Stretching Device for Mechanical Cellular Stimulation

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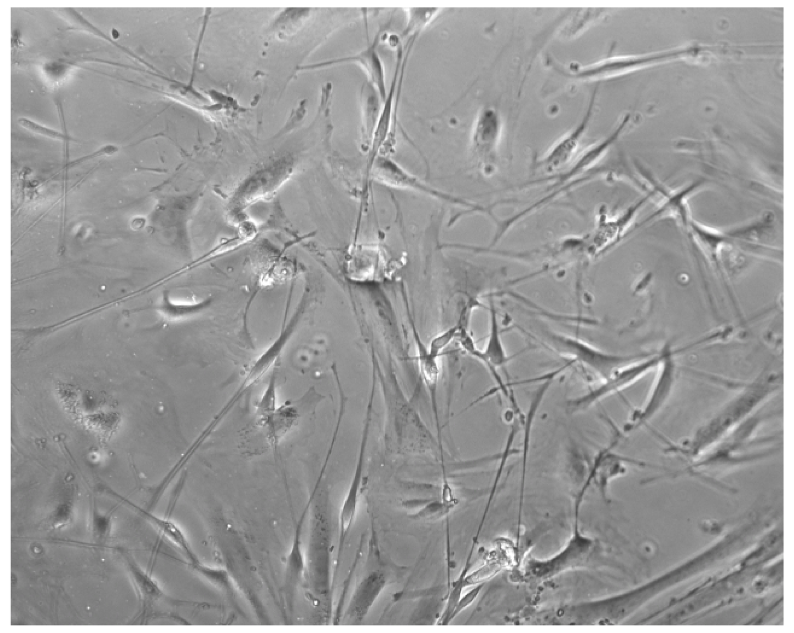
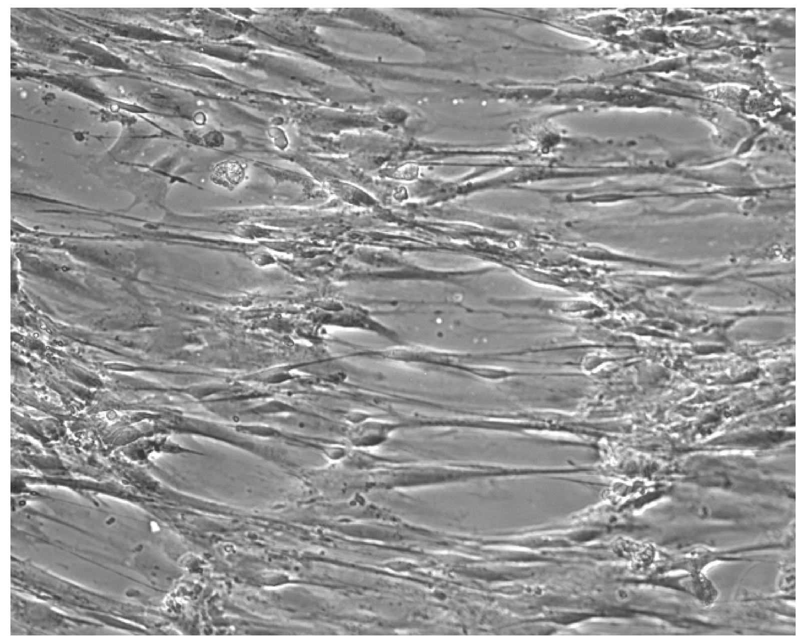
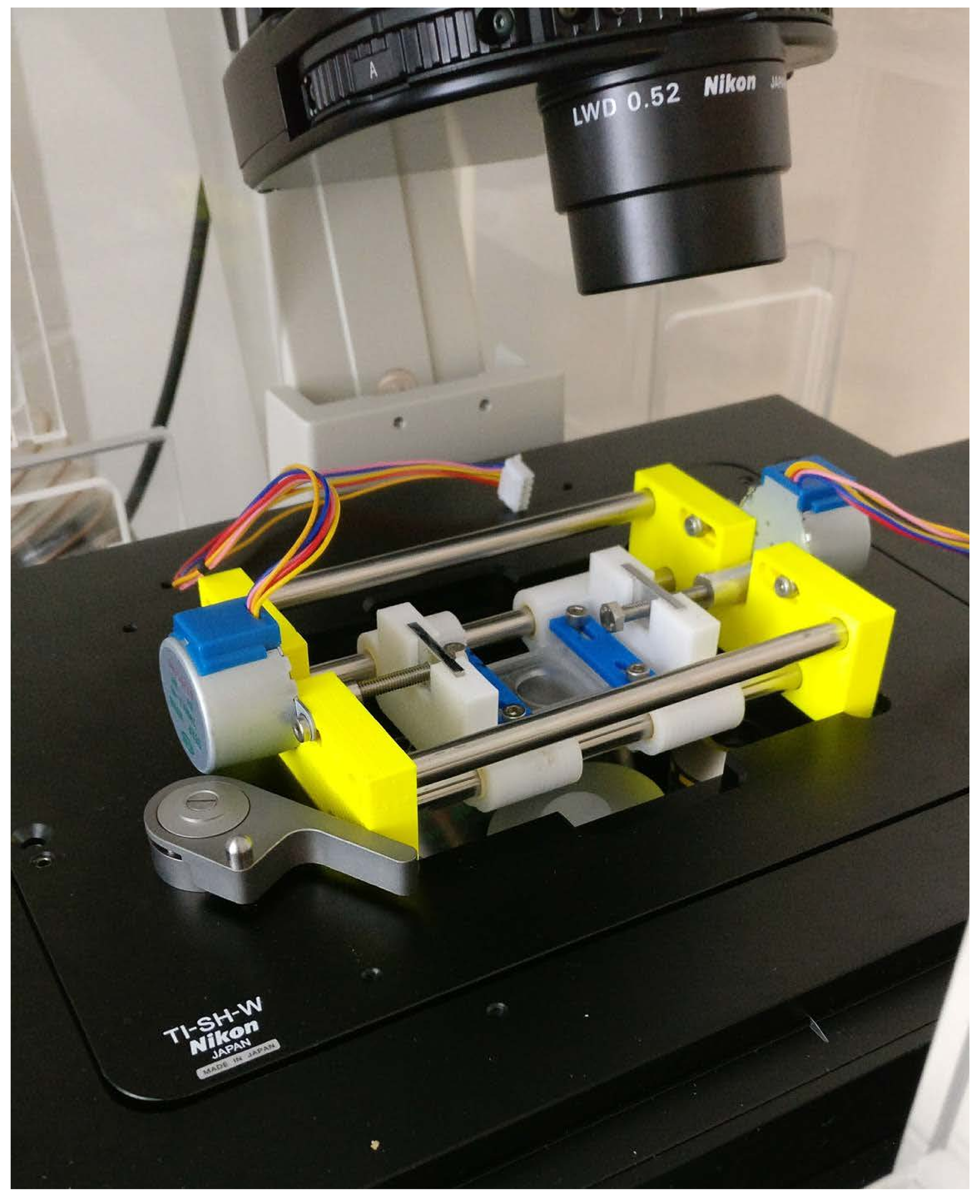
Introduction

