

# *3D Bioprinting of Vessels*

*A new means to Improve patient Outcomes*

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# 3D Bioprinting of Vessels, a new means to Improve patient Outcomes

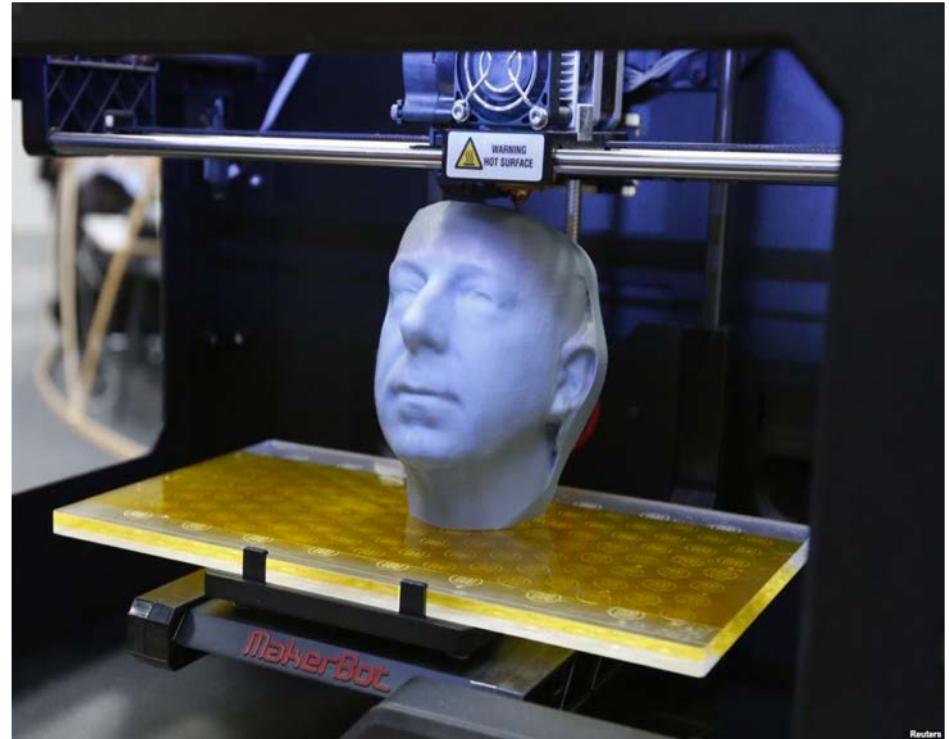
- Disclosures
  - Organovo



# Three-Dimensional (3D) Printing

- Also known as *additive manufacturing*, refers to any of several processes involving sequential deposition of material to form a 3D object

[https://en.wikipedia.org/wiki/3D\\_printing](https://en.wikipedia.org/wiki/3D_printing)

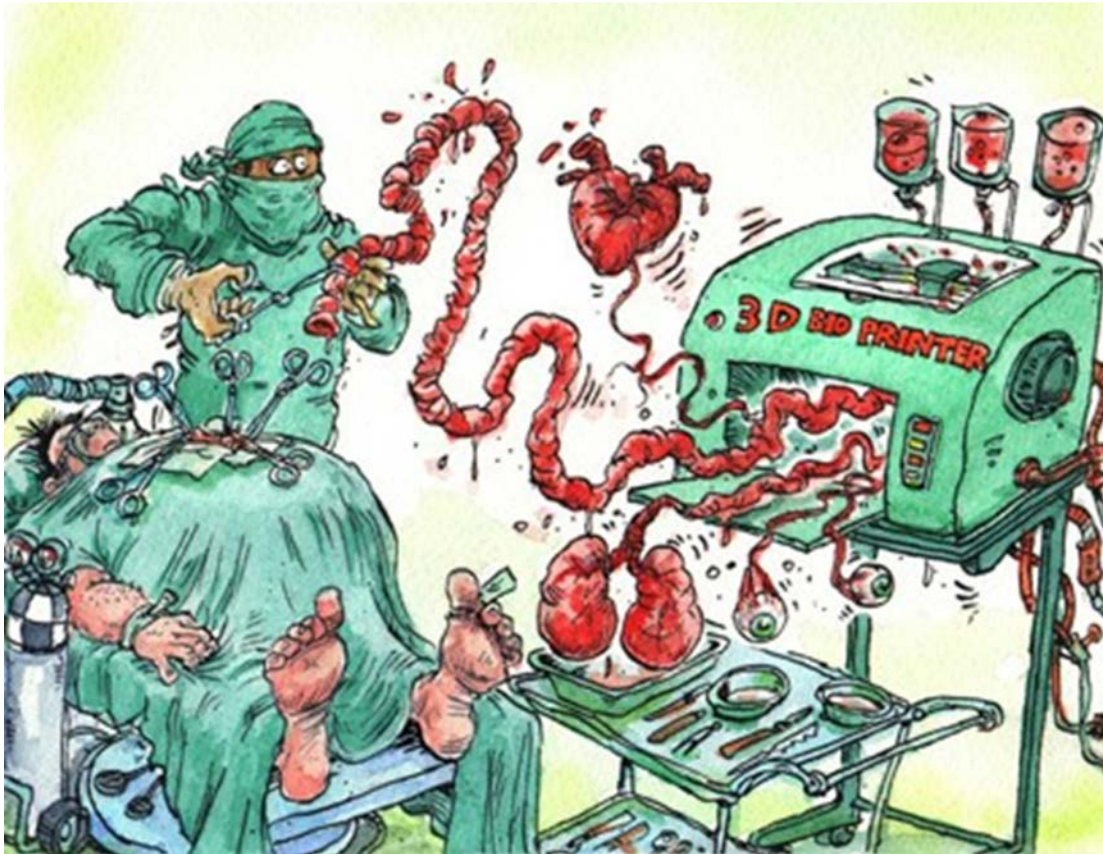


<https://chemical-materials.elsevier.com/the-world-of-3d-printing-in-2015/>



# 3D Bioprinting of Vessels, a new means to Improve patient Outcomes

- Are we ready for 3D printing in the 21st Century ?



