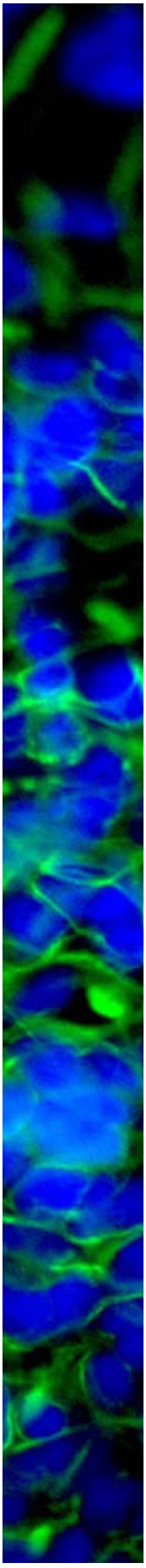


Fact Sheet 5
Stem Cell Research in Australia

Over thirty years ago bone marrow transplants were the first clinical applications of adult stem cells. More recently, stem cell research came to the forefront of public awareness, with the announcement of the birth of Dolly the sheep the first cloned mammal in 1997 and subsequently the derivation of the first human embryonic stem cells in 1998. Since these advancements, stem cell research has continued to expand and produce results at an extraordinary rate.

Australia's history in *in vitro* fertilisation has positioned Australian scientists at the forefront of human embryonic stem cell research, but for many years prior to this, Australian adult stem cell scientists have enjoyed considerable research and clinical success. Australian scientists are successful and respected contributors and collaborators in the international stem cell community. The Australian Stem Cell Centre's Chief Executive Officer, Professor Stephen Livesey, is a co-Director of the International Consortium of Stem Cell Networks and the Centre acts as the Consortium secretariat.

Stem Cells in the Laboratory

Different stem cell types have shown varying abilities to be cultured in the laboratory. Embryonic stem cells have been grown in culture successfully for six months or more, without differentiating and while maintaining a normal number of chromosomes (karyotype).

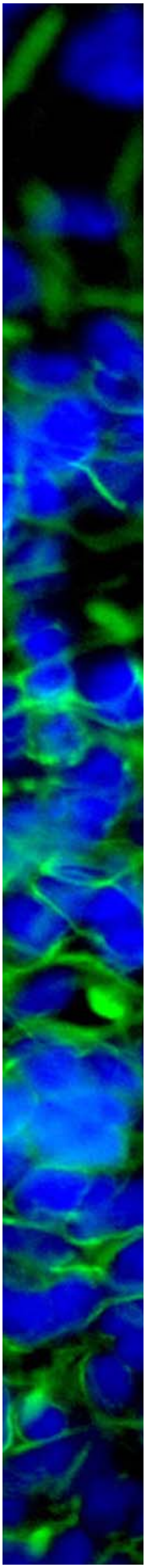
There are many new embryonic stem cell lines around the world. Once cell lines are established they can be frozen and shipped to other laboratories for further culture and experimentation.

Under the right conditions, embryonic stem cells can remain undifferentiated for an indefinite period. However, they may spontaneously differentiate into specific cell types if they are left to form unattached clumps in the culture dish. These clumps are called embryoid bodies and can further differentiate into a mixture of cell types (e.g. nerve and muscle cells). Scientists are working to control the differentiation of stem cells into specific cell types.

A number of ways to do this include:

1. adding certain growth factors to the culture medium;
2. changing the surface properties of the culture dish;
3. co-culture with other cells such as mouse or human feeder cells;
4. co-culture within a supportive scaffolding or matrix; and
5. activating the cells with their own (endogenous) control molecules called transcription factors.

Researchers around the world, and in Australia, are focusing on investigating the molecular and developmental characteristics of all stem cell types and improving the culture methods, such as growing cells without using animal products. As animal products may be a source of viruses and harmful molecules called prions which limit or preclude the use of the cells for transplantation.



Scientists are now beginning to have success in making stem cells differentiate into particular types of cells and to identify whether these specialised cells function normally.

Australian scientists have been at the forefront of this research, especially in blood cells. Scientists in Australia have also been working on using adult stem cells in cell-based therapies to treat conditions such as heart disease. They are also looking at whether stem cells can be seeded into scaffoldings or matrices to create a complex organ.

Australian Stem Cell Centre

Today, a large proportion of the stem cell research in Australia is supported by the Australian Stem Cell Centre (ASCC), a Biotechnology Centre of Excellence established by the Commonwealth Government in 2002. With dedicated ASCC laboratories in Melbourne and Brisbane, the ASCC brings together and funds approximately 26 of the country's leading stem cell research groups.

The ASCC's major research focus is haematology; the blood program is one of the Centre's most significant programs to date. The goal is to create a safe, transfusible manufactured supply of blood cells. The blood program incorporates stem cell technologies from embryonic, adult and cord blood fields. A key achievement is the differentiation of human embryonic stem cells to relatively pure populations of red blood cells.

The Centre has three core platform technologies: embryonic stem cells, adult stem cells and tissue repair. These platform technologies are the discovery engine that addresses basic scientific challenges in the field. They also underpin research in the therapeutic area of haematology, and will potentially give rise to new therapeutic interests in the future.

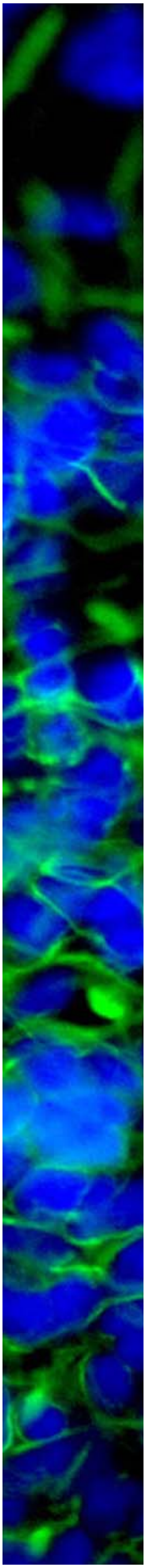
The ongoing research from organisations like the Australian Stem Cell Centre will continue to bring forward new technology and advancements in stem cell research. The Australian Stem Cell Centre is focused on developing promising stem cell research to improve the lives of people suffering from degenerative disease and injury.

The Law and Stem Cell Research in Australia

Laws which regulate stem cell research differ markedly from country to country. There is particular variation in the ethical values and hence the laws governing embryonic stem cell use and derivation.

In Australia, there is a piece of Commonwealth legislation covering stem cell research and cloning. This is the *Prohibition of Human Cloning for Reproduction and the Regulation of Human Embryo Research Amendment Act 2006*.

The various states and territories of Australia have their own legislation regulating the use of human embryos in research and SCNT for therapeutic purposes. At present, New South Wales, Victoria, Australian Capital Territory, Queensland & Tasmania have passed legislation consistent with the Commonwealth in regards to human embryonic research and SCNT, South Australia is still in debate. Western Australia is the only state to go against the Commonwealth Legislation



when in May 2008 they threw out the act which would have allowed human SCNT for therapeutic purposes.

There is no legislative framework regulating the use of human stem cells (embryonic or adult) after they have been derived. However, the use of human stem cell lines in research must comply with relevant National Health and Medical Research Council (NHMRC) guidelines.