Microfluidic pump systems: a way to replace animal models to study aortic endothelial cells response and viability to high shear stress

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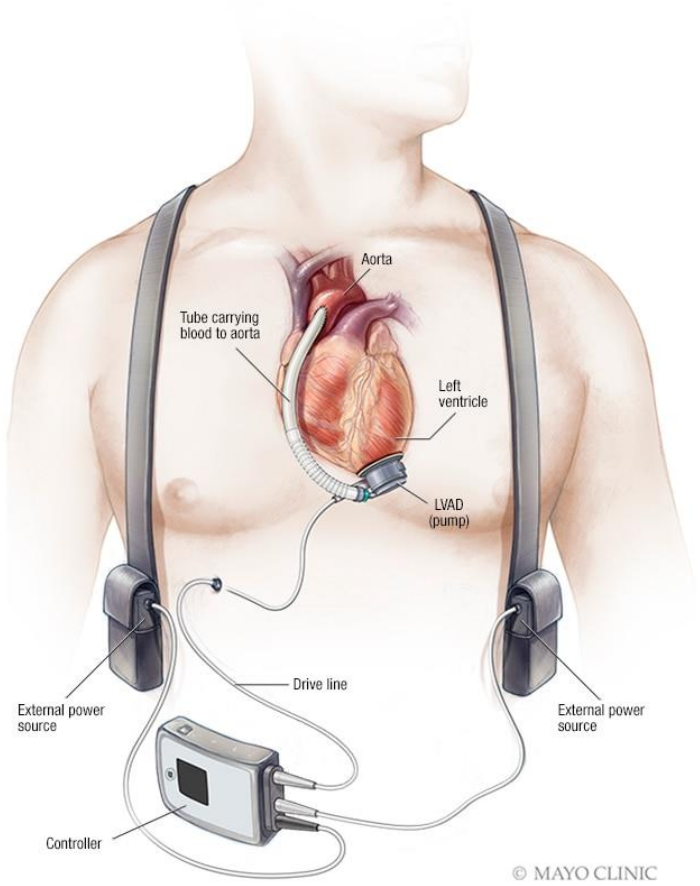
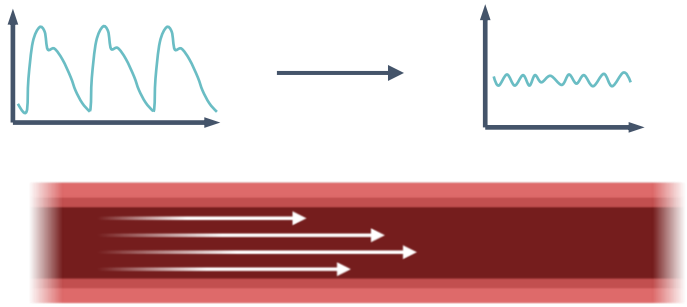
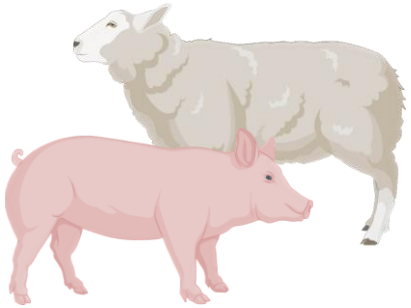
Introduction



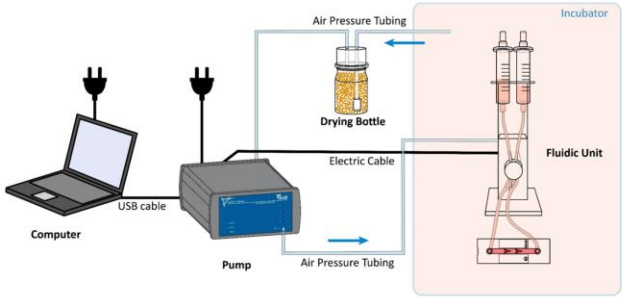
Patient with severe heart failure and left ventricular assist device implantation



Increase shear rate +
continuous flow
Effect on vascular function ?



