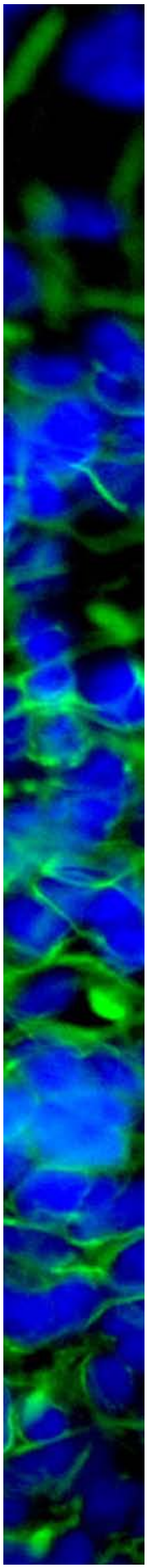


Fact Sheet 6

Ethics & Law of Stem Cell Research

All research that uses human tissues of any kind must be conducted under the highest ethical standards. This includes embryonic stem cells, adult stem cells, induced pluripotent stem cells and embryonic stem cells created via somatic cell nuclear transfer. While some forms of stem cells are more widely accepted by the community, they all use donated human tissue and should be subject to the highest level of scrutiny. In Australia, all human research is governed by Australian law that establishes rights for participants and ethical oversight of the use of human tissues in research, and imposes general and specific responsibilities on researchers and institutions.

Legislation

The Regulation of Stem Cell Research in Australia

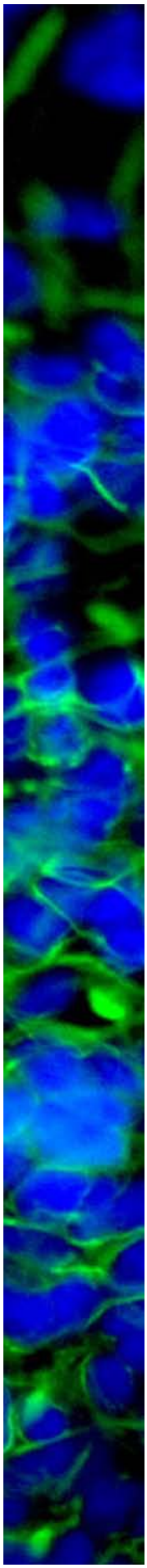
Within Australia, there is both federal and state legislation governing stem cell research. In addition to the legislation, there is a series of guidelines which set out the values and principles that apply to all research involving humans or human tissues. Prior to 2002 there was no Australian Government legislation for embryo or stem cell research and each of the states had various and differing regulations and laws.

In 2002, a historic and rare conscience vote was held following debate on new legislation that would govern embryo research and cloning. In addition at that time the States and Territories agreed to implement a nationally consistent approach. The passing of the *Research Involving Human Embryos Act 2002* and the *Prohibition of Human Cloning Act 2002* allowed for research on excess IVF embryos including for the derivation of human embryonic stem cells and prevented not only cloning for reproductive purposes but also somatic cell nuclear transfer (SCNT).

The *Research Involving Human Embryos Act 2002* and the *Prohibition of Human Cloning Act 2002* were amended by passage of the *Prohibition of Human Cloning for Reproduction and the Regulation of Human Embryo Research Amendment Bill 2006* following a review of the legislation and another conscience vote. The amended legislation, which came into effect on 12 June 2007 allowed for SCNT but continued to prohibit reproductive cloning. However the response from the states and territories to the 2006 amendments was mixed with Western Australia rejecting the amendment to allow SCNT. Victoria, New South Wales, Queensland, Tasmania, South Australia and the Australian Capital Territory, have all passed laws that mirror the Federal legislation.

Under the *Act*, a researcher must obtain a licence from the National Health and Medical Research Council (NHMRC) Licensing Committee to use excess human IVF embryos for research including the derivation of new embryonic stem cell lines. A researcher must also obtain a licence to perform SCNT. As SCNT requires the use of a human oocyte (egg) the legislation also states that women who donate oocytes for such research cannot be financially reimbursed. The use of non-human animal eggs to make human SCNT cell lines is specifically prohibited.

Once created, research using human embryonic stem cells, like the use of all stem cells including the different types of tissue stem cells (cord blood, bone marrow, foetal stem cells etc), must comply with relevant guidelines including the NHMRC National Statement on Ethical Conduct in Human Research (2007) and the individual state based human tissue legislation.



The Therapeutic Goods Administration (TGA) is responsible for regulating medicines, medical devices, blood & tissues in Australia. The TGA is currently developing a national regulatory framework for human tissues and emerging biological therapies which will include stem cells. The human cellular and tissue therapies regulatory framework is expected to be implemented in 2010.

Stem Cell Regulation around the World

Legislation and regulation which govern stem cell research differ markedly from country to country and in some cases, from state to state. The variations can be attributed to cultural, ethical and religious values. The International Consortium of Stem Cell Networks maintains a list of web links and resources which map stem cell laws around the world.

In addition, the International Society for Stem Cell Research (ISSCR) assembled a task force composed of experts in science and medicine, ethics and law from 14 countries to draft the ISSCR Guidelines for the Conduct of Human Embryonic Stem Cell Research. Whilst non-binding the guidelines specify rigorous ethical standards for scientists working with human embryonic stem cells, and seek to promote responsible, transparent and uniform practices worldwide.

