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'Synthetic' stem cells treat damaged muscle without the cancer risk

By **Henry Bodkin**

SCIENTISTS are hailing a pioneering stem cell technique promising "off-the-shelf" treatment for people with damaged muscles without all the risk.

Researchers have for the first time successfully implanted "synthetic" cardiac stem cells, which repaired muscle tissue that had been weakened by a heart attack.

Traditional stem cell therapy comes with a risk of cancer because scientists are unable to stop the cells replicating and forming tumours.

But because the man-made version is partly constructed from cell-mimicking microparticles, the cells do not "amplify" once implanted in patients.

They are also designed to bypass the body's immune system in order to wipe out the risk of implants being rejected, meaning patients do not need to find a close relation willing to be a donor.

Stem cell therapies work by repairing damaged tissue, or "endogenous repair", by secreting proteins and genetic materials.

Bone marrow transplant is the most widely used form, mostly performed on patients with cancers of the blood or bone marrow such as leukaemia.

Researchers are also trying to develop safe and effective stem cell treatments for heart disease and neurodegenerative conditions such as Parkinson's. Natural stem cells are extremely fragile, however, requiring careful storage and a laborious process of typing - matching the proteins of donor and recipient - before they can be used.

Synthetic stem cells, by contrast, are easier to preserve and can be altered for use on various parts of the body.

It is also less important that they are derived from the patient's own cells, or a close match, because they do not trouble the body's immune system.

"We are hoping that this may be a first step towards a truly off-the-shelf cell product that would enable people to receive beneficial stem cell therapies when they're needed, without costly delays," said Ke Cheng, associate professor of molecular biomedical sciences at North Carolina State University.

'They cannot amplify by themselves, so you get the benefits of stem cell therapy without the risks'

He and his colleagues fabricated a cell-mimicking microparticle (CMMP) from a biodegradable and biocompatible polymer, and then added growth factor proteins that had been harvested from cultured human cardiac stem cells, finally coating the particle with a cardiac cell membrane.

It was tested both in a laboratory dish and also in a mouse which had suffered a heart attack, and was found to promote the growth of cardiac cells in a manner comparable to traditional stem cells. Due to its structure, however, CMMP cannot replicate, which reduces the risk of tumour formation.

The study, published in the journal *Nature Communications*, states that the new technology is applicable to other types of stem cells.

"The synthetic cells operate much the same way as a deactivated vaccine works," said Professor Cheng.

"Their membranes allow them to bypass the immune response, bind to cardiac tissue, release growth factors and generate repair.

"But they cannot amplify by themselves, so you get the benefits of stem cell therapy without the risks."

Currently, donated stem cells need to closely match the patient's own, meaning they often come from a brother or sister.

In the absence of a close relative, patients can undergo a so-called "matched unrelated donor transplant", involving stem cells similar but not matching their own.

These are more likely to provoke a reaction, which can be life-threatening, when the immune cells within the donated stem cells attack the body.

This response, called graft versus host disease, can be controlled to an extent by anti rejection drugs.