



## Experimental model of bioengineered small caliber vessels through decellularization of human arteries and veins

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### OBJECTIVE OF THE STUDY:

Realization of a bioengineered vascular substitutes able to prevent clinical failures in microvascular procedures.



### Part 1: *in vitro* experimentation

Creation of scaffolds through the decellularization of **small human vessels** and the preservation of the extracellular matrix composition and structure.

### MATERIALS AND METHODS:

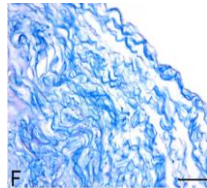
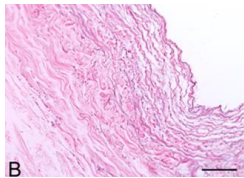


### Part 2: *in vivo* experimentation

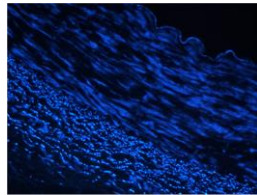
Implantation of the decellularized human arteries and veins in the femoral vessels of rabbits



# RESULTS

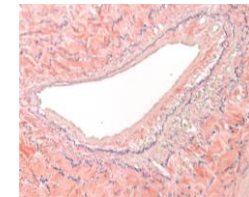
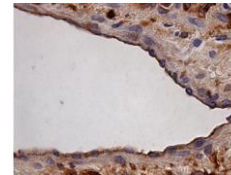


## In vitro experimentation

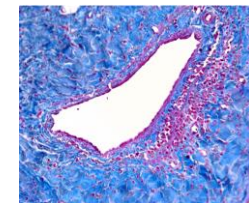
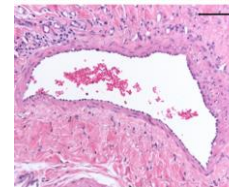


- Absence of thrombotic events and wide lumen.
- Presence of endothelial cells colonizing the lumen of the veins.
- Recellularization of the vein wall .
- Recellularization of the extreme outer part of artery wall.
- Minimal presence of inflammatory cells.

- Disappearance of the nucleus and cytoplasm of endothelial cells .
- Preservation of the structure of vascular walls (H&E).
- Persistence of collagen and elastic fibers (Azan-Mallory and Van Gieson).
- Absence of smooth muscle cells (immuno-histochemistry Ab-anti- $\alpha$ -actin).
- Complete removal of nuclear components (DAPI-4',6-diamidino-2-phenylindole).



## In vivo experimentation





## CONCLUSIONS:

- **For the first time**, histological and ultrastructural methods, together with DNA extraction and quantification techniques, **have demonstrated the possibility of both human artery and vein decellularization, as efficiently as in animal samples.**
- We have conceived an **efficient decellularization process** ideal for us in emergency microsurgery.
- Vascular substitutes were **totally pervious** two weeks after the implant in the rabbit.
- In the vascular wall and intimal layer a **recellularization process** and **very few inflammation cells** were present .
- The creation of bioengineered scaffolds without using endothelial stem cells allows **great reduction in costs of production.** This innovation could lead to the **creation of tissue banks** that provide vascular substitutes ideal in diameter and length.