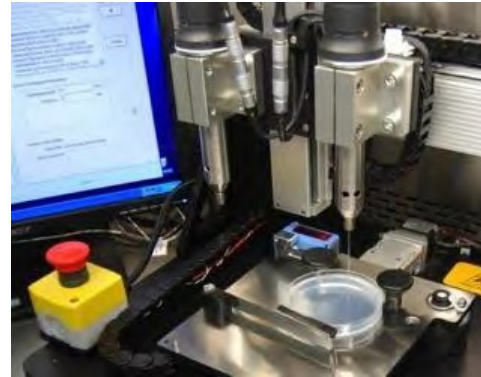
- Yes



# Bioprinting

- How Does it Work ?

- Use Printer with 2 Print Cylinders
  - Cells
  - Hydrogel



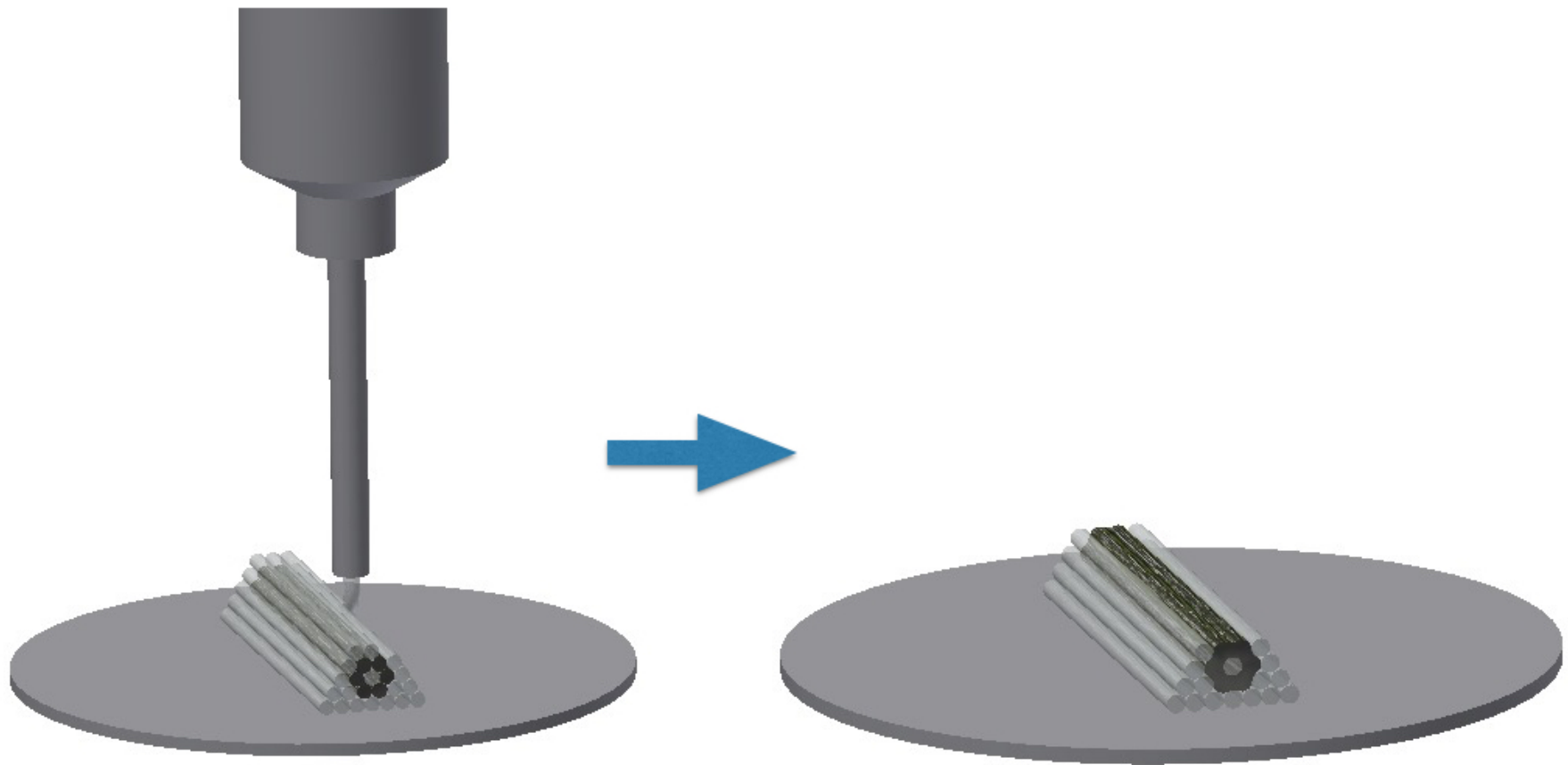
- Create 3D Model of Vessel



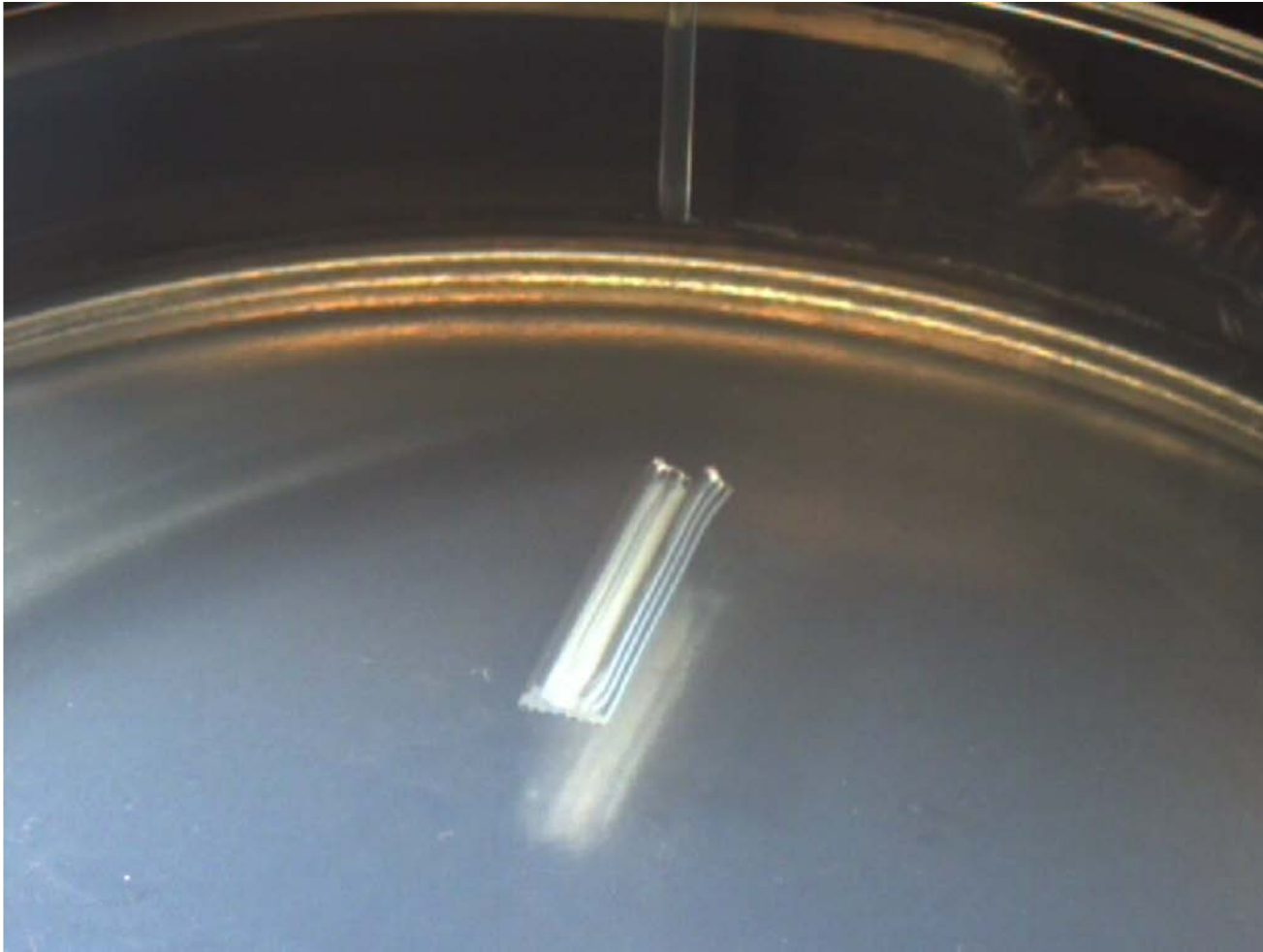
- Prepare Vessel for Implantation



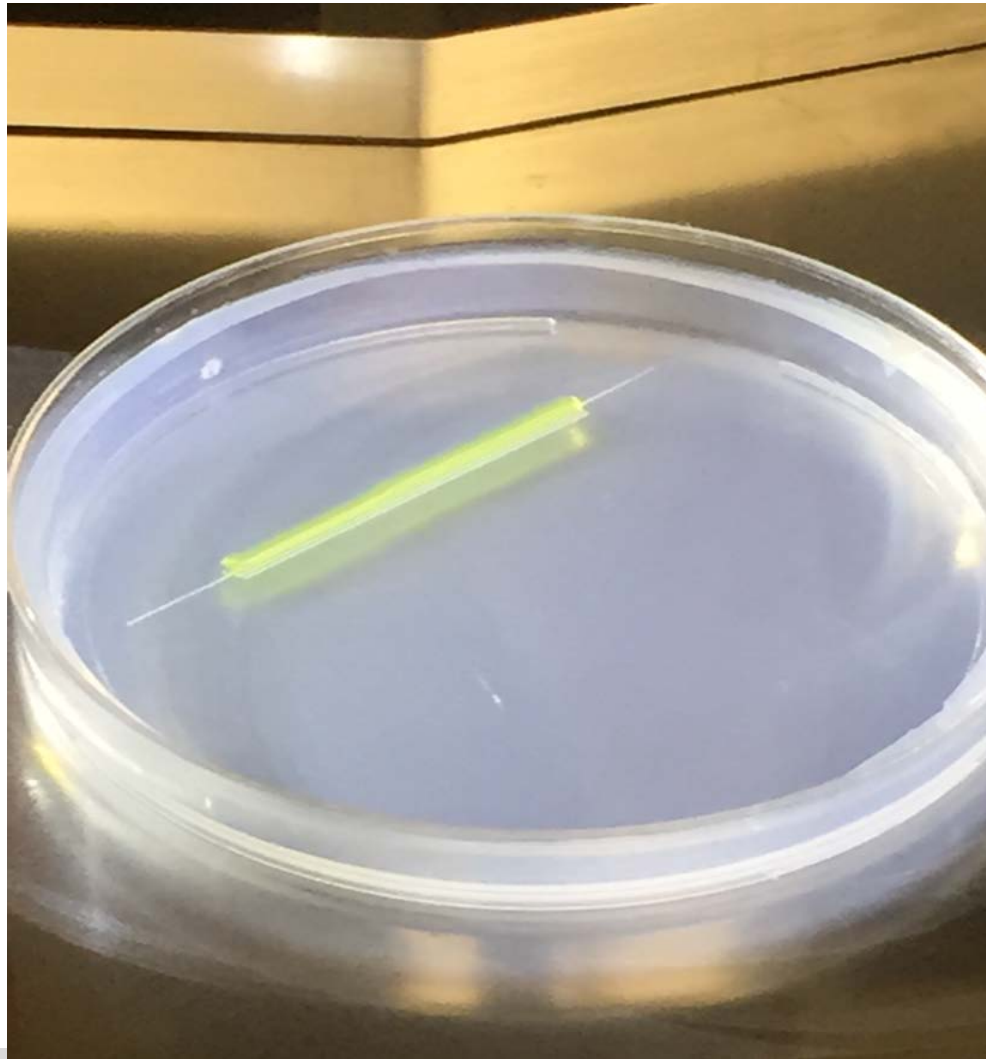
