

## Stem Cell Biology An Overview

Q. What are stem cells?

A. Stem cells are naturally-occurring living cells that haven't yet differentiated into the specialized cells that form body parts. Stem cells are part of the body's repair system, and can divide to replenish other cells if a person or animal is still alive. When a stem cell divides, each new cell has the potential to become a cell with a more specialized function such as a red blood cell, bone marrow cell, muscle cell or nerve cell.

Q. Why are doctors and scientists so excited about them?

A. Stem cells hold enormous promise for helping understand and treat a wide variety of diseases and disorders. By studying how these cells transform into the array of specialized cells that make us what we are, researchers can gain unprecedented insight into cancer, birth defects and other disorders that develop during cell growth and transformation.

Stem cells also could become a renewable source of replacement cells and tissues that could be used to treat illnesses, conditions and disabilities such as heart disease, stroke, diabetes, burns, spinal cord injury, Parkinson's, Alzheimer's and arthritis.

Q. What's the difference between an embryonic stem cell and an adult stem cell?

A. Embryonic stem cells are isolated from embryos only a few days old and have been used to create stem cell "lines" – cultures that can be grown indefinitely in the laboratory and widely distributed to other researchers. Embryonic stem cells have the potential to develop into any type of cell in the body.

Adult stem cells are taken from body parts such as cardiac tissue, the lining of the nose, or bone marrow. Thus far, adult stem cells haven't proved able to change into every kind of cell and may be limited to becoming cell types within their tissue of origin. An adult stem cell in the brain, for example, can become a neuron or glial cell – both brain cells – but not a bone or liver cell.

Q. What is a very small embryonic-like stem cell (VSEL)?

A. VSELS are rare stem cells found in adult bone marrow that have the characteristics of embryonic stem cells in terms of their potential to develop into any type of cell in the body.

Q. Are stem cells being used successfully to treat any human diseases?

A. Yes. Blood-forming stem cells in bone marrow called hematopoietic stem cells (HSCs) are routinely being used to treat disease. Doctors have been transferring these cells in bone marrow transplants for more than 40 years, and more advanced ways of collecting these cells are being used to treat leukemia, lymphoma, and several inherited blood disorders.

Only adult stem cells have been tested in humans. Thus far, their potential has been demonstrated in treating heart disease, leukemia and other cancers, rheumatoid arthritis, diabetes, and other diseases. These tests have taken place only in limited clinical studies.

Q. What is the U.S. government's policy on embryonic stem cell research?

A. Such research may receive federal funding only if the cell line used was developed before Aug. 9, 2001, and the embryo creating the line could not be developed further as a human being. To ensure that federal funds support only the stem cell research that is scientifically sound, legal and ethical, the National Institutes of Health examines stem cell lines and maintains a registry of those that satisfy federal criteria.

Q. Where can I find more information about stem cell treatments and research?

A. Several websites contain a wealth of details on this topic. They include:

National Institutes of Health Stem Cell backgrounder  
<http://www.nih.gov/news/backgrounders/stemcellbackgrounder.htm>

Stem cell glossary  
<http://stemcells.nih.gov/info/glossary.asp>

National Cancer Institute information about bone marrow and peripheral blood stem cell transplantation  
[http://cis.nci.nih.gov/fact/7\\_41.htm](http://cis.nci.nih.gov/fact/7_41.htm)

National Institute of General Medical Sciences "Inside the Cell"  
[http://www.nigms.nih.gov/news/science\\_ed/life.html](http://www.nigms.nih.gov/news/science_ed/life.html)

The July 2005 issue of National Geographic provides an overview of stem cell research. An update to that article can be found at  
[http://www7.nationalgeographic.com/ngm/0507/feature1/online\\_extra.html](http://www7.nationalgeographic.com/ngm/0507/feature1/online_extra.html)