

Stem Cell FAQs/Backgrounder

What are stem cells?

Stem cells are the body's master cells. They are unspecified, meaning that they do not have a specific role to play in the body, unlike a beta cell, which is responsible for the production of insulin or a red blood cell, which is responsible for carrying oxygen and carbon dioxide to and from your lungs.

Stem cells have two unique properties that other cells do not: first, when they divide, they can make exact copies of themselves (called self-renewal), which ensures that the body always has a reservoir of stem cells; and second, when they divide, they can make more specialized cells that the body may need to perform its regular functions or heal after exercise or injury.

There are many different kinds of stem cells. **Pluripotent stem cells** are the most powerful type of stem cell; they are the least specialized and can therefore give rise to any other type of cell in the body. There are two types of pluripotent stem cells: embryonic stem cells, which are grown in the lab from cells taken from 5-day old blastocysts, and **induced pluripotent stem cells**, or iPS cells, which are made from a regular cell (for example, a skin cell) to which genes have been added to turn them back into a pluripotent state. There are also many other kinds of **adult stem cells**, which exist in the various organs and tissues in the body and can make only the kinds of cells within that organ or tissue.

Which is more useful for regenerative medicine – adult stem cells or pluripotent stem cells?

Both are valuable. Adult stem cells are being used now in different clinical settings and have immense potential in current and future therapies. But adult stem cells are limited in what they can do – for the most part, they can only regenerate the same kind of tissue they come from: for example, blood stem cells create all the components of the blood but they can't make skin or liver or any other kind of tissue.

Pluripotent stem cells have the ability to make any kind of tissue in the body, which makes them potentially able to repair any tissue or organ. Because induced pluripotent stem cells are easy to create, they are ideal for generating disease-specific stem cells that can be used to study how disease develops and to screen for potential new drug therapies.

Embryonic stem cells are still used for comparative studies with the new induced pluripotent stem cells, but no new embryonic stem cells are being generated today. In Canada, only two lines of embryonic stem cells have ever been created and this process was regulated under strict guidelines set out by the Canadian Institutes for Health Research.

Are stem cells safe to use in people?

Some (like blood stem cells from bone marrow) have been in use for some time and are safe to use in people. Cells created from pluripotent stem cells are only just now beginning to be tested in clinical trials (for macular degeneration and spinal cord repair) and safety issues are still a concern. One of the most exciting aspects of stem cells is their ability to grow more cells, however, sometimes the stem cells grow uncontrollably and create tumours rather than healthy cells. Research is continuing to improve methods of refining and purifying the cell types needed for tissue repair in preclinical studies to eliminate the potential for tumour growth before the cells can be tested in humans.

Stem cell research is extremely promising, but researchers have just begun to discover how they can be used to treat many diseases. Only a handful of treatments are approved for use right now. While many more therapies will be possible in the future, they will require further study and testing in clinical trials with patients to ensure they are both safe and effective.

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Does stem cell research involve human cloning?

No. Reproductive human cloning – the use of technology to create a baby that is genetically identical to another human being – is prohibited by the United Nations and is a criminal offense in Canada.

What is stem cell tourism?

Stem cell tourism refers to the practice of travelling outside your home country to seek a stem cell treatment. You can find companies all over the globe that advertise and sell stem cell treatments for different diseases. In most cases, these treatments are unproven, meaning they have not been tested using scientific standards and results have not been published in a peer-reviewed scientific journal. Some of these unproven treatments have been shown to harm patients. Furthermore, choosing to get a therapy outside of Canada may make you ineligible for other treatments now or in the future in Canada, because in many cases, there is no certainty of the kind of cells received. Most scientists, ethicists and medical professionals advise against seeking an unproven stem cell therapy.

Every patient has the right to choose. Hope can be very powerful, but we must take care that hope does not override the evidence of what is possible. And currently, scientific evidence has not shown that many of these unproven therapies are safe and reliable.

What kinds of stem cell therapies are being tested?

There are many cell-based therapies currently in human clinical trials for conditions such as heart disease, type1 diabetes, vision loss, and autoimmune diseases. Most of these are in early phase trials with small numbers of patients and only a few centres and will need to demonstrate safety and efficacy before moving on to larger trials and eventually clinical approval. In Ontario, 13 different cell-based trials are underway or planned for 2017, which can be viewed [here](#).