

Research content for the short video 'Utopia – Plants as blood vessels' – 2024

“IMAGINE: Plants as blood vessels

... Enabled by revolutionary and patient-specific 3D prints made from organic materials for better health”

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Creating plant-based blood vessels in the laboratory

Inspired by the fundamental realisation that nature is an irreplaceable partner in the development of sustainable technologies, researchers in this utopia have developed a groundbreaking method to revolutionise healthcare: the creation of plant-based blood vessels in the laboratory.

Our society, which is increasingly shaped by demographic change, faces a growing demand for implants and organs that cannot be adequately met by conventional methods – whether using fossil-based, unsustainable materials or through ethically questionable allo- and xenotransplantations.

3D printing of plant-based biopolymers.

Inspired by this pressing need, researchers have developed a pioneering solution: the production of precise, personalised replicas of blood vessels through the 3D printing of plant-based biopolymers. These biopolymers, derived from an innovative blend of alginate from brown algae and nanofibrillated cellulose. Made from wood fibres, they offer greater biocompatibility due to their natural origin, allow for customisation to suit individual patients and promote sustainability, whilst at the same time reducing reliance on animal testing and xenotransplantation.

These artificial blood vessels are manufactured using specially developed 3D printers equipped with a rotating fourth axis. This innovation makes it possible to create tubular structures whose cellulose fibres can be aligned to mimic the complex fibre structure and the anisotropic mechanical properties of natural tissues – such as those of a human aorta – to be mimicked.

This process is not only a demonstration of technical finesse, but also a testament to the possibility of imitating and complementing nature. In this visionary future, 3D-printed, patient-specific blood vessels grown in the laboratory will offer a safe and sustainable alternative to conventional transplants. They eliminate the need for donor organs and the ethical dilemmas associated with animal testing and open the door to a new era in medicine. An era in which advances in technology and environmental responsibility go hand in hand.

Research at the site

- Institute of Chemistry and Technology of Bio-based Systems, Graz University of Technology <https://www.tugraz.at/institute/ibiosys/home>