Nano World: Nanofibers for heart cells

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The heart function of rats following heart attacks can be improved using heart cells wrapped in organic fibers only nanometers or billionths of a meter long that are impregnated with growth hormones, experts tell UPI's Nano World.

Cell transplants are a promising medical treatment for brain and muscle ailments. "Cell therapy for heart failure is promising because we believe that loss of heart cells is an important part of heart failure, particularly after heart attacks," said researcher Richard Lee, a molecular cardiologist at Brigham and Women's Hospital and Harvard Medical School in Boston.

The problem when it comes to injections of cells into heart muscle is the vast majority of them die. In the lab, scientists can guide how cells grow by modifying their surrounding chemistry and other factors, but when the cells are transplanted into the body, "we lose control," Lee said. "Our results indicate that we can use nanotechnology to control the cells after they are injected, to make them live longer."

The scientists employed organic fibers roughly 10 nanometers wide made from amino acids, the same building blocks proteins are built with. They incorporated the heart-growth-promoting hormone IGF-1 into the nanofibers. When exposed to the kind of chemical environments found within the body, the nanofibers automatically assemble themselves into scaffolds the researchers surrounded the heart cells with.

"The work took about four years, and we made many mistakes along the

way," Lee said. "We made design errors several times and had to go back to the drawing board and start over several times. But I work with a lot of stubborn people and we thought this approach could work if we just kept at it."

Lee and his colleagues found their new technique helped prevent transplanted heart cell death, resulting in more heart muscle cell growth and improved heart function in rats. They reported their findings in the Proceedings of the National Academy of Sciences.

While the researchers were able to show improved heart function, "we have a long way to go before we get results that look like normal heart tissue. And we must do a lot of work to prove that there are no unexpected toxicities or long-term effects," Lee cautioned.

The key thing, Lee added, was their approach was open to further improvements, say with the addition of different hormones, "to get us closer to our goal of cardiac repair and regeneration." Additional fundamental research is needed "to understand why human hearts don't heal, so we can introduce the correct factors in the correct doses and at the right times."

"They've really done a great job in showing a whole new way of controlling cell environments for transplanted cell therapies. To see it work in vivo is very exciting," biological engineer Linda Griffith at the Massachusetts Institute of Technology in Cambridge. She added the technique "could have implications for all kinds of cell delivery."

"Ultimately, we will probably want to make the system a little simpler for human use. That should be possible within two to three years, in my opinion. We aren't working with a specific company on this approach yet," Lee said. "It should be inexpensive because it is relatively simple to make."