- Cells respond to mechanical changes such as applied strain in their microenvironments.
- The skin of the spiny mouse does not scar while healing. We hypothesize that its response to applied strain is part of *Acomys'* unique, non-scarring behavior.
- We built a stretching device to study the response of *Acomys* cells to mechanical stimuli. We also designed silicone constructs to seed the cells on.





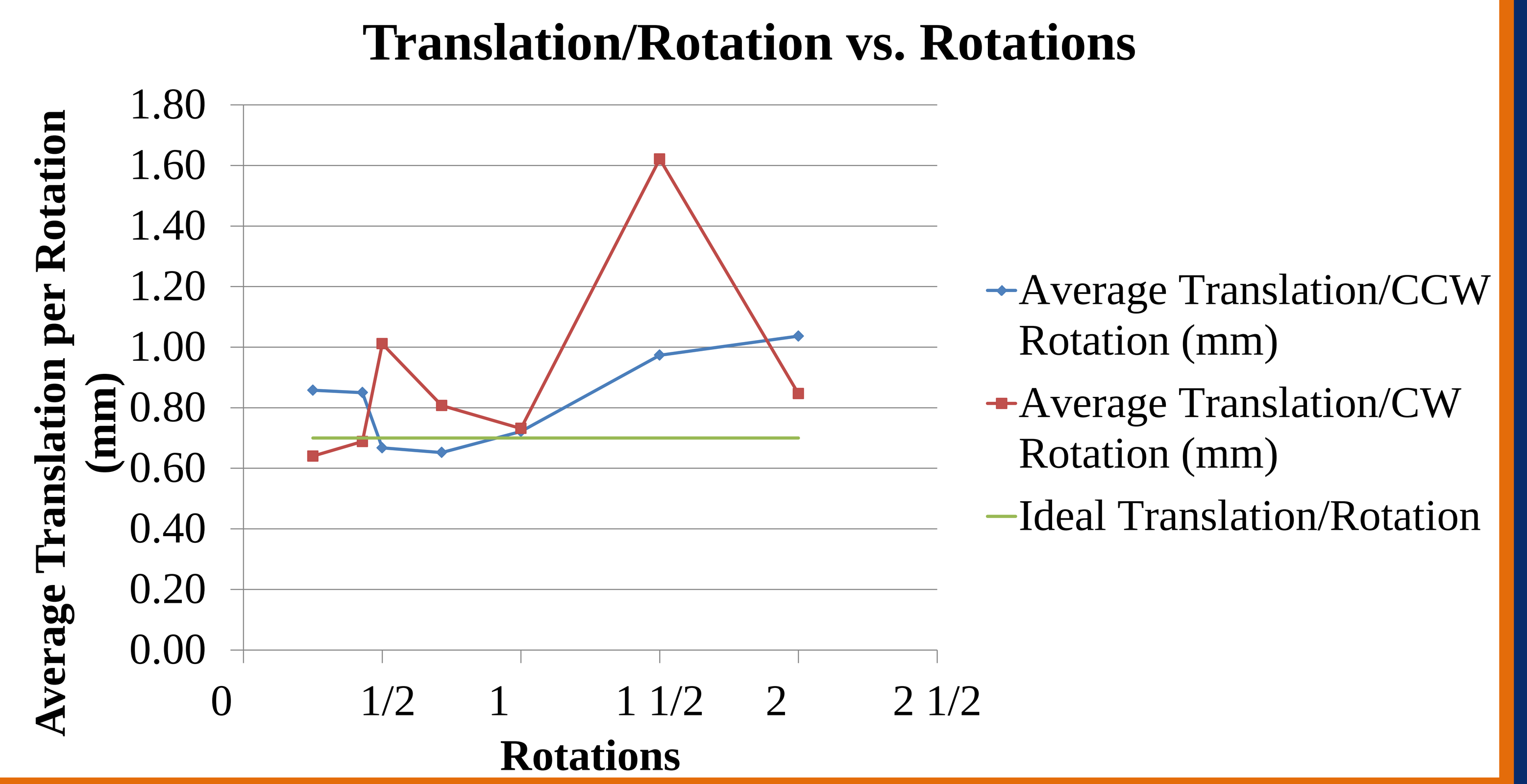
Fibroblast cells from normal mice can be plated, stretched, and imaged in real time.



ALBRTA can be set up under a microscope to perform stretching experiments.

