Biofabrication: 3D Printing for Tissue Engineering
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Abstract
Biofabrication is the use of additive manufacturing (3D printing) for biological applications. The ultimate goal of biofabrication is to print viable organs for transplantation using patients' own cells. In order for successful transplantation, printed organs must be made of living cells and incorporate functional vasculature. Therefore, the main goal of this design is to print a 3D structure of living tissue with an integrated vascular network capable of perfusion using a reproducible process. This is accomplished by building a tissue incubation chamber to maintain sample integrity during the printing process, developing an extrusion-based printing method that utilizes multiple bioinks to produce the bulk tissue and vascular tubes, and applying a unique method of alternating current (AC) electrospinning to create an integrated capillary-like network.

Key Features
- Incubation Enclosure with Environmental Controls
- Stepper-Driven, Rack-and-Pinion Bioink Syringe Extrusion System
- Tri-Tip Luer-Compatible Nozzle with Electrospinning Swing-arm

Workflow Diagram

Schematic of Printed Tissue with Integrated Vasculature
1. Printed rPASMCs in hydrogel & electrospun PLA/VEGF mesh.
2. Printed HUVECs in hydrogel & electrospun PLA/VEGF mesh.
3. Printed gelatin.
4. Subsequent layer of printed rPASMCs in hydrogel.
5. Subsequent layer of printed HUVECs in hydrogel.