# Schematic of the Process



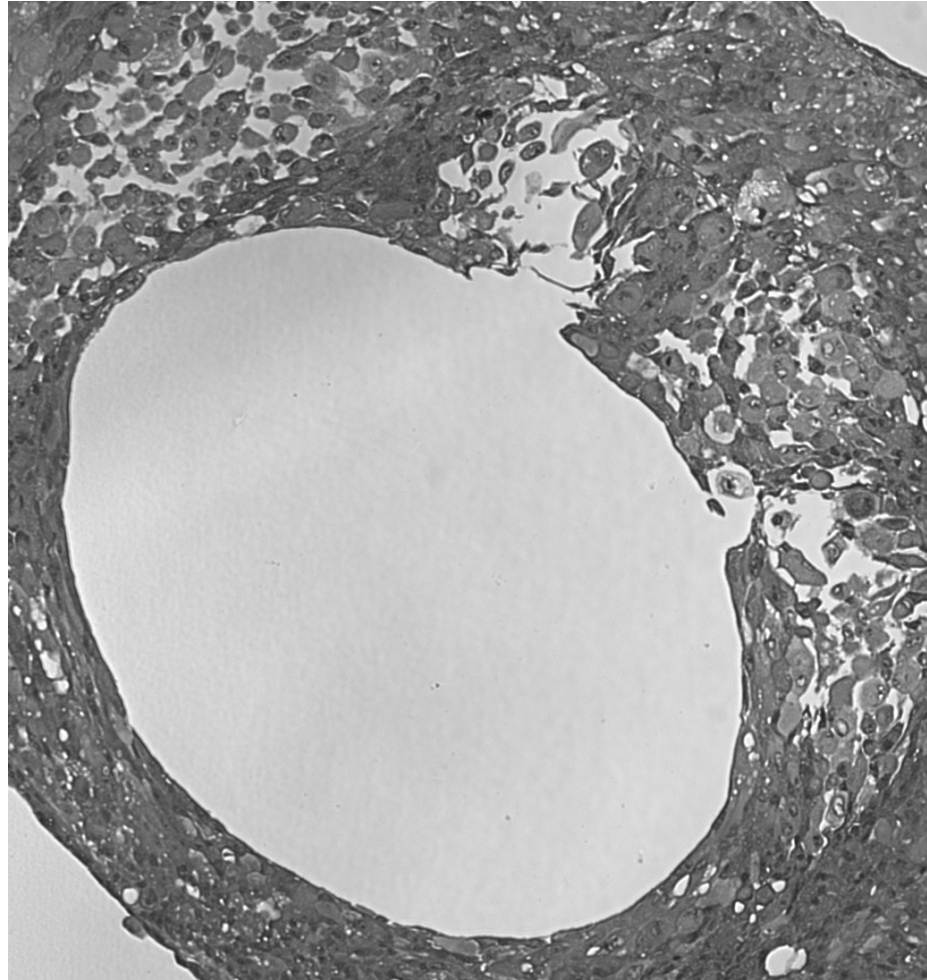
# Creation of Rat Arterial Vessel: Elapsed time to Finished Print 3 Hours







