This information sheet looks at what stem cells are and why they are important for research into a cure for Parkinson’s. It also discusses where researchers get stem cells from and looks at the sort of research Parkinson’s UK is currently funding.

What are stem cells?
Stem cells are found in many places in the body. They are important because they can divide to make copies of themselves. They can also develop into different types of cells, for example skin, blood, brain and bone cells.

Why is stem cell research important for Parkinson’s?
There is currently no known cure for Parkinson’s. While medicines can help to manage the symptoms, they may only be effective for a certain period of time before side effects develop.

Brain surgery can offer some relief from the symptoms of Parkinson’s, but this is only suitable for a small number of people with the condition. At the moment Parkinson’s can’t be stopped and it progresses despite drug therapy or surgery.

People with Parkinson’s don’t have enough of a chemical called dopamine because the nerve cells that make it in their brain have died. Current research in stem cells is trying to understand how nerve cells develop and why certain ones die. The hope is to find out how healthy cells can be used to replace damaged cells in the brain.

Researchers also hope to discover if the dopamine-producing nerve cells that are lost in the brains of people with Parkinson’s can be replaced with new
healthy dopamine-producing cells generated from stem cells grown in the laboratory. If this is possible then stem cell therapy could be one of the first treatments to offer a cure for Parkinson’s.

Dopamine-producing nerve cells created from stem cells could also be used to develop and test new drug treatments.

Where do researchers get stem cells from?
Currently researchers can get stem cells from several sources, including embryos, blood cells taken from the umbilical cord at birth and bone marrow. Researchers can also convert cells from an adult into stem cells (see Getting stem cells from an adult).

Getting stem cells from an embryo
When a sperm fertilises an egg, a one-cell embryo is formed. Pretty soon, this cell starts to divide and a few days later it will have grown into a tiny ball of around one hundred cells, this is about the same size as a grain of sand. Inside this embryo, there is a tiny clump of cells that can be grown into embryonic stem cells in the laboratory. These are powerful cells that are capable of forming every kind of cell found in the body.

In the UK, human embryonic stem cells can be collected from left-over embryos produced as part of in vitro fertilisation (IVF) programmes. This can only be done legally under strict UK guidelines from the Human Fertilisation and Embryology Authority (HFEA) based on government legislation. The Human Fertilisation and Embryology Act 1990 states that only very early-stage embryos can be used in research – up to a maximum of 14 days of development.

Scientists don’t have enough human embryonic stem cells for their research projects, so they have been looking at other ways of making them.

Embryonic stem cells show great promise for helping to find a treatment for Parkinson’s. However, they also have the risk of uncontrolled growth of the stem cells in the body, which could lead to the formation of tumours.

Much more research is needed in order for scientists to understand how stem cells work and how they may be used to produce treatments for Parkinson’s and many other medical conditions.

Getting stem cells from an adult
Although adult stem cells exist, they are only found in quite small numbers in certain parts of the body. Adult stem cells have been used to treat some conditions – for example bone marrow transplants to treat leukaemia. However, it’s not currently possible to change adult stem cells into nerve cells suitable as a treatment for Parkinson’s.

A new way of getting stem cells
At the end of 2007, two teams of researchers from Japan and the United States announced an exciting breakthrough. They had discovered a new way of converting adult cells back into ‘blank’ stem cells, which appear to be very similar to embryonic stem cells.

The researchers took human skin cells and added just four extra genes. This ‘reprogramming’ created a new kind of stem cell called induced pluripotent stem cells or iPS cells. These appear to have the potential of turning into any type of cell. More recently, researchers announced that they had successfully used these reprogrammed iPS cells to form nerve cells that eased the symptoms of rats with a Parkinson’s-like condition when they were transplanted into the brain.

Although these are gripping discoveries, some scientists are remaining cautious. iPS cells are not identical to embryonic stem cells and any differences need to be carefully explored.

In order to be used successfully, the DNA in the adult stem cell must be permanently changed to turn it into an iPS cell. At the moment, scientists don’t know if this causes any long-term harmful effects. Cells made from iPS cells might not be stable over long periods of time and may change again to form other types of cell. The initial experiments used viruses to import the new genes into cells and that risks changing the cells into cancer cells. However, more recent research indicates that it may be possible to generate iPS cells without the use of viruses, which would be a much safer approach.
Can we use stem cells to find new drugs?
In the future iPS cells may provide a way of using your own body’s cells as a treatment for Parkinson’s. At the moment iPS cells can only be made into Parkinson’s nerve cells in the laboratory. But this means that early stages of Parkinson’s can be studied and it provides a new way of testing drugs.

