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Glowing Stem Cells Mend Broken Hearts

A young Australian scientist is heralding hope for broken hearts with a cutting-edge tool that helps scientists fast-track exciting new therapies to mend damaged organs.

Richard Tan from the Heart Research Institute in Sydney has developed a glowing stem cell tracker model that could change the way the science community develops life-saving tissue therapies.

The method uses specialised bioluminescent stem cells that can be injected into sick patients and then observed in real time to see if they're working effectively to repair damaged tissue. The invention looks set to dramatically boost the success of stem cell implantation, saving lives and ensuring patients get effective therapy sooner.

"We've developed a tool that allows us to quickly establish whether tissue regeneration to save damaged hearts, brains, lungs and other organs, is actually working," Mr Tan says. "This will be great news for all the scientists working to harness the tissue regenerative powers of stem cells, which are highly sought after in many fields of medicine."

The ground-breaking research was presented at the European Chapter Meeting of the Tissue Engineering and Regenerative Medicine International Society in Stockholm, Sweden, this past July. It will also be published by *Acta Biomaterialia*, http://www.sciencedirect.com/science/article/pii/S1742706117300971 a leading journal in this field, and had nominated Mr Tan for a prestigious student prize at the Cardiac Society of Australia and New Zealand meeting in August.

Stem cells - cells that can transform into any type of cell in the body - hold great promise in the treatment of heart failure and heart disease as well as diabetes, Parkinson's disease, cerebral palsy and a host of other conditions. However, stem cell therapies have been limited to date by the failure of injected cells to firmly graft onto damaged tissue following transplantation.

In heart research, the cells have been used to treat heart attacks but effects are short-lived because stem cells are not able to survive in the damaged tissue long enough.

Scientists at the Heart Research Institute have been investigating the use of biomaterial scaffolds implanted in damaged tissue before stem cell transplantation to help the cells graft more effectively. This promising strategy could be the key to finally realising the full life-saving potential of stem cells. But as Mr Tan explains: "Unfortunately developing the right biomaterial scaffold which properly engrafts stem cells and supports their regenerative functions is highly complex and challenging because they are essentially man-made prosthetics that are meant to mimic native human tissue."

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Under the direction of HRI senior scientists Associate Professor Martin Ng and Dr Steven Wise, the PhD student came up with a solution.

“I reasoned that it was essential to develop a method to track stem cells in real time as they interact with implanted biomaterial scaffolds, to give us an insight into whether or or not it was actually working as we wanted it to,” Mr Tan says.

The team worked to isolate a population of glowing bioluminescent stem cells and transplant them alongside test biomaterial scaffold in the laboratory. “We discovered we could see the stem cells in real time homing to and engrafting within our implant, as well as being able to see how different stem cells responded to two different scaffolds.”

The method is non-invasive and avoids the need for artificial stem cell tracking agents commonly used so cells can be seen and monitored. These agents are ineffective because they either impair the normal function of stem cells or they remain in the body long after a stem cell has died, yielding false positive signalling.

“Using our bioluminescent stem cells, we avoid these limitations and created a powerful new tool that allows tissue engineers to see for the first time exactly how stem cells interact with implanted scaffolds live as it is happening.”

“This means they can quickly and efficiently determine if the biomaterial scaffolds are working and ultimately create the best scaffolds that bond with stem cells, create new tissue and save lives.”

Scientists working across multiple disease groups, from heart and brain conditions through to diabetes and lung disease, are set to benefit from the advancement.

Mr Tan says more work is needed before it is known whether success in the laboratory will be seen in humans.

“Our study provides the pioneering steps, and with it we can engineer the perfect scaffold that, all going well, can give us that long term tissue regeneration we’re all hoping for.”

For more information and interview requests, contact Lucy Williams on 0403 753 028.

About the Heart Research Institute

The Heart Research Institute is serious about hearts. Our mission is to prevent death and suffering from cardiovascular disease. The institute is made up of 12 scientific groups, each conducting cutting-edge research into a specific aspect of the disease.

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