Stem cell breakthrough could lead to new bone repair therapies on nanoscale surfaces

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Scientists at the University of Southampton have created a new method to generate bone cells which could lead to revolutionary bone repair therapies for people with bone fractures or those who need hip replacement surgery due to osteoporosis and osteoarthritis.

The research, carried out by Dr Emmajayne Kingham at the University of Southampton in collaboration with the University of Glasgow and published in the journal *Small*, cultured human embryonic stem cells on to the surface of plastic materials and assessed their ability to change.

Scientists were able to use the nanotopographical patterns on the biomedical plastic to manipulate human embryonic stem cells towards bone cells. This was done without any chemical enhancement.

The materials, including the biomedical implantable material polycarbonate plastic, which is a versatile plastic used in things from bullet proof windows to CDs, offer an accessible and cheaper way of culturing human embryonic stem cells and presents new opportunities for future medical research in this area.

Professor Richard Oreffo, who led the University of Southampton team, explains: "To generate bone cells for regenerative medicine and further medical research remains a significant challenge. However we have found that by harnessing surface technologies that allow the generation and ultimately scale up of human embryonic stem cells to skeletal cells, we can aid the tissue engineering process. This is very exciting.

"Our research may offer a whole new approach to skeletal regenerative medicine. The use of nanotopographical patterns could enable new cell culture designs, new device designs, and could herald the development of new bone repair therapies as well as further human stem cell research ," Professor Oreffo adds.

The study was funded by the Biotechnology and Biological Sciences Research Council (BBSRC).

This latest discovery expands on the close collaborative work previously undertaken by the University of Southampton and the University of Glasgow. In 2011 the team successfully used plastic with embossed nanopatterns to grow and spread adult stem cells while keeping their stem cell characteristics; a process which is cheaper and easier to manufacture than previous ways of working.

Dr Nikolaj Gadegaard, Institute of Molecular, Cell and Systems Biology at the University of Glasgow, says: "Our previous collaborative research showed exciting new ways to control mesenchymal stem cell – stem cells from the bone marrow of adults – growth and differentiation on nanoscale patterns.

"This new Southampton-led discovery shows a totally different stem cell source, embryonic, also respond in a similar manner and this really starts to open this new field of discovery up. With more research impetus, it gives us the hope that we can go on to target a wider variety of degenerative conditions than we originally aspired to. This result is of fundamental significance."

More information: onlinelibrary.wiley.com/doi/10 … l.201202340/abstract

Provided by University of Southampton