Stem cell research

1. Summary

The Society sees considerable potential in stem cell research to help understand more about the causes of dementia and to find new cures for dementia.

Stem cells can be derived from a variety of different sources, which include embryonic stem cells and therapeutic cloning. However, alternative sources of stem cells including adult stem cells and induced pluripotent stem cells (iPS) do not raise the same ethical concerns. As of July 2012 all Alzheimer's Society funded research involving stem cells uses either adult stem cells or iPS cells.

The potential for stem cells to offer new treatments must be balanced with consideration of ethical issues raised by this type of research. The Human Fertilisation and Embryology Authority is responsible for producing guidance and regulations on these issues, while Research Ethics Committees are responsible for giving ethical approval for specific research projects.

Alzheimer's Society has found significant support for stem cell research when consulting our stakeholders and research network volunteers.

2. Background

What are stem cells?

Stem cells have two important properties. Firstly, they are able to reproduce themselves many times. Secondly, they can produce all the different cell types needed to make a human being, for instance heart cells, skin cells, nerve cells and so on.

There are two categories of stem cells: adult stem cells, which are present in the body throughout adult life, and embryonic stem cells, which are only found in the embryo. Stem cells vary in the range of specialist cells they may become. Totipotent cells are found in very early embryos and have the potential to generate all the cells needed for human development. Pluripotent cells are found in embryos after about five days of development. They could become any of the specialist cells found in the human body, but not the additional cell types that support the development of an embryo. Multipotent stem cells, the only type of stem cell found after birth and in the adult, are found in specific organs and can only become cells within that organ. Multipotent stem cells in the brain can become nerve cells or other brain cells, but multipotent stem cells in other body systems are not normally programmed to become nerve cells in the brain. These cells do have the potential to maintain and repair particular organs and tissues.

The most common and well-established use of stem cells is bone marrow transplants. The transplanted bone marrow contains adult stem cells that can yield blood cells.

The ability of stem cells to turn into any cell type that the body needs means that they have major potential to treat diseases where tissue has been damaged. This is an exciting and promising area for medicine that may revolutionise the treatment of many diseases in the coming decades.

Recently, scientists have discovered that stem cells can be created from skin cells - known as induced pluripotent stem cells (iPS). These offer the potential to be able to take skin cells from an individual with a disease, turn the skin cells back into iPS stem cells, and then change these in to a new cell type to treat the disease. However it is too early to say if these approaches will work.

Stem cells research and dementia

Stem cells can grow into nerve cells, and as a result, have the potential to repair brain damage caused by neurological conditions, such as dementia. Developing stem cell therapy for Alzheimer's disease may be more complicated and challenging than for some other neurological conditions. This is because the damage caused to the brain is so widespread and many different nerve cell types are damaged. In addition, the disease impacts on communication between cells.

It is therefore unlikely that Alzheimer's disease will be one of the first diseases to benefit from advances in this area of research. But in the long term, stem cell therapy may lead to advances in the treatment of people with Alzheimer's disease.

Stem cell research may lead to advances in treatment of conditions other than Alzheimer's that give rise to dementia, for example multiple sclerosis, Huntingdon's or Parkinson's disease. Parkinson's disease is probably one of the most promising neurological disease areas likely to benefit from stem cell therapy. Research also suggests there is potential for stem cells to repair brain damage following a stroke, which could potentially reduce the risk of dementia developing in people who have had a stroke. Furthermore, research has demonstrated that stem cells that are found in the brain are activated following a stroke, which raises the possibility of stimulating self-repair in the brain.

It is unlikely that there are sufficient neural stem cells to be able to repair the widespread damage caused by Alzheimer's disease. However, research funded by the Alzheimer's Society suggests that it may be possible to stimulate adult stem cells from other parts of the body to turn into nerve cells. The direct benefits of this work in terms of possible therapy are unlikely to be realised for some years. But the indication that we may be able to replace dead nerve cells is very exciting.

The rising numbers of people with dementia and the related high costs make it vital that sufficient research funding is made available to take forward these exciting avenues for potential treatments.

3. Alzheimer's Society funds stem cell research

Alzheimer's Society is funding a number of research projects investigating the potential of stem cells. For example, the Society funded a three-year research project investigating whether it is possible for bone marrow stem cells to change into brain cells. This work has led to discoveries about how stem cells may be influenced to change their normal behaviour. It has also established two important ways of studying bone marrow stem cells, which are being used to generate further valuable results.

Other Alzheimer's Society funded projects include an investigation into the activation of brain stem cells to help the design of therapies for brain repair and a study of whether stem cells could reverse damage caused by stroke. These research projects may lead to new treatments whereby stem cells acted as repair systems for the brain.

Researchers, including some funded by Alzheimer's Society, are also generating iPS cells from individuals that have familial (rare genetic) forms of dementia. These can be converted in to nerve cells and be used to understand why individuals develop dementia as well as being used for early testing of new drug compounds.

We recognise that some donors and supporters will continue to hold moral objections to the use of embryonic stem cells. The Society does not currently fund any research which uses embryonic stem cells. All current stem cell research we fund is focused on the use of adult stem cells or iPS cells. The wishes of any donor wanting to support research that does not involve embryonic stem cells will be fully respected.

4. Regulation and ethical guidance

There are important ethical issues concerning stem cell research, in particular about the use of stem cells derived from early human embryos. The Human Fertilisation and Embryology Authority (HFEA) is the government body responsible for producing guidance and regulations on these issues, while Research Ethics Committees are responsible for giving ethical approval for specific research projects.

Embryonic stem cell research is illegal unless carried out under a license granted by the HFEA. In order to gain a license stem cell research has to meet strict conditions. These are laid out in the Human Tissue and Fertilisation Act (2008). For example, scientists are only allowed to obtain stem cells from very early human embryos that have not developed beyond 14 days and they must demonstrate that the research cannot be done by any other means.

Further regulation to ensure high standards in the procurement, storage and use of stem cells is provided by the Human Tissue Act (2004) and the Human Tissue (Quality and Safety for Human Application) Regulations 2007. These implement the EU Tissues and Cells Directive (EUTCD). The regulations create additional licensing requirements with the Human Tissue Authority for the creation and storage of stem cell lines intended for human application.

The Medical Research Council and Biological Sciences Research Council have established a National UK Stem Cell Bank, which provides quality- controlled stem cell lines for research. Researchers who wish to use embryonic stem cells from the bank have to comply with a strict Code of Practice, which ensures the stem cell lines have been ethically sourced with informed donor consents.

5. The Society campaigns for

- The advancement of stem cell research in order to explore its potential for treating Alzheimer's disease and other causes of dementia.
- A legislative environment that will allow stem cell research to continue and develop within a strict

regulatory framework.
- Better public understanding of the issues involved in stem cell research and of the potential benefits of this type of therapy.
- Research funding strategies to ensure dementia research funding no longer lags behind other major health priorities.

6. References and further information

Department of Health, 2000, Stem cell research: medical progress with responsibility, London

Alzheimer's Society, 2003, Stem Cell Research, London

Parliamentary Office of Science and Technology, 2004, Postnote 221: Regulating Stem Cell Therapies, London

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