High skilled surgery
Anesthesia
24 hours max

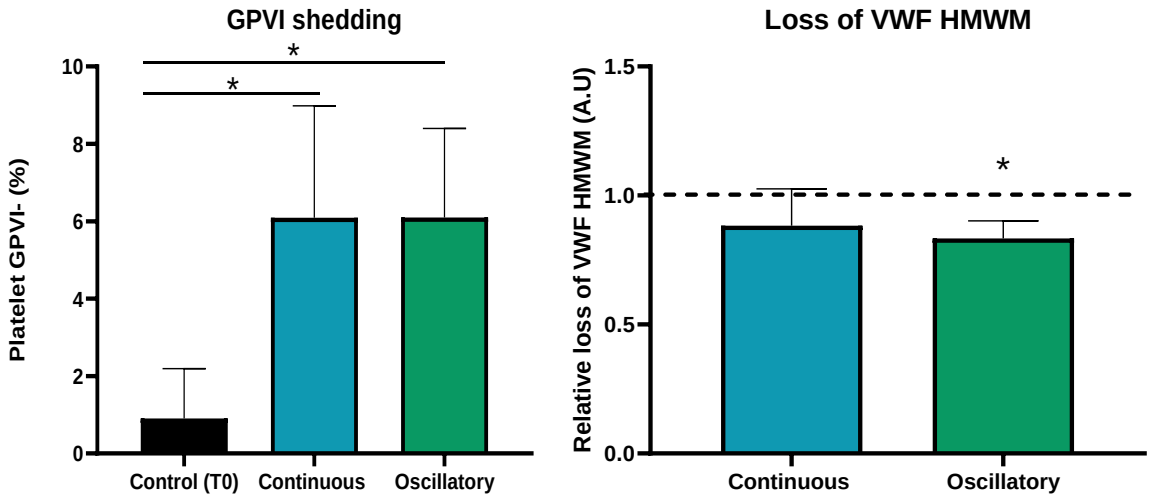


Easy to use
Human cells
Long term experiment

Results

Validation of the pump system

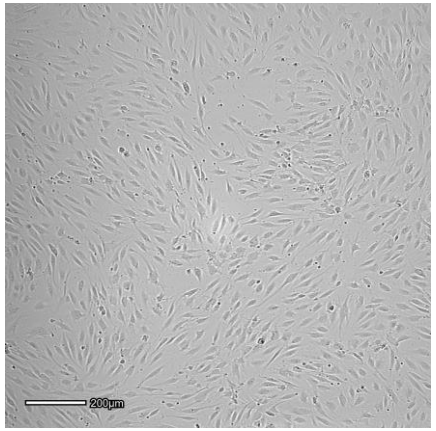
High shear rate condition (10 000s^{-1})
Platelet rich plasma

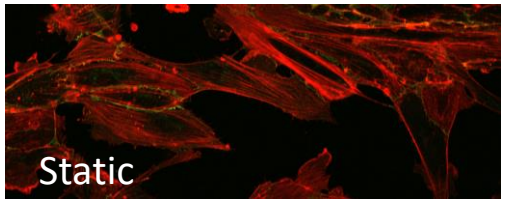


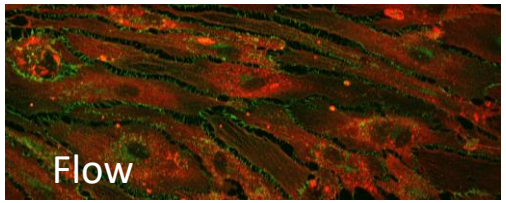
Loss of GPVI receptor and high molecular weight multimers of von Willebrand factor

