AcoustaMed

AcoustaMed

Acoustically Driven Transfection Device

Table of Contents

Introduction

This document has been created by the AcoustaMed team to give a more detailed look at our project and the science behind Acoustically Driven Transfection

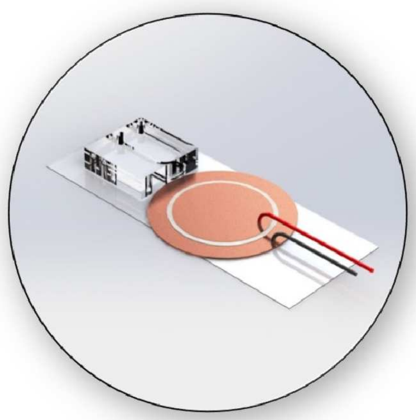
To goal of this document is to provide the following:

- Outline the process of transfection and the drawbacks of current methods
- Give an overview of how our device has improved the transfection process through the use of microfluidics and acoustics

---

Dr. Ding's Mechanical Engineering Lab:

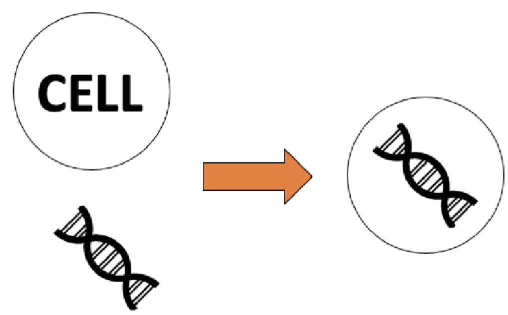
Dr Xiaoyun Ding's mechanical engineering lab at Univeristy of Colorado Boulder has developed the novel microchannel technology shown to the right. A fluid and cell mixture is pumped through the microchannel to provide a revolutionary new way to perform a long and tedious process called transfection. AcoustaMed has set out to provide a device that achieves the requirements for power, frequency, and flow rate that was given to us by the researchers. This device is built around the technology provided by Dr. Ding and his lab and provides an all encompassing easy to use device.



Transfection Overview

Transfection is the process of inserting genetic material such as DNA and mRNA into a cell.

The challenge with inserting genetic material into a cell is that is the both of these materials are anionic (negatively charged), which means that they resell each other. The way that this is usually overcome is through positively charged reagents as well as electrical shocks known as electroporation. Both of these methods are time consuming, labor intensive and tedious. At AcoustaMed our objective was to create a device that is easy to use, semi autonomous and able to perform this process in a fraction of the time it takes current methods.

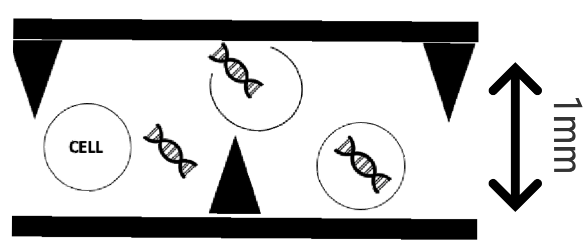


Applications:

- Vaccine Development
- Cancer Research
- Cell Therapy

Acoustofluidic Transfection:

Acoustofluidics is a newly emerging field that combines vibrations and fluidics on the microscopic level. The micro channel contains sharp tips (shown below) that induce vortices when a fluid is flown through it. These vortices create a shear force on the cell, allowing genetic material to permeate the cell membrane.



Project Objectives

These are the objectives that we set out to accomplish at the start of the project

Time Reduction

One of the biggest limitations to transfection right now is that is takes upwards of 48 hours. We set out to accomplish this same goal in just around 1 hour.

