3D Bioprinting

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OVERVIEW OF PRESENTATION

- Introduction
- Best qualities of this technique
- Steps in Bioprinting
- Bioprinter
- Methods of Bioprinter
- Bioinks
- Bioprinted tissue
- Advantage and Disadvantage
- Conclusion

INTRODUCTION

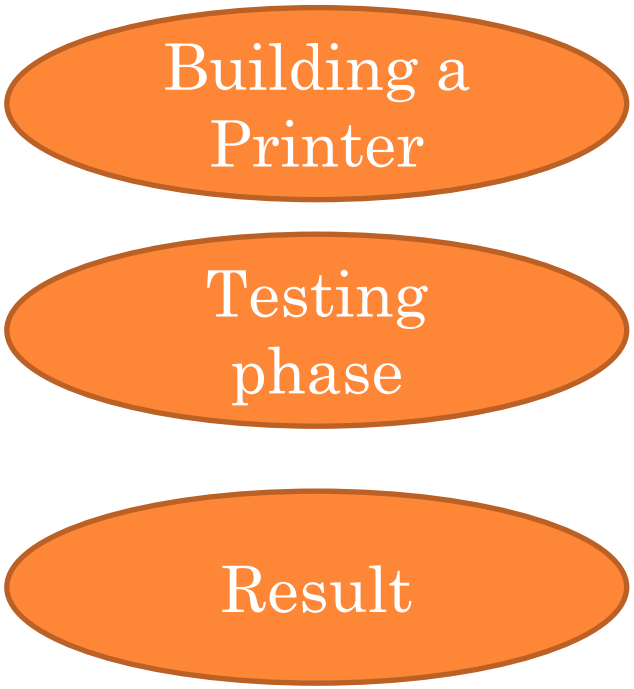
- 3D BIO-PRINTING is the three-dimensional printing of biological tissue and organs through the layering of living cells.

- BIO PRINTING is an automated computer aided layer-by-layer deposition of biological materials for manufacturing of functional human organs.

Best qualities of this technique .

