Abet Adedeulum
Team #32 Justin Liu

Project Needs:

- *Specialized cardiac tissue models*: Engineer cardiac tissue that captures the physiological differences between the different heart chambers (atrium and ventricle). These tissues should capture differences in tissue structure, mechanical properties, and cellular/genetic differences.
- *Accurate computational model*: Developed a computational model for each of the different chamber tissues and use to predict tissue/cellular response to outside stimulus.

Major Constraints:

- *Time*: It requires a great deal of time for cell culture, cell experimentation, and biological assays.
- *Biological variance/reproducibility*: Cell behavior, such as differentiation, may vary batch to batch. Even with the same protocols, there is still a biological variance that is limiting.
- *Cost*: Experiential regents are extremely costly; for example, a kit to extract RNA is around 800 dollars.

Major engineering standards:

- *ASTM F2150*: Standard characterization and Testing of Biomaterial Scaffolds Used in tissue-engineered products covering areas such as physical and chemical properties.
- *21 CFR Part 58* - Good Laboratory Practice (GLP) for Nonclinical Laboratory Studies
- *ASME V&V 40-2018* - Verifying credibility of Computational Modeling

Ethical, Environmental, or Societal concerns:

- With a validated computation model, simulations can be used to cut down on in-vitro experimentation, which reduces reagent consumption.
- The model can be used for clinical research to better understand cardiac disease mechanics.

Active Teamwork and Leadership

- Project delegated to 2 separate parts: In-Vitro team and computational team to tackle the 2 needs of the project.
- Weekly full team meeting with mentor to discuss progress, deadlines, feedback, and future direction of the project.

Significant Motivating Factors

- Interest in cardiac mechanics research and motivation to contribute to a project with significant impact.
- Opportunity to expand skill set for both wet and dry lab, such as learning new bioassays and new approaches for data analysis.

Most Innovative and/or Entrepreneurial Ideas:

- Developing a more specialized and “physiologically relevant” model by including the chamber specificity.
- Deriving cardiac ECM in vitro from cardiac fibroblast cultures rather than decellularizing native cardiac tissue.
- Engineering cardiac tissue with 3 components: Cardiac ECM, Cardiomyocytes, and cardiac fibroblasts. Much more complex than current cardiac tissue models.