosis (ALS). Based on these findings, MSCs have been identified as a potential treatment for MS.

### How can mesenchymal stem cells potentially be used to treat MS?

Studies in animals which have an MS-like disease have shown that injected MSCs can combat the actions of harmful immune cells and protect nerves from inflammatory attacks, leading to improvement of symptoms. MSCs may also promote repair of already damaged nerves by stimulating the production of new nerve cells as well as releasing substances that keep nerve cells alive and functioning.

To date, very few studies have examined the therapeutic benefits of MSC therapy in people with MS. Two small clinical trials have studied the safety and effectiveness of MSCs in improving outcomes for people with MS, and both studies have shown promising results. These findings are still preliminary, and more research is required to make sure that MSC therapy is an effective treatment for MS.

## Appendix

Stem Cell Type	Origin	Features
<b>Embryonic stem cells (ESC)</b>	Derived from the inner cell mass of a 5-day old, pre-implantation embryo.	Can give rise to almost any cell type of the body; are capable of unlimited self-renewal in the laboratory; harvesting of ESCs usually results in destruction of the embryo.
<b>Adult (somatic) stem cells (ASC)</b>	Found in small numbers in many organs and tissues of the body.	These cells can develop into specialized cells belonging to one or more tissues, but their differentiation potential is limited; are typically involved in replacing damaged or aging cells.
<b>Induced pluripotent stem cells (iPSC)</b>	Mature cells (e.g. skin cells) that have been genetically "reprogrammed" to resemble embryonic stem cells.	In theory, give rise to almost any cell type of the body while bypassing the need for an embryo; the technique to generate iPSCs was discovered in 2006.

Table 1: Types of stem cells, their origins and characteristic features.

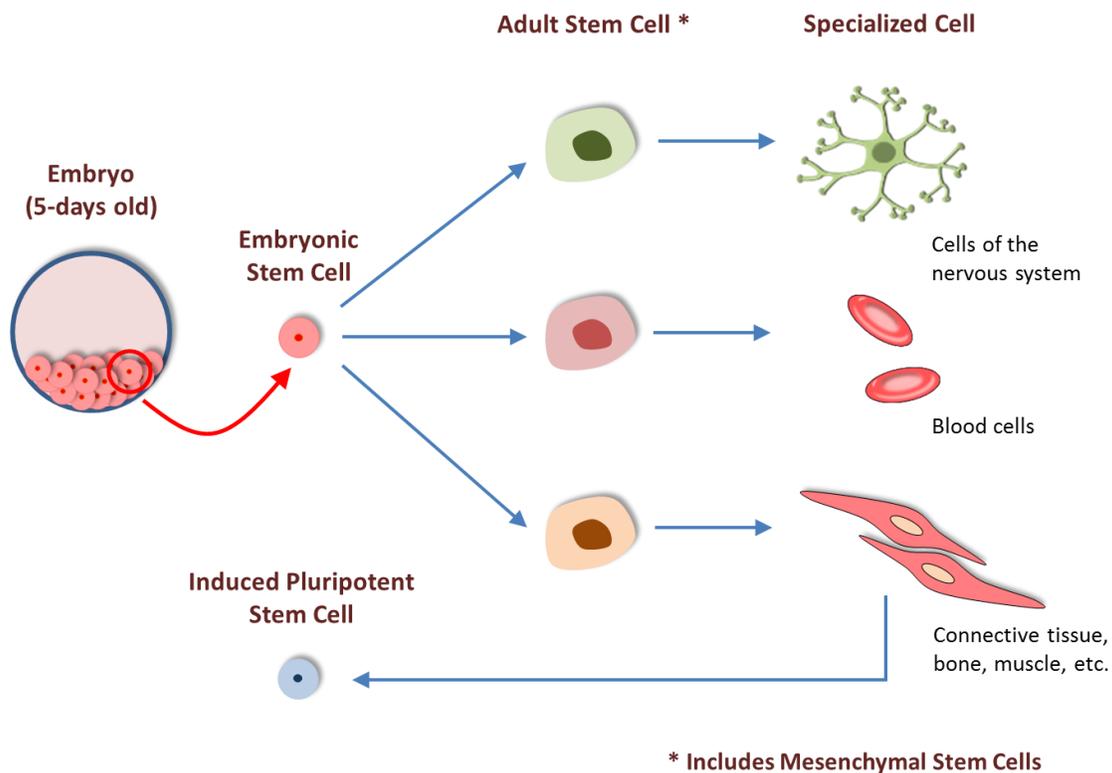


Figure 1: Schematic illustrating the different types of stem cells and their paths of development. Note that these are only a few examples of the many specialized cells in the body that come from stem cells.

## References

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