Scientists uncover the potential to control adult stem cells

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Research being presented today at the UK National Stem Cell Network Annual Science Meeting in Edinburgh represents a step towards the use of Adult Stem Cells (ASCs) to repair damaged tissue. Speaking at the conference in Edinburgh, Professor Cay Kielty of the University of Manchester describes how she and her team have uncovered a messaging system that instructs ASCs to contribute to tissue repair in response to chemical signals in the body.

This work, funded by the Medical Research Council, holds great hope for the development of techniques by which ASCs could be instructed to repair damaged tissues.

ASCs have potential for therapeutic use and avoid many of the ethical issues associated with embryonic stem cells. However, at present it is necessary to gain a better understanding of how, from first principles, ASCs can be controlled based on signalling systems that normally give instructions within the body. There is the potential in the future to apply such understanding to the generation of cells for transplant.

Professor Kielty's team study stem cells that are found in human bone marrow called mesenchymal stem cells (MSCs). MSCs have the ability to relocate and develop into several different types of cells and tissue and are very promising as a source of cells for transplant in tissue repair. As well as offering the potential for bespoke treatments derived from a person's own cells, MSCs are unlikely to trigger a severe immune response, and may be suitable for "off-the-shelf" treatments for tissue

repair. This research focuses on the details of a messaging system that leads to the development of blood vessels from MSCs in the body. This system is called 'PDGF receptor signalling'.

In PDGF receptor signalling, receptors on the surface of the MSCs receive messages in the form of molecules that are involved in directing human growth and development – 'growth factors'. It has been found that there is a complex messaging system that relays and coordinates the signals from certain growth factors to the MSCs, which encourage their recruitment to new blood vessels. This involves cooperation between two types of receptor called 'PDGF receptor' and 'neuropilin-1' that respond to growth factors called PDGF and VEGF-A arriving at the cell surface, as well as sensing close proximity to other cells that make up the blood vessel.

As well as offering insights into the use of ASCs for tissue repair therapies, a better knowledge of how blood vessels develop is crucial to understanding and treating a huge range of diseases such as cancer, diabetic retinopathy and cardiovascular disease.

Professor Kielty said: "What we have shown is that adult stem cells respond in particular ways to some of the chemical signals in the body. The next stage will be to understand how this messaging system regulates relocation of the MSCs and instructs them to become blood vessel cells. After that, we can look at applying our understanding to develop stem-cell derived therapies for tissue repair."

Source: Biotechnology and Biological Sciences Research Council