Fall 12-6-2017

Building and Modifying an Open-Source 3D Printer to Extrude Viable 3D Cell Cultures

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INTRODUCTION

- 3D printing, also known as additive manufacturing, traditionally has been the process of adding heated plastic layer by layer to create 3D objects
- RepRap (Replicating Rapid Prototyper) is a project that began to enable 3D printers to self-replicate using minimal extra materials
- Recently, 3D printing has developed to include printing viable biological materials
- Applications of 3D bioprinting include:
  - Tissue engineering and reconstruction
  - Drug testing
  - Prosthetics

OBJECTIVES

Completed Fall 2017:
- Researching directions and methods of 3D bioprinting
- Researching methods of building a RepRap 3D printer
- Based on this research, the RepRap Mendel90 model was chosen
- An OURCA Grant Proposal to fund building a 3D printer in Spring of 2018 was submitted

Objectives for Spring 2018:
- Gathering materials and build printer
- Use Chapman’s existing 3D printer to print parts
- Modify the printer to mount a syringe-extruder head

METHODS

- Research for the printer was conducted via communication with the RepRap community
- Possible directions in bioprinting were researched using scientific databases
- Parts for the extruder head were printed

FUTURE METHODS

- Parts will be printed using Chapman’s AW3D AXIOM printer
- Vitamins, or parts that cannot be printed, will be bought at local stores and online
- Printer head will be modified by switching out the plastic-extruding head for a syringe extruder

FUTURE DIRECTIONS

Tissue engineering and reconstruction
- Top-down approach: printing cells into degradable porous scaffolds
- Bottom-up approach: printing cell-laden hydrogels layer-wise

Possible modifications
- Heat-based extruder head
- Inkjet printing head

REFERENCES