MND Factsheet 16
Stem Cells

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What are Stem Cells ?

Our bodies are made up of over 200 different types of cells which perform a huge range of different functions. Our cells are constantly dying and new ones being made to replace them. Think about your red blood cells - they survive for about 3 months and then need to be replaced. New red blood cells (which we need to carry oxygen around our tissues) are being constantly generated in our bone marrow. However, this is not the case for the nerve cells (neurones) which are found in our brain and spinal cord. Unfortunately, if these cells are damaged, most often they cannot be replaced. Thankfully, our bodies produce special cells called Stem cells which, theoretically, can become any type of cell and can be used to replace tissues which have been damaged by trauma or disease. We can think of them as a super "repair kit" for the body,

Are there different types of Stem cell?

Yes, there are three different types of Stem Cells :

- **Embryonic Stem Cells** (ESCs) are derived from embryos and grown in the laboratory – they can be described as Pluripotent stem cells as they can change (differentiate) into any cell type.
- **Adult Stem Cells** are found in the tissues of our bodies throughout our lives, where their primary function is to maintain and repair the tissue in which they are found.
- **Induced Pluripotent Stem cells** (iPSCs), or 'reprogrammed' Stem cells: these are similar to embryonic stem cells but made from adult specialised cells using a laboratory technique discovered in 2006

In Edinburgh, scientists have created iPSCs from the skin cells of people with MND. This has been an exciting breakthrough in MND research as these skin cells can be converted into iPSCs, which can then be converted back into neuronal cells for laboratory studies. By using the same technique on cells taken from people who don't have MND, the researchers can compare the differences in the way the neurones and tissues grow and develop, and what is happening when they malfunction. To date, Stem cell technology is still regarded as a laboratory tool rather than a treatment, but one which can also be used to test the effects of experimental drugs in the hope of discovering therapies and treatments for many diseases including MND.

Do existing Stem cell treatments for MND work?

Several clinical trials have been undertaken in people with MND, but to

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date, no MND patient has been known to recover from the disease as a result of commercially available Stem cell treatment.

Why Don't Stem Cell Treatments Work For MND?

In order to repair the damage caused by MND, Stem cells would need to get into the nervous system itself. Once inside the nervous system, they would have to change into motor neurones, which would then need to grow to the correct length and connect to the correct muscles. That's quite a challenge when you consider some cells would need to grow over a metre in length to connect from your spinal cord to muscles in your foot.

Are there safety concerns?

Yes, Stem cells have the potential to turn into any type of cell, including cancer cells. In fact, some research has also raised the possibility that cancer may be a Stem cell disease.

What hope is there?

Stem cell therapies are undoubtedly at the cutting edge of medicine. However, the challenges faced in their use are simply too great at the moment for them to be used safely and effectively.

MND Scotland Funded Research

Professor Chandran, of Edinburgh University, is overseeing Stem cell-based research to fast track the discovery of new drugs for the treatment of MND

Further Information

The Centre for Regenerative Medicine Edinburgh has excellent information about Stem cells.

The EuroStemCell website has information about Stem cells in MND.

ALS Worldwide produce a helpful guide about the potential pitfalls to avoid when considering Stem cell therapy.

For a more detailed discussion of Stem cells, see the NIH's Stem Cell Reports. Check the Frequently Asked Questions page for quick answers to specific queries.

The following websites, which are not part of the NIH Stem Cell Information site, also contain information about Stem cells. The NIH is not responsible for the content of these sites.

International Society for Stem Cell Research (ISSCR) provides information for the public.

Medline Plus provides quality assured health resources, clinical trials, and more.

Explore Stem Cells is a United Kingdom-based resource for the general public that discusses the use of Stem cells in medical treatments and therapies.