- Rapid phototyping
- High precision
- High resulution
- Computer control

Steps in Bioprinting



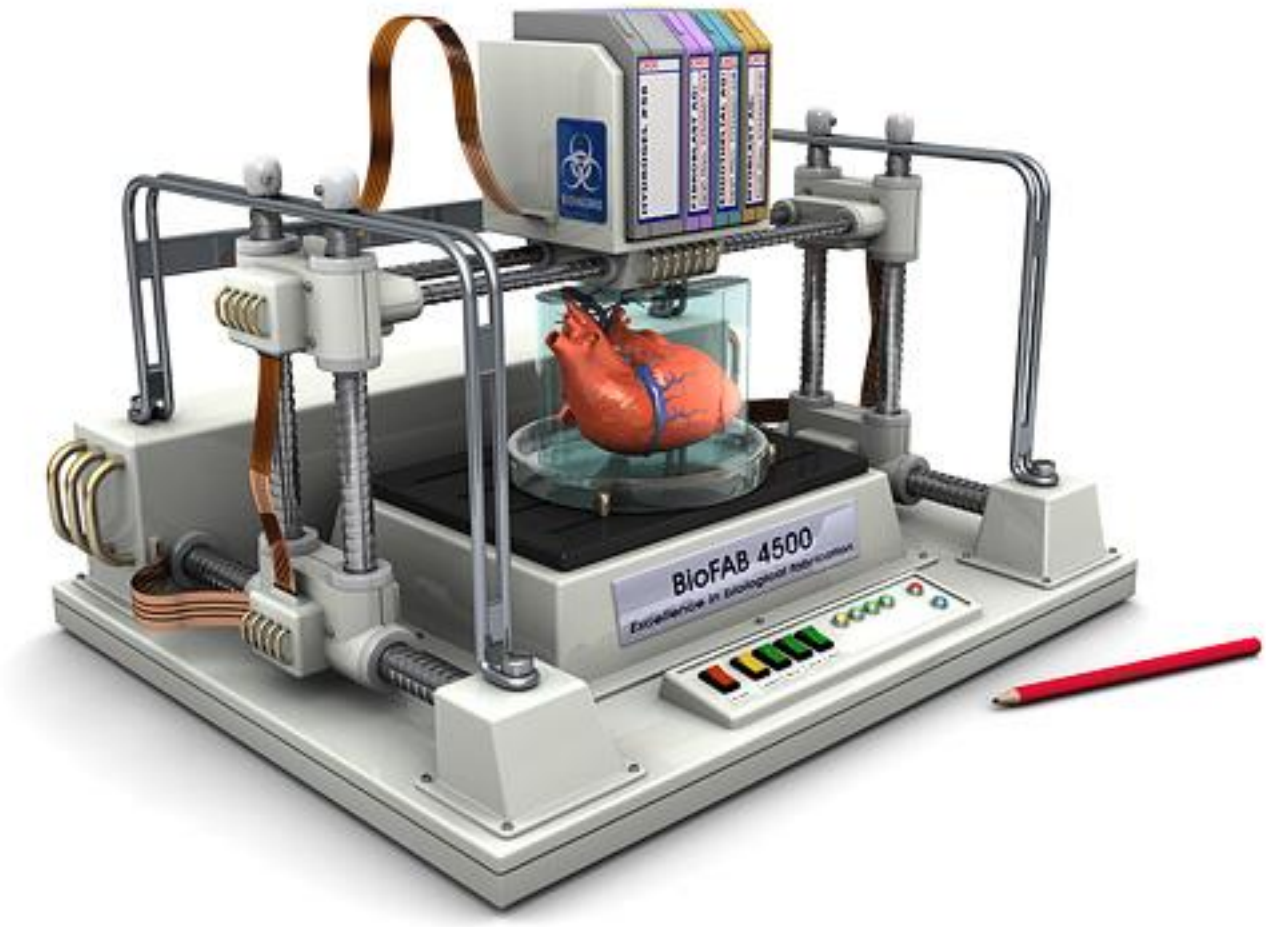
Building a Bioprinter

- Bio printing aims to build an organ, layer by layer, using scanners and printers .
- The most important axes, X and Y, were built with 1 sheet of Poly(methyl methacrylate) (PMMA), also known as acrylic glass, with one stepper motor and rails to guide the printing head.
- For the Z axis, a different motor is needed since it had to support the weight of the print head.