Ethics

Human Embryonic Stem Cells

Human embryonic stem cells (hESC) are derived from human blastocysts (early stage embryos) that are usually five to six days old. These blastocysts are donated with full informed consent to research and are deemed in excess following *in vitro* fertilisation treatment. At this stage of development the blastocyst is a hollow ball of about 200 to 250 cells, no bigger than a pinhead. Within the blastocyst, next to a large internal cavity, is a small group of approximately 30 cells called the inner cell mass from which the stem cells are obtained. Human embryonic stem cells are considered special as they are pluripotent, that is, a single embryonic stem cell is able to give rise to all of the various cell types that make up the body.

There are a range of opinions about the creation and use in research of hESCs within the community. The overwhelming issue for most people opposed to embryonic stem cell research is that obtaining the inner mass cells inevitably leads to the destruction of the blastocyst. For those that view a fertilised egg as a human life this is most distressing. Others consider the blastocyst a mass of cells with the potential to become a human life.

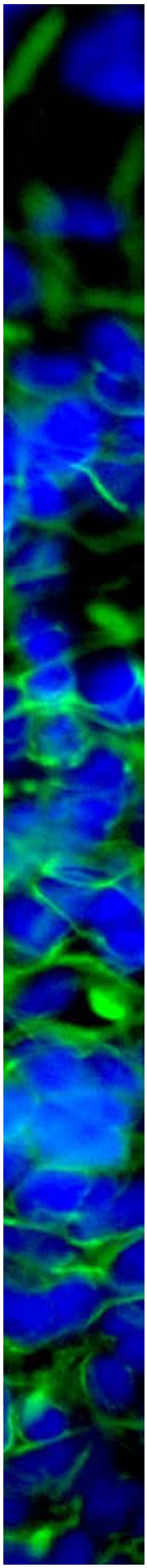
The two polar views within the community can be summed up by the following statements. Some people regard research on human embryos created by any means, and at any age, as unethical, believing that human life begins when a human egg gains the ability to form an embryo.

Conversely, there are others with the strongly held view that embryonic stem cells hold the promise of sufficient benefit to human health to justify the use of human embryos for research purposes.

There is currently no shortage of embryos donated for licensed stem cell research in Australia; if these embryos were not donated then they would otherwise be destroyed.

Somatic Cell Nuclear Transfer (SCNT)

SCNT refers to the removal of a nucleus, which contains the genetic material, from virtually any cell of the body (a somatic cell) and its transfer by injection into an unfertilised egg from which the nucleus has also been removed. The newly formed egg then starts dividing. After 4-5 days in culture, embryonic stem cells can then be removed and used to create many embryonic stem cells in culture. These embryonic stem cell 'lines' are genetically identical to the cell from which



the DNA was originally removed. Whilst having been proven in animals this technique has yet to be fully achieved in humans.

An ethical issue for consideration regarding somatic cell nuclear transfer (SCNT) is that is that an embryo is deliberately created for research or therapeutic purposes and was not originally created to treat infertility through IVF. This raises a wider range of objections, as some who consider that a blastocyst is a potential life, believe it has been created to then be destroyed.

Another point to consider is that an embryonic stem cell line created using SCNT is genetically identical to the donor cell used to create the embryo. In theory the embryo generated using SCNT could be implanted into a uterus and allowed to continue development, potentially leading to the birth of a child. However, there are serious ethical and medical concerns (if it is at all possible – to date it has not been proven) associated with the use of nuclear transfer technologies to reproduce humans (reproductive cloning) and it is illegal in Australia and many other countries to conduct any research into reproductive cloning of humans. Despite this, some people fear that allowing nuclear transfer for therapeutic purposes will be the start of a 'slippery slope' into reproductive cloning.

Induced Pluripotent Stem Cells (iPS cells)

The recent discovery of induced pluripotent stem cells (iPS) is a significant development that occurred when scientists developed the technology to cause mature human adult cells to resemble embryonic stem cells. Any cell which was originally a non-pluripotent cell, such as a human skin cell, and has been induced to mimic the properties of a pluripotent stem cell is given the term iPS. iPS cells are created using a type of genetic engineering to insert factors that reprogram the cells.

Some people believe the development of iPS cells may extinguish the controversial debate on the use of embryos in obtaining pluripotent stem cells; however iPS cells still throw up many questions for consideration. iPS cells have been genetically engineered into the pluripotent state and as such must comply with the Gene Technology Act and like, all research on human tissues, proper donor consent must be obtained.

Creation of Gametes from Stem Cells

In theory any of the ways used to create pluripotent stem cells (hESC, SCNT and iPS) creates cells that can turn into any cell in the body, including gametes, also known as sperm and eggs, which could be used to create an embryo. Though an embryo may not have been destroyed in the process (in the case of iPS), an embryo could in theory be created. The status of these potential embryo's or gametes should be considered. All research involving gametes is subject to the *NHMRC Ethical Guidelines on the use of Assisted Reproductive Technology in Clinical Practice and Research (2004)*.

Tissue Specific Stem Cells

Tissue specific (adult) stem cells are undifferentiated cells found in tissues and organs in the body. Their differentiation is mainly restricted to forming the cell types of that tissue or organ, therefore they are known as multipotent. Their main role is to maintain and repair the tissue in which they are found. Skin stem cells, for example, give rise to new skin cells, ensuring that old or damaged skin cells are replenished.

Although adult stem cells are less versatile than embryonic stem cells as they are not pluripotent but multipotent, their use in research is less controversial as it does not involve the destruction of embryos. Donors of adult stem cells for research must also provide informed consent to the procedure.