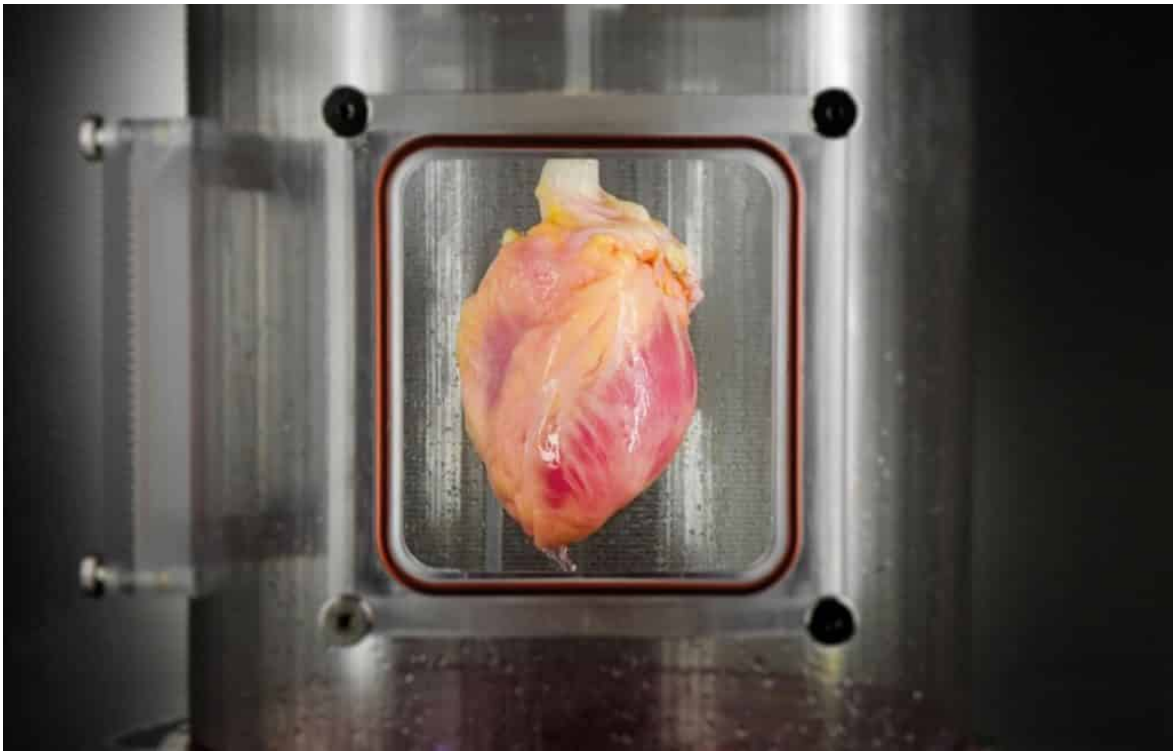

Scientists Grow Full-Sized, Beating Human Hearts

Transhumans will be happy to learn that that they will promote immortality by growing their own heart replacements. The science of this is exciting on one hand, but lacking thorough ethical discussion on the other. TN Editor

Massachusetts General Hospital (MGH) researchers have taken some initial steps toward the creation of bioengineered human hearts using donor hearts stripped of components that would generate an immune response and cardiac muscle cells generated from induced pluripotent stem cells (iPSCs), which could come from a potential recipient. The investigators described their accomplishments – which include developing an automated bioreactor system capable of supporting a whole human heart during the recellularization process — earlier this year in *Circulation Research*.

“Generating functional cardiac tissue involves meeting several challenges,” says Jacques Guyette, PhD, of the MGH Center for Regenerative Medicine (CRM), lead author of the report. “These include

providing a structural scaffold that is able to support cardiac function, a supply of specialized cardiac cells, and a supportive environment in which cells can repopulate the scaffold to form mature tissue capable of handling complex cardiac functions."

The research team is led by Harald Ott, MD, of the MGH CRM and the Department of Surgery, senior author of the paper. In 2008, Ott developed a procedure for stripping the living cells from a donor organ with a detergent solution and then repopulating the remaining extracellular matrix scaffold with organ-appropriate types of cells. Since then his team has used the approach to generate functional rat kidneys and lungs and has decellularized large-animal hearts, lungs and kidneys. This report is the first to conduct a detailed analysis of the matrix scaffold remaining after decellularization of whole human hearts, along with recellularization of the cardiac matrix in three-dimensional and whole-heart formats.

The study included 73 human hearts that had been donated through the New England Organ Bank, determined to be unsuitable for transplantation and recovered under research consent. Using a scaled-up version of the process originally developed in rat hearts, the team decellularized hearts from both brain-dead donors and from those who had undergone cardiac death. Detailed characterization of the remaining cardiac scaffolds confirmed a high retention of matrix proteins and structure free of cardiac cells, the preservation of coronary vascular and microvascular structures, as well as freedom from human leukocyte antigens that could induce rejection. There was little difference between the reactions of organs from the two donor groups to the complex decellularization process.

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