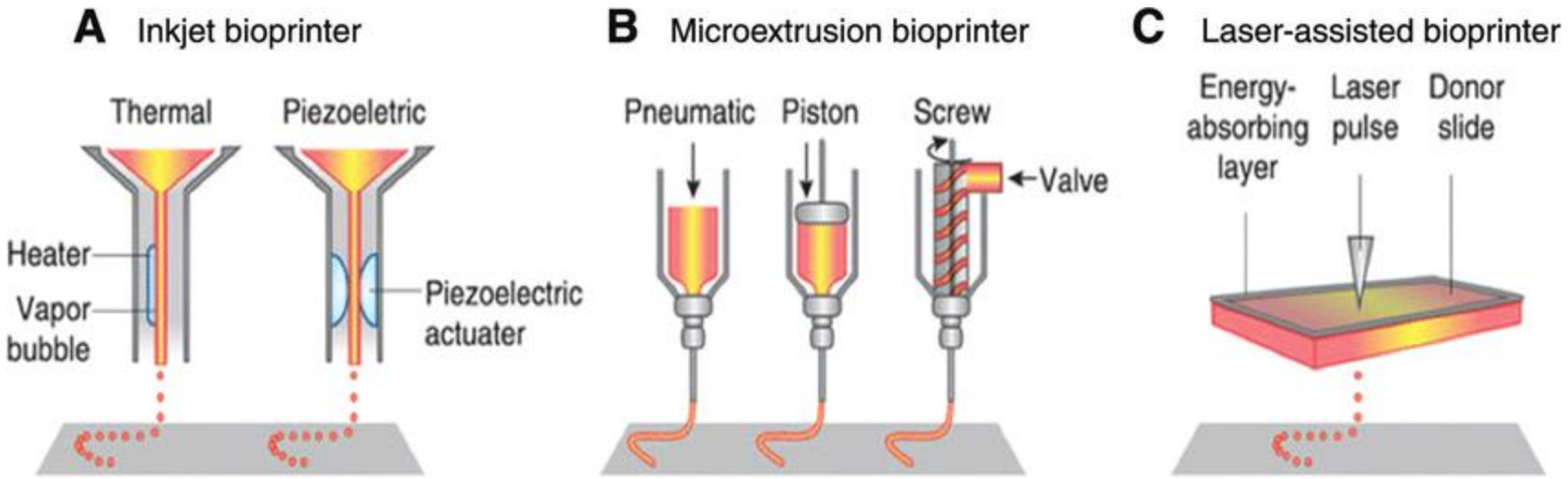
TESTING PHASE

- After the building process ,testing phase is processed. It is mainly to test the three axes and all the functioning of bio printer.
- Before the biological print process to get started the bio printer was set to print with the cartridge intact, with the factory ink it came with.
- This allowed to observe step loss or nozzle firing malfunction events in order to redefine the timing parameters and other algorithm parameters to ensure the system correct functioning.

Bioprinter

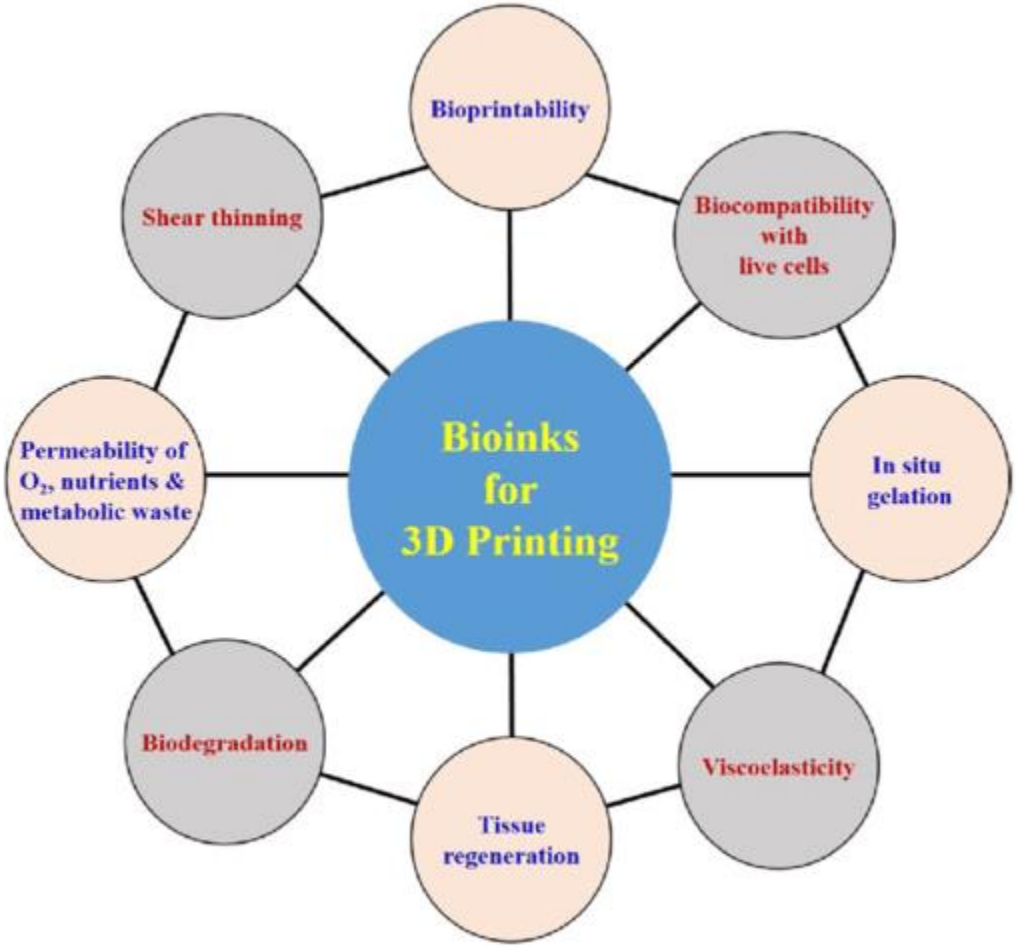


METHODS OF BIOPRINTING.