# Cross-Section of Print 36+ hours from Print



# Perfusion of New Print Technology



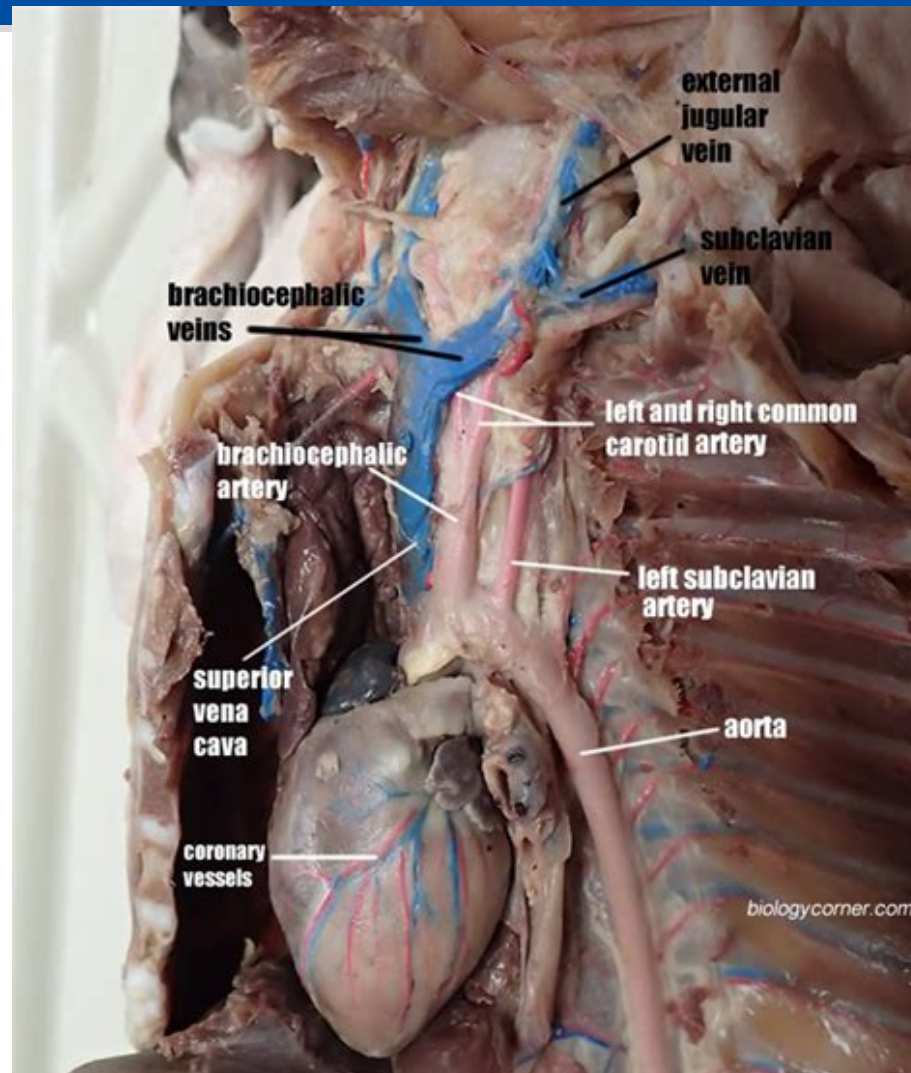
# Question of Tensile Strength

- Are the new prints able to withstand the pressures of aortic perfusion?



