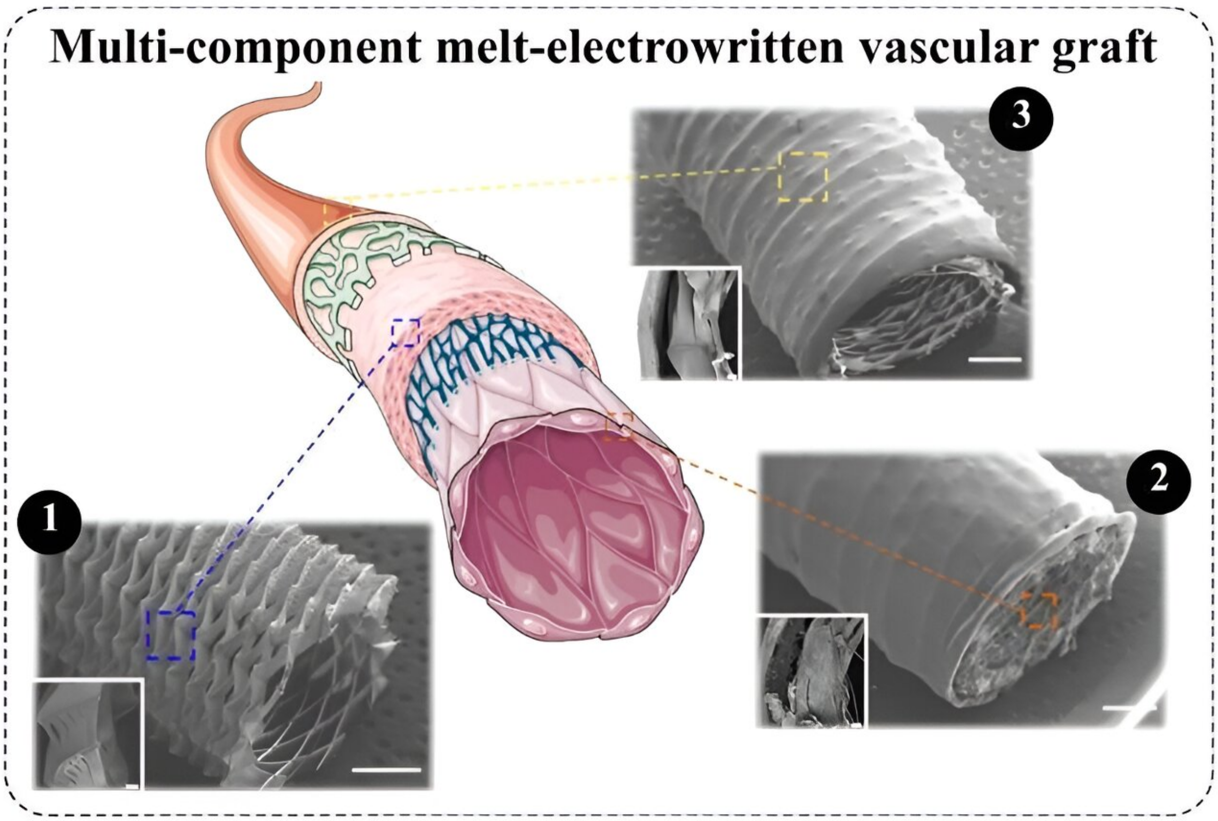
Bioengineers develop hybrid grafts to combat cardiovascular disease

August 22 2024



A graphical abstract of the cardiovascular graft, showing how it can help a blood vessel repair. Credit: *Advanced Functional Materials* (2024). DOI: 10.1002/adfm.202409883

Researchers from AMBER and Trinity, led by Dr. David Hoey, have successfully replicated the behavior of a blood vessel and its guiding structure to regenerate damaged tissue.

The researchers, who published their work in the journal *Advanced Functional Materials*, used a Melt electrowriting (MEW) technique to provide an innovative off-the-shelf alternative to address the unmet clinical need for small-diameter vascular grafts to help combat cardiovascular disease.

Cardiovascular disease is a leading cause of morbidity. Current treatments include vessel substitution using autologous/synthetic vascular grafts, but these commonly fail in small diameter applications, largely due to compliance mismatch and clot formation.

In this research, a multicomponent vascular graft, that takes inspiration from native vessel architecture, was developed to overcome these limitations. Melt electrowriting (MEW) is used to produce tubular scaffolds with vascular-mimetic fiber architecture and mechanics, which is combined with a lyophilized fibrinogen matrix with tailored degradation kinetics to generate a hybrid graft.

Lead Investigator and study author Associate Professor David Hoey said, "We developed a novel multicomponent vascular graft that was inspired by the layered architecture of native blood vessels.

"Utilizing advanced biofabrication technologies such as melt electrowriting (MEW) we could produce tubular scaffolds, that when combined with a fibrinogen matrix, could not only replicate the behavior of a blood vessel but could also act as a guiding structure to regenerate damaged tissue.

"This exciting off-the-shelf graft meets clinical requirements and is therefore a promising solution for addressing the unmet need for small-diameter vascular grafts."

The graft satisfies ISO implantability requirements, matches the compliance of native vessels, and re-establishes physiological flow with minimal clot formation in a preclinical model.

3D bioprinting has emerged as a promising technology for engineering 3D 'living' biological tissues for promoting bone and tissue regeneration.

The overall goal of TRANSITION, led by AMBER's Professor Daniel Kelly, is to develop a new class of 3D-printed biological implants that will regenerate, rather than replace, diseased joints.

More information: Angelica S. Federici et al, Muticomponent Melt-Electrowritten Vascular Graft to Mimic and Guide Regeneration of Small Diameter Blood Vessels, *Advanced Functional Materials* (2024). DOI: 10.1002/adfm.202409883

Provided by Trinity College Dublin