**Team:** P21677 – 3D Bioprinter **Engineer:** Emma Kurz

**What were the outcomes of the prior phase?**

1. What did I plan to do?

In the System Level Design phase, I planned to break down components of the printer that we hoped to design and/or improve, and brainstormed creative, reasonable, and testable designs. Specific aspects that we hoped to focus on included print head mounting, printing nozzle design, printing parameter control, syringe pump automation, biomaterial selection, and the introduction of cells into the system. I planned to focus on biomaterial selection, biocompatibility, and incorporation of cells in the system.

1. What did I actually do?

During this phase, I worked with my team to create a functional decomposition diagram to display the functions and subfunctions of the printer we plan to develop and optimize. I developed a transformational diagram to detail how energy will flow to transform out inputs into our outputs. I brainstormed how many functions could be satisfied by various concepts and worked with my team to compile those concepts into a morph chart. Through several iterations, that morph chart was narrowed down to reasonable solutions. We then created a list of potential system-level concepts. Each of these concepts was evaluated, against criteria created by our team, using Pugh Matrices. We then selected our optimal design and brainstormed feasibility testing that may be necessary to conduct to confirm that the selected design is possible. Aside from the assigned module work, our team met with Dr. Dan Reynolds, an engineer at Harvard who works with 3D bioprinters to learn more about how they are used in research. Finally, we met with Dr. Iris Rivero, a professor at RIT who also conducts research using 3D bioprinters, and gained some useful insight on what designs might work well for our project and application.

1. What did I learn? How were plan and reality different?

I learned a lot more about how much will go into our final design and I have gotten a lot more comfortable with the breakdown of our project. The process of this phase was much more iterative than I had expected, but it was a very effective process to allow us to develop a concept for further evaluation.

**Team level goal for next phase**

In the Preliminary Detailed Design phase, we will divide work and develop specific schedules for the bioprinting and mechanical/electrical/software teams. Each team will work on design and conduct feasibility tests for their appropriate subsystems in order to determine viability of the selected concept and discover necessary adjustments to the system. Specifically, some feasibility tests that will be conducted include cell and material combination, crosslinking implementation, compatibility of existing electrical equipment, print head design details, and extrusion pressure limits.

**What do I plan on doing to ensure that my team has a successful review at the end of the next phase?**

* Research/benchmarking about 3T3 Fibroblasts used in 3D Bioprinting (6 hours)
* Research/benchmarking about the use of UV crosslinking in conjunction with 3D printing (8 hours)
* Develop testing procedures to evaluate our feasibility considerations for:
  + Combining cell and materials appropriately (5 hours)
  + Implementation of crosslinking method (8 hours)
  + The impact of extrusion speed on cell viability (6 hours)
* Review team peer evaluations (0.5 hour)

**What is standing in my way of meeting my next phase goals?**

* Trying to figure out the extent to which in-person work will be possible for our team given lab restrictions / adjusting to in-person work from remote work