Affordability

Current Transfection Models are very expensive, costing around $7000 per device and $400 per batch. We aimed to create a device that coasts only $400 and $100 per batch

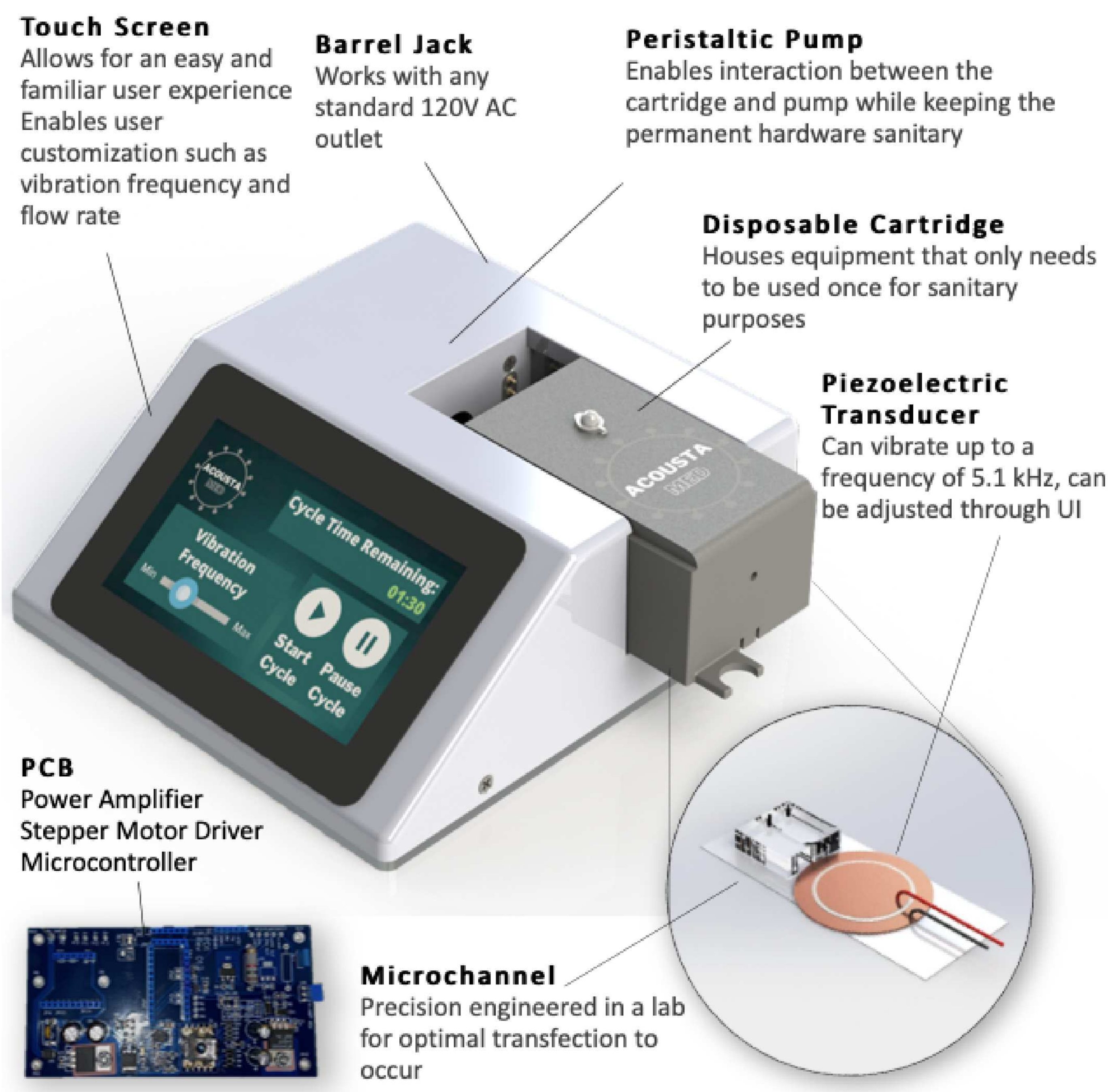
Ease of Use

Current methods are messy, tedious and often allow for human error. Our device will be able to achieve the same outcome while remaining semi autonomous and easy to use.

