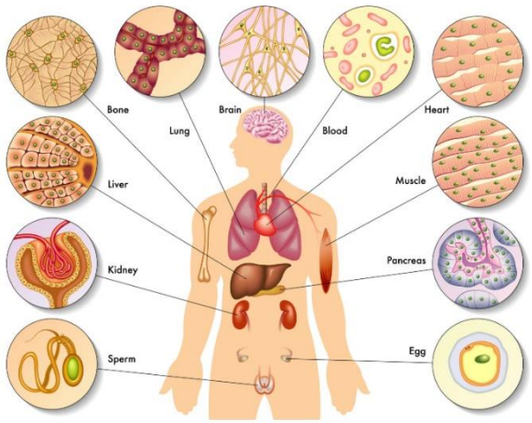
Imagine being able to repair human body parts with tissue grown especially for the purpose. For instance, people who have had heart attacks could receive new cardiac (heart) cells. Instead of waiting for organ transplants, people with failing livers, kidneys, or lungs could have healthy new organs grown for them. People ho have lost the use of their legs through paralysis might be able to walk again with new nerve cells growing in their spinal cords. The key to these technological feats is stem cells.

What Are Stem Cells?

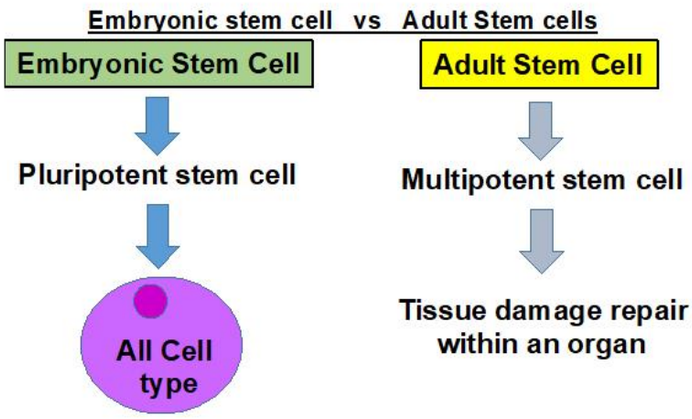
Stem cells are undifferentiated cells with the capacity to both differentiate and multiply into the 200 cells types that form a human being.



What are stem cells?

Stem cells are unspecialized or undifferentiated cells. This means that they have not yet begun to develop into red blood cells, muscle cells, or any other of the 200 or so cell types that make up the human body.

Stem cells have two important features. First, they can replicate (make copies of themselves) for a long time by dividing. Second, under suitable laboratory conditions, stem cells can be coaxed to give rise to cells with special functions, such as heart muscle cells and neurons (nerve cells).



There are two main types of stem cells: adult stem cells (also called somatic stem cells) and embryonic stem cells. In spite of their name, adult stem cells are found in humans of all ages. In fact, one source of adult stem cells for medical use is the umbilical cords of newborns. Small numbers of these stem cells have now been found in many different human organs and tissues.

Embryonic stem cells, as their name implies, come from embryos—about four or five days after fertilization. The source of embryonic stem cells has been an assisted reproduction technique called in vitro fertilization. In this process, embryos are produced in a lab; more are produced than are implanted in the woman who wishes to become pregnant. Scientists now also have the ability to create embryos solely for research, but many countries, including Canada, have banned this technique as unethical.

Embryonic stem cells are pluripotent, which means that they can become many different types of cells in the human body. Until very recently, it was thought that adult stem cells could only give rise to the different types of cells in the tissues where they were found. For example, basic blood stem cells found in bone marrow could become red blood cells, white blood cells, and so on. However, recent research has shown that many adult stem cells can be made to develop into a wider range of specialized cells. For instance, in the laboratory, blood stem cells have yielded muscle cells, including heart muscle cells, and nerve cells. This is an exciting area of research for two reasons: first, it would avoid the ethical issues of embryonic stem cell research, and second, it could produce repair tissues from a person's own body cells that would be a perfect match.

Stem cell research in Canada

Working together, Alberta-born biophysicist James Till and Toronto physician Ernest McCulloch discovered stem cells in 1960. In 1992, neuroscientist Samuel Weiss of the University of Calgary was the first to show that adult stem cells exist in the human brain. Today, Canada is still in the forefront of stem cell research. Dr. Weiss, for example, is now researching how the brain's stem cells could be used to help people who have had strokes. Meanwhile, researchers at the University of Alberta are working on a stem cell treatment for type 1 diabetes, while an Ottawa scientist is working with heart stem cells that could be used in the treatment of heart attacks.

Many important questions about stem cells still remain to be answered. Among them: how many different types of adult stem cells can be found in the human body, and in what tissues? What is the purpose of adult stem cells in the body? Why do they remain in an undifferentiated state, when all the cells around them have differentiated?

QUESTIONS

1.) One of the first diseases to be treated with stem cells was leukemia. Google what this treatment was and why it worked. How has the treatment changed today?

2.) Depending on their source, stem cells may be referred to as totipotent, pluripotent, and multipotent. What are the differences among these types of stem cells, and where are they found in the body?

3.) Some people (including some scientists) consider stem cell research and use objectionable. What is the foundation of the controversies surrounding stem cells?

4.) What steps has Canada taken to restrict the ways in which stem cell research can be performed?