

Decellularized Porcine Heart

A BioFabUSA Project / Department of Defense Manufacturing Innovation Institutes



Technology: Decellularized Porcine Heart

Project Participants: Organamet, Advanced Solutions Life Sciences, DEKA Integrated Solutions Corp.

Institutes' Role: The institute led the scale-up and optimization of cell culture, automation of porcine heart decellularization, robotic recellularization with human cells and maturation of the cellularized heart in a novel bioreactor capable of maintaining conditions favorable for cell viability and heart muscle maturation.

Technology Description: The technology developed by Organamet starts with a donor heart from a pig, which is decellularized leaving a bare heart scaffold. Human heart cells are cultured and then injected into the scaffold. Once cells are present, they require further culture so that they integrate fully into the scaffold. The institute led the optimization and automation of heart cell culture in a single vessel, eliminating the manual processing of nearly 400 individual tissue culture plates by multiple operators. The decellularization process was closed and automated, increasing throughput and consistency of scaffold production. Institute members with expertise in AI-driven robotics automated the injection of cells into the heart scaffold, eliminating a significant risk of contamination of the final product.

Impact: Transplantation is the only definitive cure for end-stage organ failure. However organ donation cannot keep pace with demand and requires immunosuppression of the recipient. Building a complex solid organ such as liver, kidney, lung, or heart with a patient's own cells that could eliminate the organ donor shortage and obviate the need for immunosuppression is the Holy Grail of tissue engineering. This project developed broadly-applicable technologies to facilitate the product of organs via decellularization and recellularization and demonstrated the potential of manufacturing whole organs.