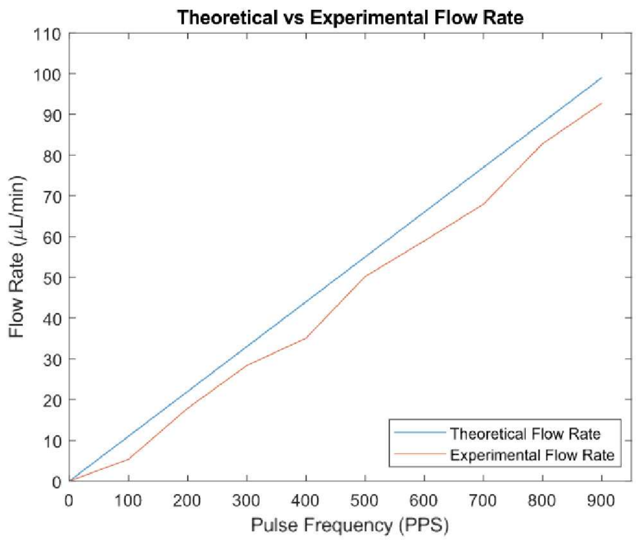
Sanitary

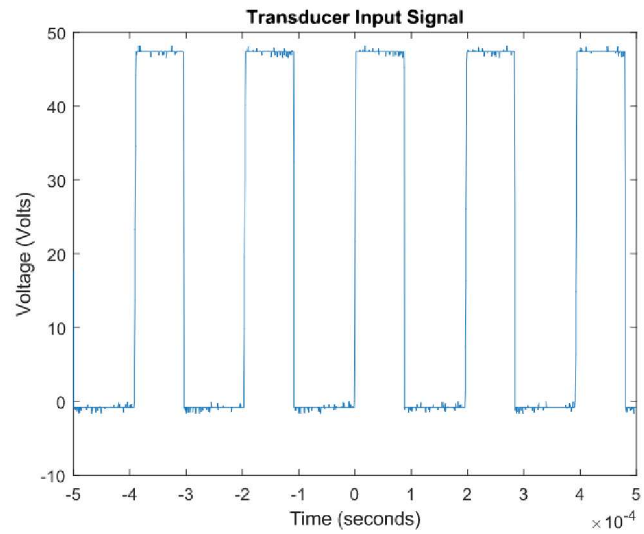
For this device to be used in a real lab it needs to meet medical standards. Therefore we decided we wanted our device to be able to perform transfection in the most sanitary way possible.

Device Breakdown



Impacts and Results





Testing:

To make sure that our device met the objectives that we set out to accomplish we performed numerous tests. We tested the flow rate, transducer voltage input and frequency, the sound output and the temperature of our circuit board after a long run time. All of these tests showed that our device works as intended. The only slight issue that we ran into during testing was that the flow rate form our pump was slightly lower than the manufacturer specifications, as can be seen in the graph above. However, this is an easy fix and we are currently calibrating our code to ensure that the output form the pump is what it should be.

Impact:

This device has the potential to drastically speed up the research process for in many areas of the medical industry. This could potentially mean a reduction in the time it takes to develop a new vaccine during future pandemics or getting us even closer to developing a cure for cancer. We plan to continue to work on this device and implement more features that were recommended by lab technicians we interviewed. This could include multiple sample capabilities or remote capabilities such as an app

Contact Us

Andrew Virden
anvi9858@colorado.edu
(720) 648-6585

Sean Spindler
sesp9268@colorado.edu
(303) 895-4861

Owen Grace
owgr5993@colorado.edu
(303) 819-8165

Jacob Allen
jaal4610@colorado.edu
(413) 884-4637

Pete Snyder
pesn1763@colorado.edu
(720) 552-0099