

Ethics of stem cell research

Stem cells reports often appear in the media. Many people have strong and varied opinions about where stem cells are derived from and how they should be used.

Why is the topic of stem cells so divisive? Do you feel you know enough to have an opinion?

In this worksheet, you will examine and discuss several ethical areas of debate surrounding stem cells and form your own opinion.

You will need:

- Printouts of the information summaries in this worksheet
- Access to the *Stem cells* section of *Biotechnology Online*
- If needed, access to the internet for more information (useful websites are given at the end of this work sheet)

What to do:

1. Read the *Stem cells* section of *Biotechnology Online* and the information summaries in this worksheet.
2. Form groups of four or five students and each discuss a different topic from this sheet, then bring your discussion into the class as a whole (OR pick sections from this worksheet to discuss as a class).
3. Think about and answer the questions at the end of each section.
4. Choose two people to take notes of the discussion.

What to do with your information:

- Prepare a 5-minute radio program or podcast detailing the pros and cons of human stem cell research. Include discussion of potential uses, risks and impacts on society. Use scientific, legal and ethical considerations in your preparation.

Part A: Stem cells and their origins

There are three major types of human stem cells, named according to how they are obtained: adult, embryonic and germline. Each of these is being used in active research, and all have the potential to treat disease in the future.

Embryonic stem cells (ESCs) are able to renew themselves indefinitely in the laboratory, and are therefore said to be 'immortal'. They are unspecialised cells that are pluripotent (have the ability to develop into all of the different cell types found in an adult, such as skin, blood and nerve cells). ESCs are collected from the inner cell mass of an early embryo (usually 5-6 days old), resulting in the destruction of the embryo. Once these cells are removed from the embryo, they can no longer give rise to a whole organism.

Adult stem cells (ASCs) are found in adults. They produce new cells to replace old ones, such as blood, liver and nerve cells. Some ASCs can be removed from a patient who is undergoing treatment while causing minimal harm. ASCs have been used to replace diseased bone marrow in patients with leukaemia.

Non-embryonic stem cells can also be sourced from umbilical cord blood following birth (cord blood stem cells). These cells have properties similar to ASCs.

Some critics argue that the extraction of ESCs from embryos is unnecessary, because stem cells from cord blood or adults can produce similar results without destroying an embryo. The removal and isolation of ASCs (other than bone marrow) is at present difficult. It is also not clear how to make them develop into the wide variety of cell types that can be obtained from ESCs.

The use of ASCs in research raises a number of ethical concerns, including obtaining informed consent from donors, and deciding upon the ownership of biological material derived from these cells.

Embryonic germline stem cells are immature cells that will give rise to sperm and egg cells. They are pluripotent and have similar properties to ESCs.

1. How might we obtain "informed consent" from a patient undergoing ASC treatment?
2. Discuss the main differences between embryonic and adult stem cells and their possible uses.

Part B: The potential treatment of disease with ESCs

Scientists hope that ESCs could be made to develop into organs and tissues (such as kidneys) that could replace diseased organs. This would help alleviate the current worldwide shortage of organs and tissues that are available for transplantation.

Cell therapies for degenerative diseases such as Parkinson's could be developed using human ESCs and ASCs.

ESCs might be 'programmed' to develop into neurones and then purified and injected into the brain to regenerate new tissues to replace those that are diseased.

Toxicology testing of potential new drugs could also be done on tissues developed from stem cell lines.

However, some limitations need to be overcome before this technology can be used.

First, there are obstacles to organ construction using human stem cells. Stem cell-derived organs will be grown outside the human body and will therefore require some type of scaffolding during development. Such scaffolds are presently being developed incorporating human or animal stem cells.

Second, cancers could be an unintended side effect of ESC therapies. The injection of undifferentiated ESCs into an adult can produce tumours called teratomas. To avoid this, undifferentiated ESCs must be eliminated before injection. Current cell-sorting technology is not yet efficient enough to do this.

Third, immune rejection may occur if there is a poor match between the cells of the embryo from which the ESCs are derived and the person who will receive them during treatment.

The chief ethical conflict about ESC research is between the alleviation of human suffering that stem cell technologies may provide and the destruction of embryonic life that is involved in their extraction. The following sections discuss some of these issues.

1. What alternatives might there be for a shortage of organs for donation in Australia and elsewhere?
2. One alternative to making new organs using ES cells is xenotransplantation (the transplantation of tissue or organs from one species e.g. a pig into a human). What scientific or ethical issues might be raised by this procedure?
3. Many of the potential therapeutic applications of embryonic and adult stem cell technologies will not be widely available for at least a decade. Should we be debating these issues now?

Part C: Life, death and multiculturalism

Three broad schools of thought are found in the Australian debate about the moral status of the early embryo.

