

Designing a Low Cost, Single-Use Bioreactor to Grow Tissue

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Tissue engineering has opened the door to a new era in regenerative medicine. Engineered tissues can provide more effective methods of screening drugs and therapies in the lab, as well as provide safer alternatives to grafting damaged tissues in clinics. Bioreactors are an essential part of tissue engineering as they provide a controlled and reproducible environment to grow tissues, but are often expensive and labor-intensive to run. Given the potential applications of engineered tissues in research and medicine, it is essential that bioreactor technology is made more accessible. In this project, we designed the first prototype of a disposable, low-cost bioreactor compatible for the Advanced Regenerative Manufacturing Institute (ARMI) Tissue Foundry Fabrication Line. This design includes a unique, disposable bioreactor chamber that is mounted onto a mechanical stimulation system, which mimics in vivo biomechanics to produce phenotypically accurate tissues. The bioreactor chamber was designed to be inexpensive and includes two rigid end pieces on either end of a bag with a tissue construct held inside. The disposable bioreactor chamber is flexible so the mechanical stimulation system can apply strain to the tissue when stretching the entire bioreactor chamber. The mechanical stimulator is designed to non-invasively measure force and calculate the stress and stiffness of the growing tissue, but as it stands is not functional. With further development, this bioreactor would provide a low-cost option for researchers and hospitals, and is an important step toward increasing the accessibility of engineered tissues.