Bioinks

- Naturally derived hydrogels
- Synthetic derived hydrogels


Bioprintability
Shear thinning
Biocompatibility with live cells
Permeability of O_2, nutrients & metabolic waste
Bioinks for 3D Printing
In situ gelation
Biodegradation
Tissue regeneration
Viscoelasticity

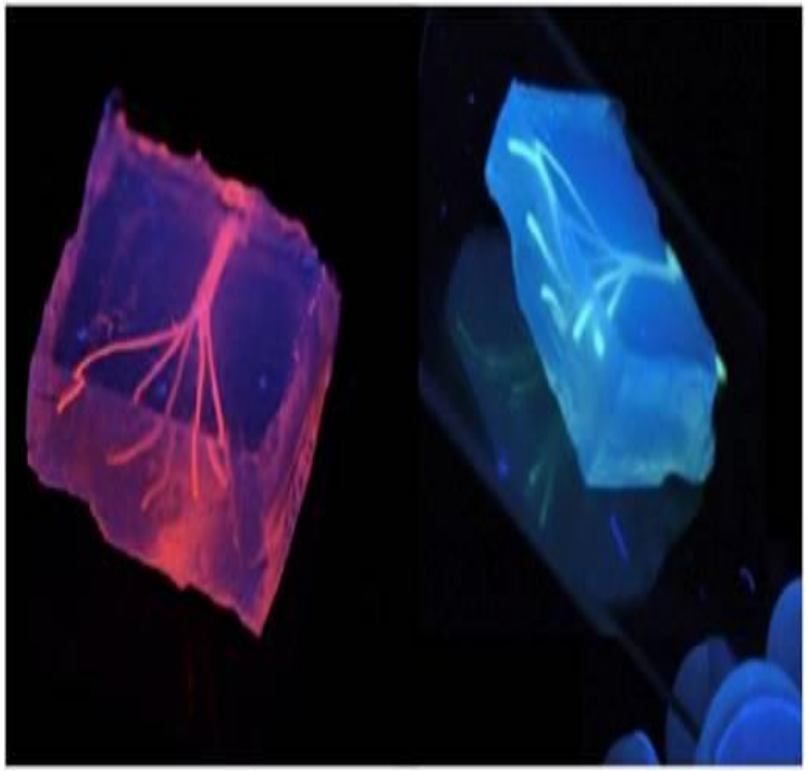
Ideal bioprinting hydrogel properties	
Printability	Viscosity Shear-thinning property Response and transition time Sol-gel transition stimulus
Biocompatibility	Degradability Cell binding motifs Non-toxic Non-immunogenic
Mechanical properties	Stiffness Elasticity Strength
Shape and structure	Pore size Micro/Nano structure

Bioprinted tissue

- Neurals
- Skin
- Cartilage
- Bone
- Cardiovascular
- Muscle

Advantage

- Replace human tissue by full body transplant.
- Allows scientists to eliminate the wait list of organ transplants ·
- Higher survival rate of printed cells.
- Offers high precise resolution



DISSADVANTAGE

- Organ is not sure about whether they can fit into a human body .
- 3D printers can create dangerous items, such as guns and knives.
- Printing capabilities of complicated tissues

Conclusion

- With the continuous growth of the world's population , and increase of human life expectancy, more cases of organ failure and tissue damage appear .
- Most common bio printing methods were described and discussed with their characteristics and limitations.
- In terms of future perspectives for this work, more bio print testing would be needed to be done to optimize the bio ink, substrate and the process parameters.