Designing a Universal Liquid 3-Dimensional Printer Utilizing a Novel Liquid Transport System

Yu, Jeffrey (School: Roslyn High School)

Liquid three-dimensional printing using non-traditional materials has a vast range of applications. However, current technology has failed to create a low-cost and efficient system. Researchers have demonstrated that liquid 3D printing is useful when working with living cells, soft materials, and even industrial-grade materials; however, research and applications are restricted by prohibitive costs and limited print material capacity deposition systems. The current project aimed to address both the problems of cost and print material capacity by creating a low-cost, universal liquid 3D printer apparatus. A novel method of material transport, using a peristaltic pump, was created. The apparatus is comprised of three main components: the extruder assembly, a peristaltic pump system, and an refillable open reservoir. The apparatus is platform-independent and utilizes many open source components, thus it is able to be used with a variety of existing 3D printer gantry systems. In a preliminary phase of testing, a common test print was fabricated on the print bed using water and data regarding the dimensional accuracy of the given print were collected. In a second and third phase testing, the applicability of the printer utilizing a hydrogel printing strategy and as bioprinter using an E. coli cell suspension were shown to be successful. This prototype has provided a proof of concept that liquid 3D printing can be accomplished with a peristaltic pump system with dimensional accuracy. This project can have profound impact on 3D printing and rapid prototyping technology, helping create printers capable of using non-traditional build materials cheaply and efficiently.