

Method To Direct Vascularization Of Tissue Grafts

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ABSTRACT

Researchers at the University of California, Davis have developed a method and composition that direct the growth of long, coronally oriented blood vessels in tissue grafts to improve vascularization and clinical transplant outcomes.

FULL DESCRIPTION

This technology provides compositions and methods for implanting tissue grafts composed of a matrix attached to a porous barrier designed to regulate and direct blood vessel growth. The porous barrier permits nutrient and fluid passage but selectively blocks angiogenesis through its surface, causing blood vessels to grow from the edges inward in a controlled coronal orientation. By incubating these grafts in the host tissue, typically muscle such as the rectus abdominis, long and organized blood vessels develop throughout the graft, overcoming limitations of previous grafts that suffered ischemia and poor perfusion due to limited vessel ingrowth. The vascularized graft can then be transplanted to target tissues such as the urinary bladder, enhancing graft survival, muscle regeneration, and functional integration. The porous barrier is typically a polyester or polycarbonate membrane with pore sizes tuned (~0.4 microns) to allow fluid imbibition but block cellular migration, supported by a silicone or biocompatible mesh frame for stability.

APPLICATIONS

- ▶ Bioengineered bladder tissue grafts for augmentation cystoplasty in patients with bladder dysfunction or injury.
- ▶ Vascularized tissue grafts for regenerative medicine in organs such as kidney, liver, heart, lung, pancreas, and gastrointestinal tract.
- ▶ Large-scale tissue engineering constructs requiring reliable and rapid vascularization.
- ▶ Autologous and allogenic graft preparation for reconstructive surgery.
- ▶ Implantable scaffolds in urology, plastic surgery, and organ transplantation.
- ▶ Advanced wound healing and skin graft vascularization enhancements.
- ▶ Pre-vascularized grafts for clinical applications requiring staged transplantation approaches.

FEATURES/BENEFITS

- ▶ Promotes growth of long, coronally oriented blood vessels that recapitulate native tissue vascular patterns.
- ▶ Enhances central graft perfusion and prevents ischemia and contraction in large grafts.
- ▶ Allows passive nutrient and fluid exchange while blocking unwanted vessel ingrowth through membrane pores.

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INVENTORS

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OTHER INFORMATION

KEYWORDS

autologous,
 bioengineered tissue,
 decellularized matrix,
 graft vascularization,
 porous barrier, tissue
 regeneration, tissue
 scaffold, urinary bladder
 matrix, vascularized
 graft, vascular patterning

CATEGORIZED AS

- ▶ **Biotechnology**
- ▶ Health
- ▶ **Materials & Chemicals**
- ▶ Biological
- ▶ **Medical**
- ▶ Delivery Systems

- ▶ Enables staged implantation: pre-vascularization on host muscle followed by transplantation to target organs.
- ▶ Compatible with natural decellularized matrices (e.g., urinary bladder matrix) and synthetic matrices.
- ▶ Improves graft size maintenance and muscle regeneration after transplantation.
- ▶ Customizable barrier pore size and frame supporting structures to tailor vascular growth patterns.
- ▶ Demonstrated efficacy in large animal models including pig, relevant to human clinical applications.
- ▶ Overcomes limited vessel ingrowth and delayed angiogenesis in large tissue grafts that cause ischemia and graft failure.
- ▶ Addresses the inability of endothelial cell seeding alone to generate organized, functional vascular networks.
- ▶ Prevents central graft necrosis by directing vessel growth around barriers ensuring faster and more uniform graft perfusion.
- ▶ Reduces graft contraction and tissue degradation seen in prior bioengineered grafts, especially for bladder augmentation.
- ▶ Solves the challenge of graft vascularization in tissues without distinct artery/vein for direct anastomosis.

- ▶ [Devices](#)
- ▶ [Disease: Kidneys and Genito-Urinary System](#)
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PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	2025-038753	12/25/2025	2021-622

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