The first view is that human life and moral status both begin at the point of *conception*. On this view, the moral status of the embryo is equal to that of a human adult and hence the destruction of a human embryo is morally equivalent to killing adults. ESC research is morally unacceptable to those who hold this belief.

A second, less clearly defined group, holds a more developmental view — that the embryo's potential for personhood develops as it grows, with different views about what point in the process an embryo or foetus deserves special protection. For example, the Jewish and Islamic faiths attach moral significance to foetal *viability* and *quickening*.

Viability is the point at which a foetus has the capacity to survive independently of its mother. Quickening describes the first moment at which the mother can feel the foetus move. *Ensolement*, in Islamic tradition, is said to take place at quickening (usually 120 days). After this time, the foetus is accorded special moral status.

A third group of views hold that *personhood is required for moral status*. In this view, having self-awareness, sentience, memory, life-history, or some combination of these, is a necessary condition for moral consideration. Since an early embryo does not possess any of these qualities, then in this view, the early embryo is not entitled to special moral status and ESC research is morally acceptable – especially when it holds the promise of major therapeutic gains for human beings.

1. The use of stem cells in regenerative medicine potentially could cure some currently untreatable forms of disability. Why then, would *some* people with disabilities be opposed to ESC research?
2. Which view, if any, do you accept about when we should accord a human embryo or foetus special moral status? Explain your answer.
3. There is general agreement in the community that “brain death” in a human being defines death. What features of an organism at the beginning of its existence might be relevant in deciding when human life *begins*?

Part D: The distribution of scarce health resources

An ethical issue that may arise if use of stem cells produces effective treatments for human diseases is: who should have access to these treatments? The costs of these treatments could be quite high, at least initially, especially if they are developed by commercial companies. If this were so, such treatments may only be available to a select few for some time, even in developed countries. Even if cell replacement treatments can be made affordable, their availability may be limited by embryo supply. Creating banks of ESC lines could avoid this problem, but these banks might also be commercialised.

Presently, some countries allow ESC research on surplus embryos originally intended for fertility treatment. In Australia, embryos cannot be created solely for the purpose of ESC research. In the future, if more embryos were required than were available, it may be suggested that ESC researchers should obtain oocytes (eggs) for embryo production by advertising for, and paying, healthy donors. This raises the potential exploitation of disadvantaged women who agree to be paid to undergo invasive oocyte extraction.

1. Should only those who can afford to pay for medical treatment have access to it?
2. What current medical treatments might new stem cell technologies replace?
What new conditions might be treated?
3. What problems might occur if we allow the sale of human biological material such as oocytes, blood, or organs?

Part E: The role of the media in the stem cell debate

The media have an important role to play in disseminating information about scientific discoveries and their potential to treat human diseases. They also make scientists and policy makers accountable to a wider public.

The way media messages are received by an audience is dependent upon the audience's educational background, occupation, previous knowledge and interest in science news stories.

The media are often criticised for "sensationalising" debates about controversial topics such as human stem cell research. This occurs because media coverage of the debate often pits the most extreme opposing views in the name of "ensuring balance". The result often is to simplify the debate and ignore more moderate views.

The media also tend to focus on news stories that highlight the benefits and play down potential risks. This has can lead the public to over-estimate the potential benefits of new technologies.

1. Write a short explanation for someone with limited scientific knowledge of stem cell research and its implications.
2. Do you think the media has portrayed the stem cell debate in a positive or negative light? Give reasons for your answer.
3. There are different ethical, legal and scientific concerns about ESC research. List three issues under each heading (ethical, legal and scientific) that are raised by human ESC research.

For further investigation

Form an “ethics committee” to discuss the benefits, risks and implications of ESC and ASC research. An ethics committee might consist of a lawyer, various religious representatives, lay community representatives, disability representatives, scientists or clinicians, indigenous representatives, etc. Each person in the group should take on one of these roles and argue their case.

1. Was it difficult to find concrete answers to these ethical questions? Are there any concrete answers at all?
2. Why do people's opinions about stem cell research vary?
3. Is anyone right or wrong? How do we decide?
4. Can we find a way to make everyone comfortable with the use of stem cells?

Further reading and some useful web sites

Books:

Stem Cell Research (2003) J. Healey (Ed) Spinney Press, New South Wales.

The Human Cloning Debate (2004) G. McGee & A. Caplan (Eds) Berkeley Hills Books, Berkeley California.

Stem Cell Research: New Frontiers in Science and Ethics (2003) N. Snow (Ed) University of Notre Dame Press, Notre Dame.

Websites:

The Office of Public Policy and Ethics: <http://uq.edu.au/oppe>

The Australian Stem Cell Centre: <http://www.stemcellcentre.edu.au>

Nuffield Council on Bioethics: <http://www.nuffieldbioethics.org/>