In work funded by Parkinson’s UK, iPS cells were created from someone with early onset Parkinson’s. These cells produced an increased level of a protein called alpha-synuclein. This protein doesn’t work properly in people with Parkinson’s. The iPS cells act in a similar way to cells that have been affected by Parkinson’s and so are ideal to use when checking if new drug therapies are effective.

How long will it take to develop a stem cell treatment for Parkinson’s?
While the idea of using stem cells to treat Parkinson’s is now becoming a possibility, these therapies are still experimental and under development. At the moment, it is impossible to predict how long it will take for stem cell therapy to become available to people with Parkinson’s. Also, even if a therapy is approved, it is unlikely to work for everyone. This is similar to the way people respond differently to Parkinson’s drugs.

It is very important that all the different types of stem cell research (ie embryonic stem, adult and iPS) are kept going, to move as swiftly as possible towards developing a possible cure for Parkinson’s. Developments in one type of stem cell research can help bring forward a scientific breakthrough in another. At this stage, scientists do not know which type of stem cell, if any, may eventually lead to a successful treatment or cure.

What is the position of Parkinson’s UK’s on stem cell research?
We firmly support stem cell research and warmly welcome the UK regulations that allow stem cell research into conditions such as Parkinson’s.

Our specialist researchers advise us that stem cell research has the potential to lead to new and better treatments. Our Board of Trustees therefore decided to support stem cell-based research.

We respect that other people may not share our view, but we believe that using a range of research methods will help us find a cure more quickly.

Are brain implants using foetal brain material a type of stem cell research?
No. Brain implants using foetal material and stem cell research are different.

Brain implants using foetal material involve taking developing nerve cells directly from aborted foetuses. This material contains cells that are already going to become dopamine cells. The aim is that these cells will connect with other cells in the region of the brain they are implanted in and start producing enough dopamine to correct the problems that result from a shortage of dopamine.

Results for this type of transplant have been mixed, partly because it has been impossible to standardise the foetal cell material that is used for the implants. Also it’s not possible to accurately control the amount of dopamine released by the cells. This may result in side effects such as uncontrolled movements (dyskinesia). Using stem cells may overcome this obstacle, since it should be possible to produce large amounts of pure, quality-controlled dopamine-producing nerve cells from stem cells that could then be implanted into the brain.

Research into the possible use of stem cells in Parkinson’s generally uses nerve cells made from stem cells that are at a much earlier stage of development than the material that is taken from a foetus.

Could I use umbilical cord blood banking as a source of stem cells?
Cord blood banking can be useful for the treatment of blood diseases. However, there is not enough evidence to support the use of umbilical cord blood as a source of stem cells to repair the brains of people with Parkinson’s. We would not recommend that people pay for this in case they get Parkinson’s in the future, given the current advances in the development of stem cell technology.
Can nose stem cells treat Parkinson’s?

Along with embryonic stem cells, there have also been advances with adult stem cells. A group of Australian scientists have recently discovered that human nose stem cells appear to treat rats with Parkinson’s-like symptoms. This research is at an early stage so it is not possible to say whether it may lead to any therapeutic benefits.

What is the status of stem cell research at the moment?

Research on stem cells relating to the brain and Parkinson’s has been taking place for more than 10 years. Progress has been made, but there is still a long way to go. In particular, the growth of different types of stem cells needs to be better understood and controlled, so that the outcomes are always predictable. At the moment there are problems producing enough reliable dopamine-producing cells. The development of iPS technology has allowed us to move further forward, but more research needs to be carried out.

Only when stem cell production is predictable and reliable would the therapy be ready for testing in a clinic. Some research groups and companies think they are close to that stage. However, researchers connected with Parkinson’s UK feel that a move into human trials at present it is too early and runs the risk of producing negative results and possibly even side effects.

Recently there have been some advertisements for stem cell treatments for people with Parkinson’s in China. There is no evidence, however, that this therapy works and at this stage treatments may actually be harmful. We do not recommend that people should have any such therapy.

We’re watching the developments in this field and will update our advice as soon as any of the advances made become a safe therapy.

What research is Parkinson’s UK funding?

We know that stem cell science is an extremely fast moving field that has many hurdles to overcome. So over the last seven years, we have invested £2million into 16 stem cell projects throughout the UK.

Our scientists are working hard to understand adult and embryonic stem cells so they can treat Parkinson’s. For more information on current research see the Parkinson’s UK research magazine Progress or contact the Research and Innovation team on research@parkinsons.org.uk or by calling 020 7963 9376.

While we give broad support to stem cell research, we also know that support is needed for other complementary avenues of research to further our understanding of Parkinson’s, and to identify other possible treatments.

Each year Parkinson’s UK funds research into many different areas, including genetics, surgery and developing therapies. We have also established and support the Parkinson’s UK Brain Bank, currently based at Imperial College London.

