Nanomaterials in a heart beat

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Stem cell scientists have capitalised on the electrical properties of a widely used nanomaterial to develop cells which may allow the regeneration of cardiac cells. The breakthrough has been led by a team of scientists at the Regenerative Medicine Institute (REMEDI) at the National University of Ireland Galway in conjunction with Trinity College Dublin.

Heart disease is the leading cause of death in Ireland. Once damaged by heart attack, cardiac muscle has very little capacity for self-repair and at present there are no clinical treatments available to repair damaged cardiac muscle tissue.

Over the last 10 years, there has been tremendous interest in developing a cell-based therapy to address this problem. Since the use of a patient's own heart cells is not a viable clinical option, many researchers are working to try to find an alternative source of cells that could be used for cardiac tissue repair.

REMEDI researchers Dr Valerie Barron and Dr Mary Murphy have brought together a multi-disciplinary team of Irish materials scientists, physicists and biologists from REMEDI at National University of Ireland Galway and Trinity College Dublin to address this problem.

The researchers recognised that carbon nanotubes, a widely used nanoparticle, is reactive to electrical stimulation. They then used these nanomaterials to create cells with the characteristics of cardiac progenitors, a special type of cell found in the heart, from adult stem

cells.

"The electrical properties of the nanomaterial triggered a response in the mesenchymal (adult) stem cells, which we sourced from human bone marrow. In effect, they became electrified, which made them morph into more cardiac-like cells", explains Valerie Barron of REMEDI at National University of Ireland Galway. "This is a totally new approach and provides a ready-source of tailored cells, which have the potential to be used as a new clinical therapy. Excitingly, this symbiotic strategy lays the foundation stone for other electroactive tissue repair applications, and can be readily exploited for other clinically challenging areas such as in the brain and the spinal cord."

This work has recently been published in two leading scientific journals, Biomaterials and Macromolecular Bioscience, and was carried out in collaboration with Professor Werner Blau, Investigator in CRANN and the School of Physics, Trinity College Dublin (TCD).

"It is great to see two decades of our pioneering nanocarbon research here at TCD come to fruition in a way that addresses a major global health problem. Hopefully many people around the world will ultimately benefit from it. Some of our carbon nanotube research has been patented by TCD and is being licensed to international companies in material science, electronics and health care," said Professor Blau.

Nanoweek 2012 is currently underway, running 14-21 September. It offers an opportune time to reflect on the type of healthcare solutions that nanomaterials can offer.

More information: The electrical stimulation of carbon nanotubes to provide a cardiomimetic cue to MSCs. Mooney E, Mackle JN, Blond DJ, O'Cearbhaill E, Shaw G, Blau WJ, Barry FP, Barron V, Murphy JM. Biomaterials. 2012 Sep;33(26):6132-9. Epub 2012 Jun 6.

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