New technology enables the manufacture of materials that mimic the structure of living blood vessels

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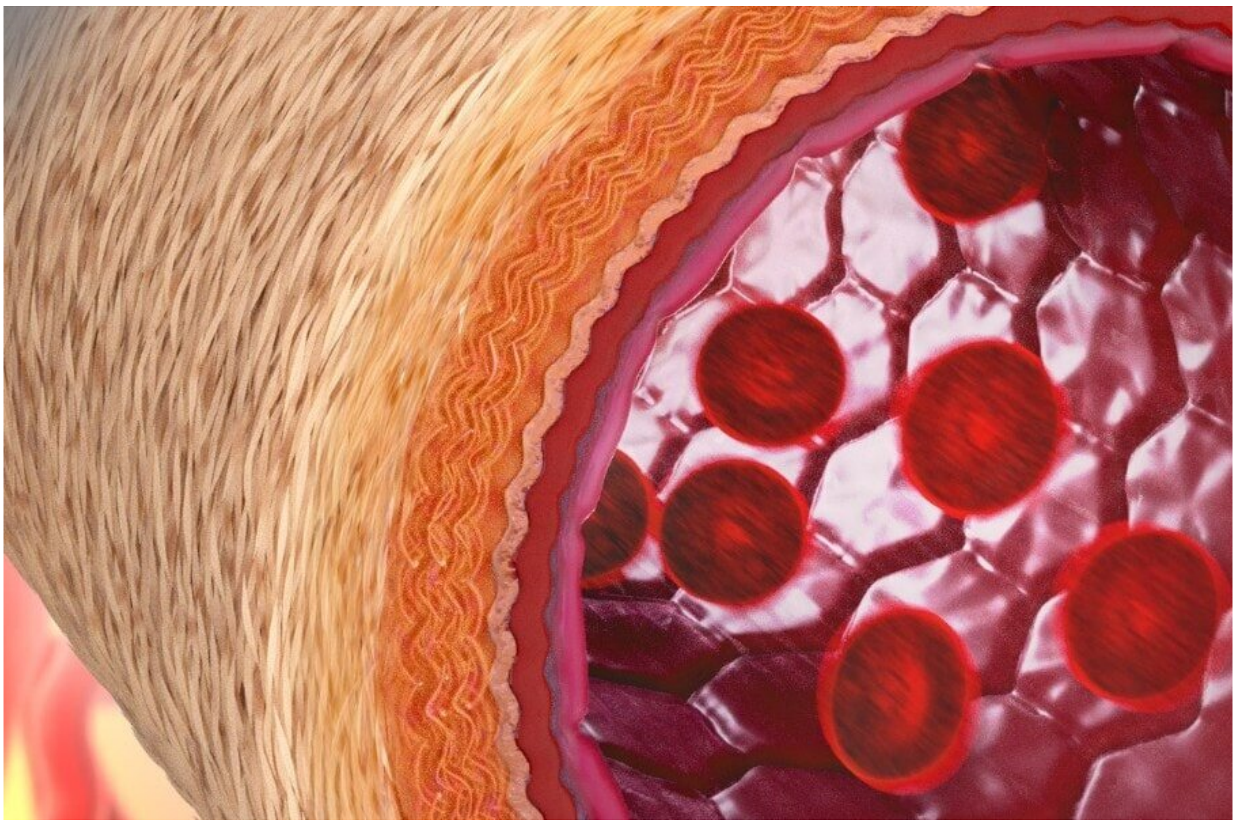

Artist's representation of the 'living blood vessel'. Credit: Ziyu Wang, Ella Maru Studio

An international consortium of researchers led by the University of

Sydney, has developed technology to enable the manufacturing of materials that mimic the structure of living blood vessels, with significant implications for the future of surgery.

Preclinical testing found that following transplantation of the manufactured blood vessel into mice, the body accepted the material, with new cells and tissue growing in the right places—in essence transforming it into a "living" blood vessel.

Senior author Professor Anthony Weiss from the Charles Perkins Center said while others have tried to build blood vessels with various degrees of success before, this is the first time scientists have seen the vessels develop with such a high degree of similarity to the complex structure of naturally occurring blood vessels.

"Nature converts this manufactured tube over time to one that looks, behaves and functions like a real blood vessel," said Professor Weiss.

"The technology's ability to recreate the complex structure of biological tissues shows it has the potential to not only manufacture blood vessels to assist in surgery, but also sets the scene for the future creation of other synthetic tissues such as heart valves."

Co-author Dr. Christopher Breuer of the Center for Regenerative Medicine at Nationwide Children's Hospital and the Wexner Medical Center in Columbus, U.S. said he is excited about the potential of the research for children.

"Currently when kids suffer from an abnormal vessel, surgeons have no choice but to use synthetic vessels that function well for a short time but inevitably children need additional surgeries as they grow. This new technology provides the exciting foundation for the manufactured blood vessels that to continue to grow and develop over time."

Lead author and bioengineer Dr. Ziyu Wang from the University of Sydney's Charles Perkins Center pioneered the technology which was developed as part of his Ph.D. He built on earlier work by Dr. Suzanne Mithieux, also at the Charles Perkins Center.

The walls of natural blood vessels comprise a series of concentric rings of elastin (a protein that gives vessels elasticity and the ability to stretch)—like nesting dolls. That makes the rings elastic, which allows blood vessels to expand and contract with blood flow.

This new technology means that, for the first time, these important concentric elastin rings can develop naturally within the walls of implanted tubes.

Unlike current manufacturing processes for synthetic materials used for surgery, which can be lengthy, complex and expensive, this new manufacturing process is swift and well-defined.

"These synthetic vessels are elegant because they are manufactured from just two naturally occurring materials that are well-tolerated by the body," said Dr. Wang.

"Tropoelastin (the natural building block for elastin) is packaged in an elastic sheath which dissipates gradually and promotes the formation of highly organized, natural mimics of functioning blood vessels."

The manufactured tube can also be safely stored in a sterile plastic bag until transplantation.

The study led by the University of Sydney's Charles Perkins Center and Faculty of Science is published in the international journal *Advanced Materials.*

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More information: Ziyu Wang et al, Rapid Regeneration of a Neoartery with Elastic Lamellae, *Advanced Materials* (2022). DOI: 10.1002/adma.202205614

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