More information and support

If you would like to know more about how you can get involved in supporting our research, contact Emily Hughes at rsn@parkinsons.org.uk or 020 7963 9376.

The following websites contain further information on stem cells:

UK sites
Human Fertilisation and Embryology Authority – www.hfea.gov.uk
Medical Research Council – www.mrc.ac.uk
The Wellcome Trust – www.wellcome.ac.uk
BBC – www.bbc.co.uk/health

US sites
International Society of Stem Cell Research – www.closerlookatstemcells.org

Parkinson’s nurses
Parkinson’s nurses provide expert advice and support to people with Parkinson’s and those who care for them. They can also act as a liaison between other health and social care professionals to make sure your needs are met.

Parkinson’s nurses may not be available in every area, but your GP or specialist can give you more details on local services.
Information and support from Parkinson’s UK
You can call our free confidential helpline for general support and information. Call **0808 800 0303** (calls are free from UK landlines and most mobile networks) or email **hello@parkinsons.org.uk**.

Our helpline can also put you in touch with one of our local information and support workers, who provide one-to-one information and support to anyone affected by Parkinson’s. They can also provide links to local groups and services.

Our website has information about your local support team and how to contact them at parkinsons.org.uk/localtoyou. You can find details of our local groups and your nearest meeting at parkinsons.org.uk/localgroups. You can also visit parkinsons.org.uk/forum to speak with other people in a similar situation on our online discussion forum.

**Glossary**

**Adult stem cells** – stem cells derived from adult tissue.

**Differentiation** – the process by which unspecialised stem cells develop into specific types of cells.

**DNA** – stands for deoxyribonucleic acid. DNA is a large, ladder-like molecule in humans and other living beings that contains the instructions needed for growth and function.

**Embryo** – stage in the development of a human being from implantation to about 8–12 weeks after conception.

**Embryonic stem cells** – cells derived from the very earliest stages of fertilisation. Such cells have the capacity to form any cell in the body, including dopamine-producing nerve cells.

**Foetus** – stage in the development of a human being usually from 8–12 weeks after conception.

**IVF (in vitro fertilisation) treatment** – fertility treatment involving fertilisation outside the body in a laboratory.

**Neural transplant** – transplanting material into the brains of people with conditions like Parkinson’s, to replace lost or damaged cells and restore normal function.

**Induced pluripotent stem cells (iPS cells)** – stem cells that have been generated by the reprogramming of ‘adult’ cells such as skin cells. These can then be used to generate specialised cells, such as nerve cells.

**Stem cell** – unspecialised cells that have the ability to maintain themselves and also to develop into specialised types of cells within the body tissues, eg skin, blood, intestine.

**Unspecialised stem cells** – have the potential to develop into specialised cells or divide into other stem cells.
Thank you to everyone who contributed to and reviewed this information sheet:

Dr T Kunath, Group Leader, Edinburgh University.

Dr Maya Sieber-Blum, PhD, Professor of Stem Cell Sciences, Institute of Genetic Medicine, Newcastle University Centre for Life.

Thanks also to our information review group and other people affected by Parkinson’s who provided feedback.

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**Stem cell research and Parkinson’s**

If you have comments or suggestions about this information sheet, we’d love to hear from you. This will help us ensure that we are providing as good a service as possible. We’d be very grateful if you could complete this form and return it to Resources and Diversity, Parkinson’s UK, 215 Vauxhall Bridge Road, London SW1V 1EJ. Or you can email us at publications@parkinsons.org.uk. Thanks!

Please tick...

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☐ I’m family/a friend/a carer of someone with Parkinson’s

☐ I’m a professional working with people with Parkinson’s

Where did you get this information sheet from?

☐ GP, specialist or Parkinson’s nurse

☐ Parkinson’s UK local group or event

☐ Our website

☐ Information and support worker

☐ Ordered from us directly

☐ Other ..............................................................................................................................................

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We’re the Parkinson’s support and research charity. Help us find a cure and improve life for everyone affected by Parkinson’s.

Can you help?
At Parkinson’s UK, we are totally dependent on donations from individuals and organisations to fund the work that we do. There are many ways that you can help us to support people with Parkinson’s. If you would like to get involved, please contact our Supporter Services team on 020 7932 1303 or visit our website at parkinsons.org.uk/support. Thank you.

Parkinson’s UK
Free* confidential helpline 0808 800 0303
Monday to Friday 9am–8pm, Saturday 10am–2pm. Interpreting available.
Text Relay 18001 0808 800 0303
(for textphone users only)
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☐ NA ☐ It hasn’t helped ☐ It has helped a little ☐ It has helped a lot

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If you would like to become a member of Parkinson’s UK, or are interested in joining our information review group, please complete the details below and we’ll be in touch.

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