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Canadians working on method to heal heart

Technique would implant adult stem cells to help regenerate healthy cardiac tissue

BY CAROLYN ABRAHAM
MEDICAL REPORTER

Canadian scientists are applying for ethics approval to test a revolutionary cardiac treatment that could help people heal their own damaged hearts.

After finding that injections of stem cells can regenerate healthy tissue in the scarred hearts of rodents, Toronto researchers hope to test the method in humans, perhaps before the end of the year.

Their approach would not rely on the controversial use of stem cells from human embryos but rather on stem cells harvested from an adult patient's own blood, muscle or bone marrow.

This not only would sidestep the controversy but, because the transplanted cells would be derived from the patients themselves, would eliminate any chance of patients' immune systems rejecting them.

"The body has its own stem cells ready to be used for repair," said Richard Weisel, professor and chairman of the cardiac surgery division at the University of Toronto and Toronto General Hospital. "We've been working on this for the past four or five years and we've had encouraging results in animals."

If hospital and university ethics boards give Dr. Weisel and his team the nod, Canada will join France, the United States, the Netherlands and Brazil in exploring the treatment. Researchers in those countries have already implanted stem cells in the battered hearts of nearly 20 patients with mixed preliminary results.

The fact that the scientists are ready to shift their experiments from the lab to the clinic is a testament to the speed of stem-cell research, hailed as the precursor to regenerative medicine.

Stem cells have the versatility to become any tissue type in the body. With chemical cues they can grow into nerves, blood, bone, skin and muscle – and into healthy heart cells.

Implanting them to restore function to a failing heart could theoretically transform conventional cardiac surgery and provide a powerful new weapon in the war against heart disease, the industrial world's No. 1 killer.

"It's getting to be a reality that's here much quicker than we thought," said Peter Liu, head of cardiovascular research at U of T. "All of a sudden there has been a great momentum that's gathered behind the entire concept."

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Scientists discovered only recently that stem cells found in adult tissues, such as blood or bone marrow, might be as versatile as stem cells from human embryos.

Then last month, the *New England Journal of Medicine* reported that the body dispatches stem cells to repair a damaged heart, yet not always enough of them. "This was against everything we had learned in medical school," Dr. Weisel said.

It had always been assumed that people are born with all the heart cells they will ever have; that explained why cardiac muscle cannot regenerate itself after a heart attack, forcing the rest of the organ to work harder and ultimately fail.

"By implanting stem cells, we are just hoping to assist the body with what it can do naturally," Dr. Weisel said.

Ren-ke Li, a senior scientist at the Toronto General Hospital Research Institute, said he and Dr. Weisel have found that injecting stem cells that are in their blank-slate state into a rat's heart actually stimulates blood vessels to grow.

Being in the environment of the heart also encourages the stem cells to become cardiac cells, he said.

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"We don't really know if [the improvement] is due to the bypass or the injection of cells," Dr. Weisel said.

The trials in France revealed risks with the procedure. Of the 10 patients who received stem-cell transplants, four developed extra heartbeats, which can disrupt circulation and cause sudden death.

One patient in the test has died, but Dr. Weisel said he was severely ill and in need of a heart transplant.

If the Canadian trial proceeds, the team is considering a range of patients who might qualify.

Among them are people who experience a major heart attack but are not considered likely to benefit from other treatments, and those who can undergo a by-pass to one part of their heart and receive a stem cell injection in another section.

The article EM0206 reprinted above is used in Chapter 10 of the STAT 231 Course Materials.