

Sameera Chandrasekhar

Member of Group 34

### Bioengineering Day Poster Addendum (with ABET questions)

#### 1. **Desired Needs**

- Researchers need a micro-CT compatible device that can compress cartilage with displacement control
- People suffering from osteoarthritis who go through surgical joint replacement need thoroughly tested implants.
- Medical device companies need compact and effective devices to test the biomechanical properties of cartilage.

#### 2. **Constraints**

- Must fit within 50 mL conical tube (manufacturability)
- Must be made of micro-CT compatible and allow for fluid release of cartilage (which does not reach the micro-CT machine) (safety, risks)
- Must be able to compress cartilage sample through displacement control (quality control/marketability)

#### 3. **Engineering Standards**

- Major engineering standards that were relevant to our project (ASTM F3259-17) related to micro-CT imaging methodology or analysis measures which affected how we designed our compression device to improve its performance
- An engineering standard that can be developed from our project is a protocol for sample preparation, compression of an osteochondral core sample, and image analysis for measuring the change in thickness and GAG distribution of a cartilage sample

#### 4. **Ethical, Environmental, and Societal concerns**

- Ethical concerns for practical applications of our project include the risk of exposure to tissue samples which need to be handled while taking precautions and wearing PPE
- Environmental concerns include the environmental impact of using osteochondral cores from calf cartilage and ensuring that only the required number of samples are being used
- The societal concerns include lack of reproducibility for researchers without access to expensive resources such as a micro-CT machine

#### 5. **Active Teamwork and Leadership**

- Feedback from interviews on how to approach our problem statement (collaboration)
- Members each had a sub-aim: rabbit knee isolation, micro-CT compatible load bearing mechanism, micro-CT imaging methodology, and micro-CT image analysis (delegation)
- Followed pacing guidelines from BENG187 series and our mentor (goals and deadlines)
- The team received constructive feedback from our mentor on parts of the project including the written report, presentation, and study documents (constructive feedback)

#### 6. **Motivating factors**

- Studying last year's team's device to improve our own device (acquire new knowledge)
- Being able to do micro-CT imaging was a motivating factor to be self-initiating and finalize the compression device before imaging could begin (be self-initiating)
- Our interest in biomechanics, gathering polished data, and preparing our presentation motivated us to persist against challenges (persist against challenges)

#### 7. **Innovative and/or entrepreneurial ideas**

- Design changes we made for our core compression device in the plates
- Coding for image analysis to determine the thickness of cartilage in Python