Cell culture under high shear forces

Human aortic endothelial cells
5000 or 10 000s^{-1}

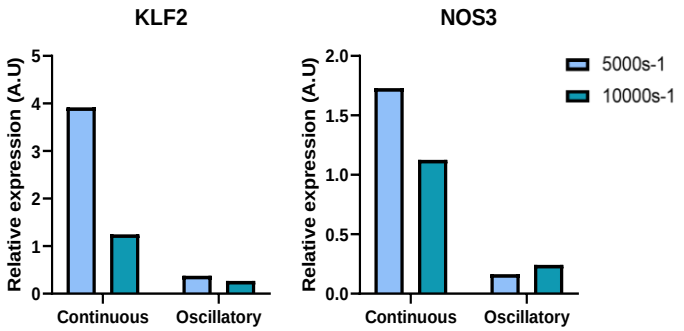






Actin
Ve-cadherin

Relative genes expression



Cells' alignment and tight junction +++
Diminution of KLF2 and NOS3 expression with oscillatory flow

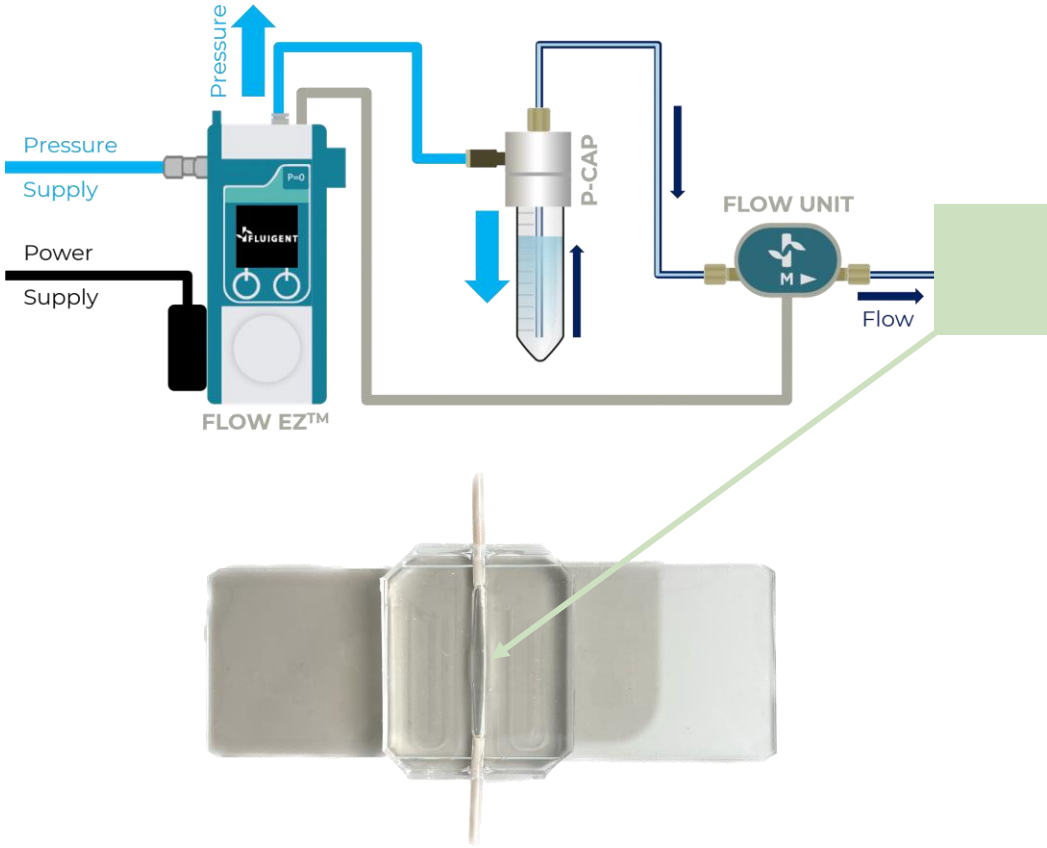
Conclusion & Perspectives

- Validation of an *in vitro* pump system to study endothelial cells response to high shear force

- Improvement of the cell culture for 10000s^{-1} condition

- Perfusion of plasma with cells to study their interaction with blood elements

More physiologic : a 3D vessel model



In collaboration with Marie Guilbert and Anthony Treizebre (IEMN, UMR 8520)