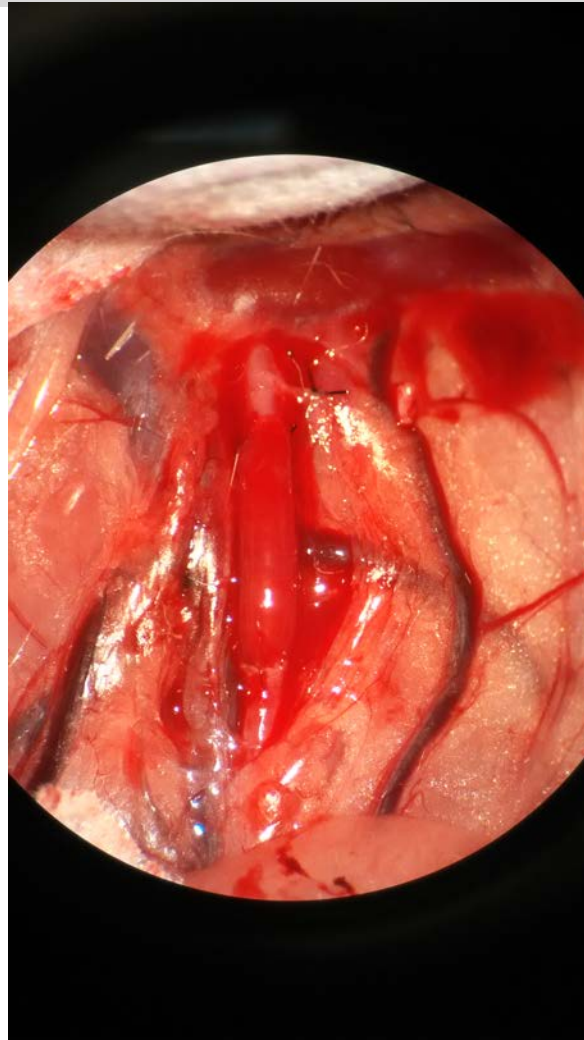


# Rat Aorta





# Implanted full length graft



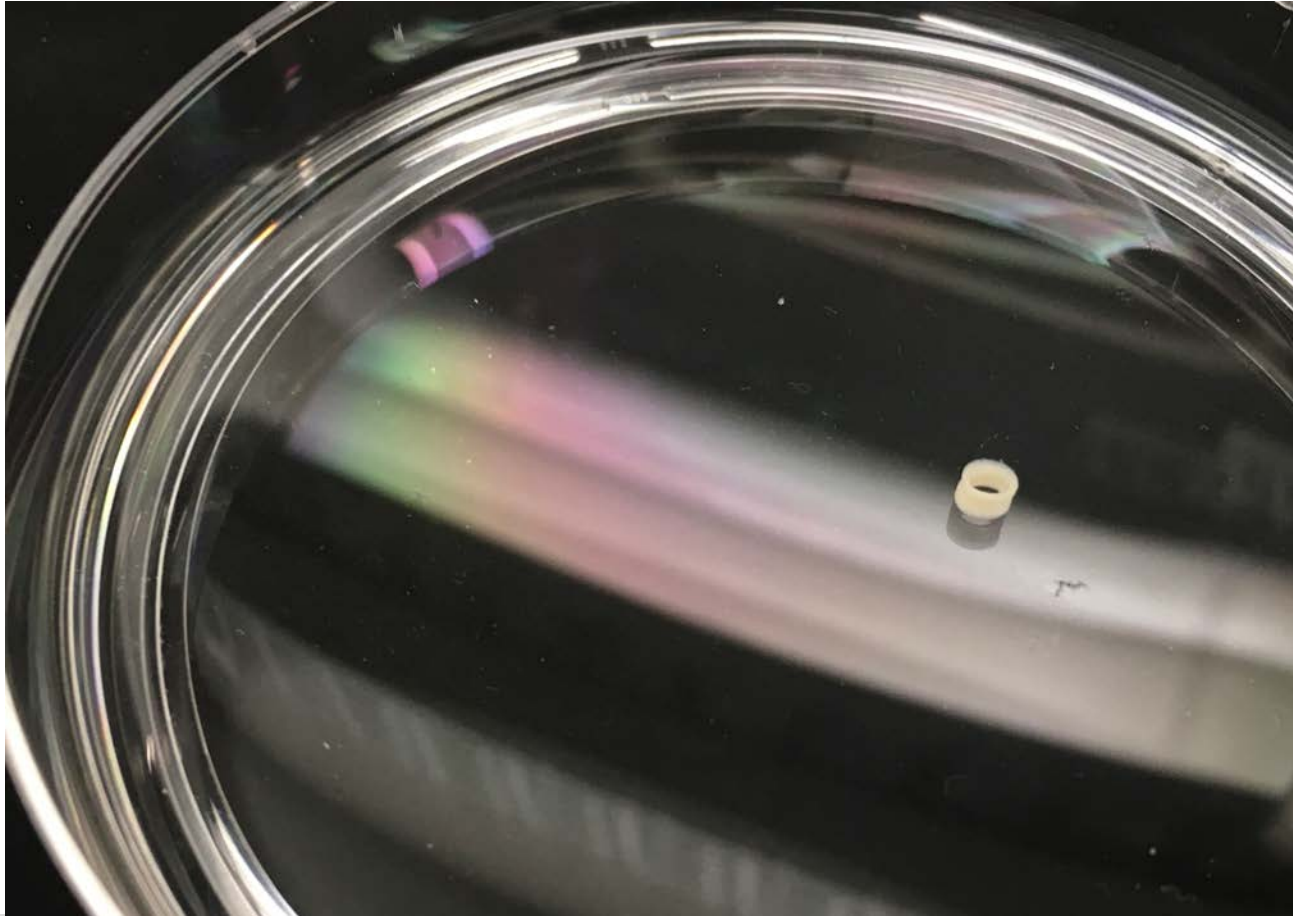
# Intestinal Repair with 3D Prints



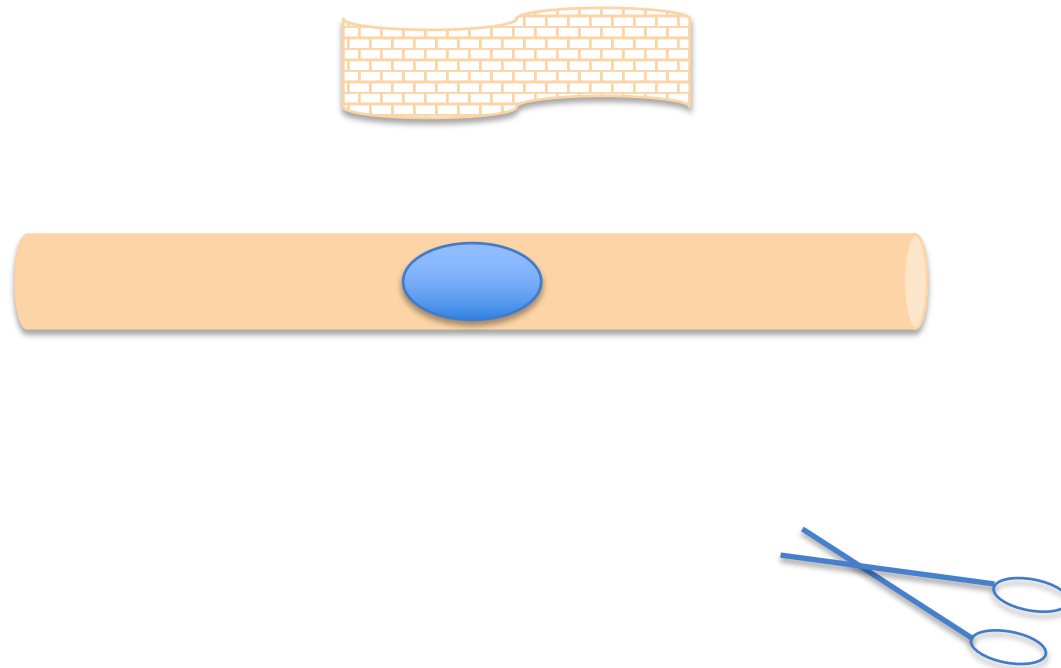


# Larger ID multilayer robust print

- Print at 24 hours post print

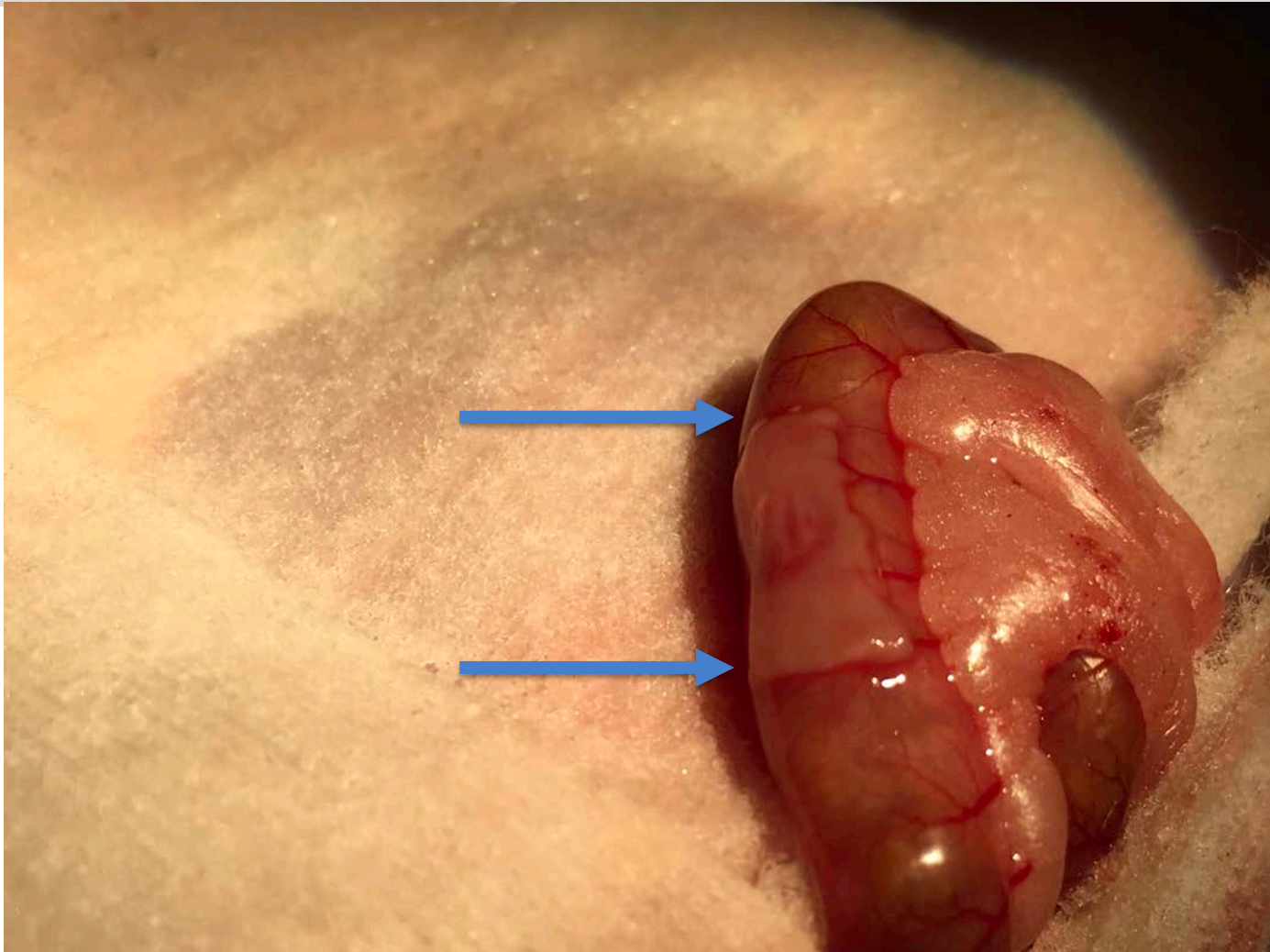


# Process For Intestinal Patch



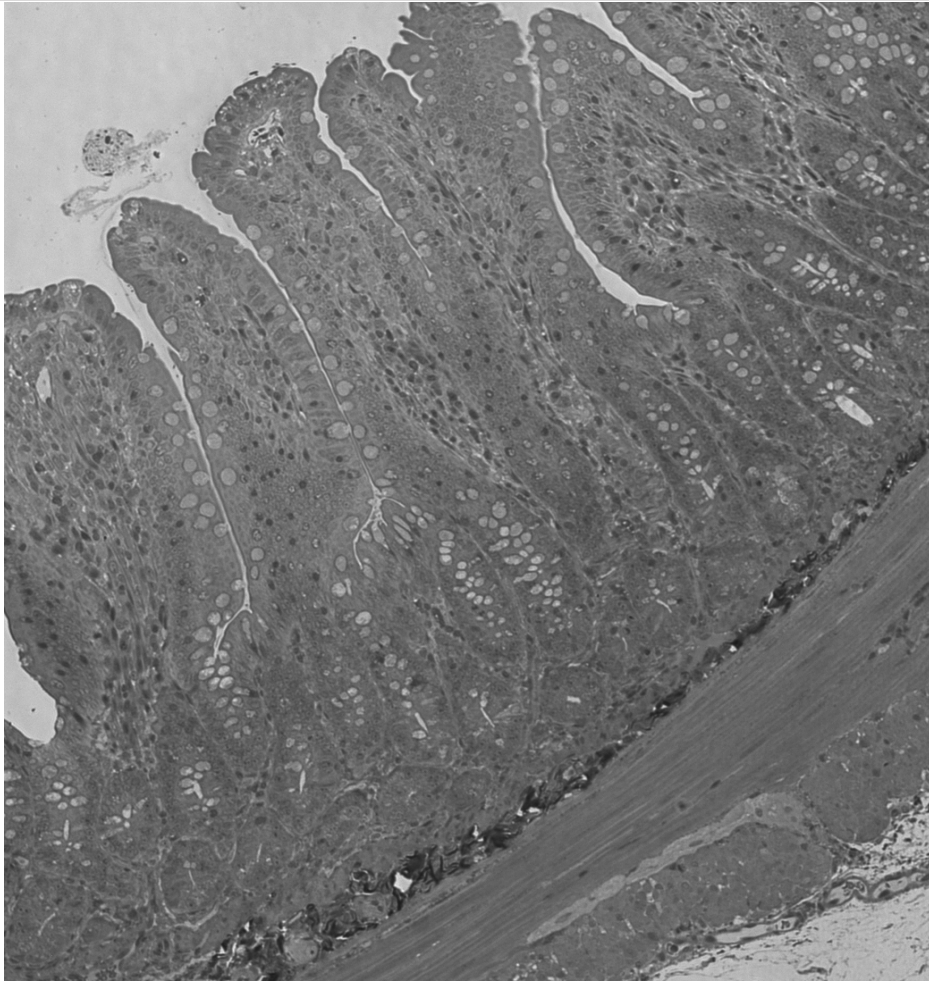


# In Vivo 21 days Post Op

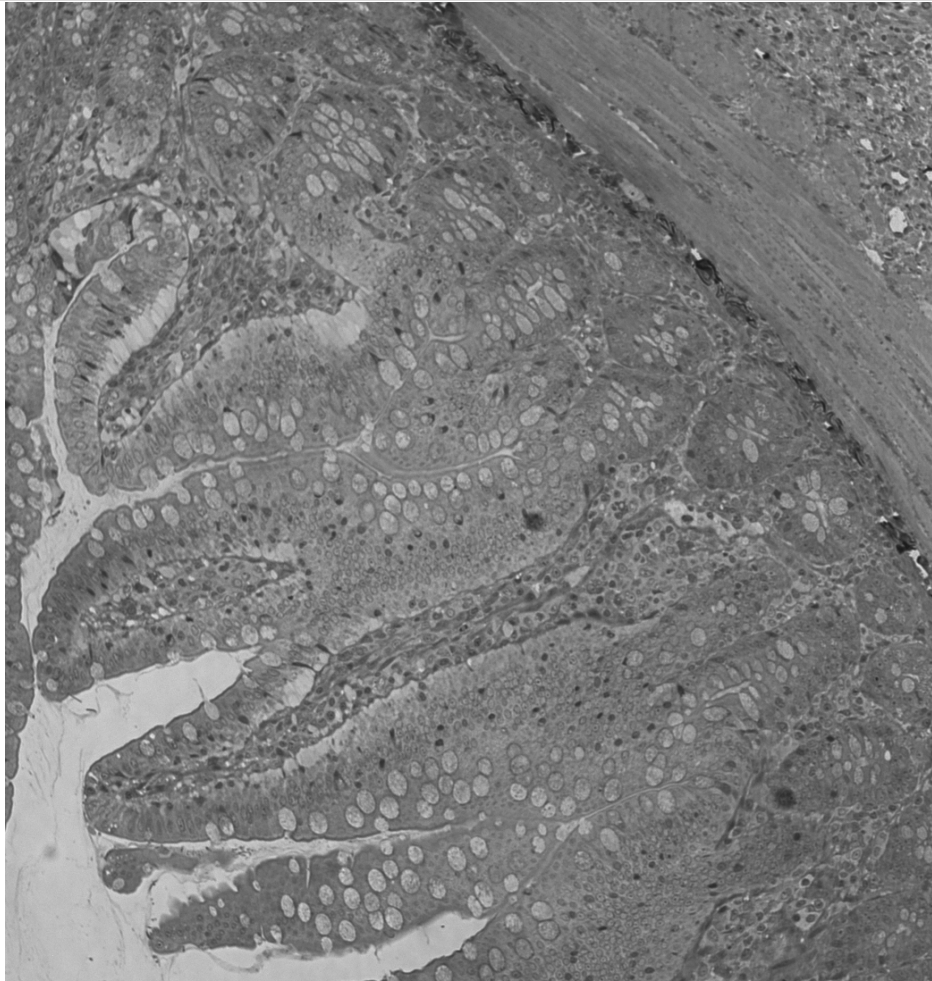




# 30 Days Post Implantation of Patch



Implant Cross Section



Sham Operated Cross Section

# Yale Instrumentation Initiative Help

- ***Critical Needs for your Instrumentation Work***
  - Supplies to expand cell culture levels to move on to higher organisms
  - Acquisition of More incubators and TC hood to allow for more prints
- ***How could the Yale Instrumentation Initiative help your work***
  - Provide infrastructure to make facility available to more labs
  - Expand the printing facility to make it accessible to other labs/groups
- ***What can you offer to the Yale Instrumentation Community***
  - Consult on what is needed for successful 3D Bioprinting
  - Potentially print organoids for drug development using human cell models
  - Work on designing Cartridges for 3D Organ replacement
    - Pancreas
    - Liver
    - Kidney



# Acknowledgements

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# Thank you!

- Questions?