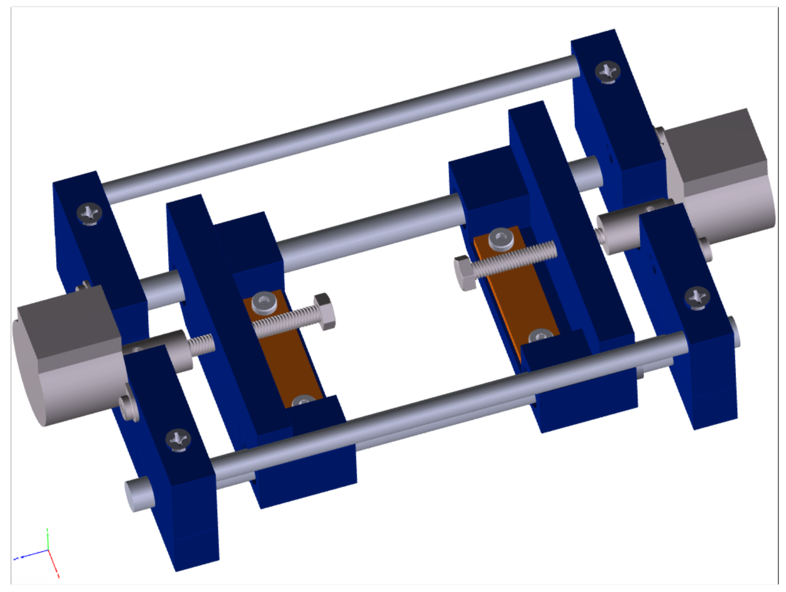
Calibration Results

ALBRTA was calibrated by programming the motors to turn a specified number of steps. We watched how far the stages travelled under a microscope and took pictures after each run. An analysis of the images yielded the values below:

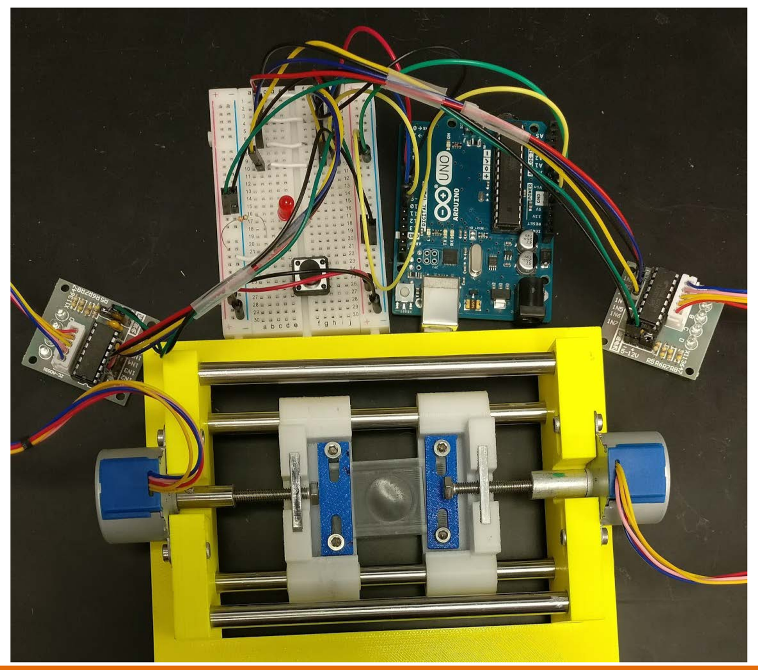


Design

- A Live Biomimetic Real-Time Actuator (**ALBRTA**) that fits under the microscope and stretches cells.
- ALBRTA is a mini tensile tester designed to accommodate soft materials such as flexible silicone constructs.
- Constructs with cells seeded on them are clamped down at each end and pulled apart using two high-precision stepper motors to apply tension. Due to the geometry of the constructs, the resulting strain is transferred to the cells.
- Screws are used to convert the motors' rotational motion into linear motion. The number and direction of turns are programmed using an Arduino microcontroller.
- Multiple manual iterations of ALBRTA were manufactured and tested before it was automated.
- ALBRTA has been calibrated so that a specific number of turns of the motor results in a known strain value of the silicone constructs.



A CAD model of the latest version of ALBRTA. The frame can be easily disassembled to facilitate the insertion of the constructs.



ALBRTA connects to the Arduino board, which powers and sends signals to the motors.

Future Work

- The device is now being used to stretch and observe normal mouse cells and will later be used to stretch and observe *Acomys* cells.
- The stepper motors initially used were found to have inadequate torque ratings. They will be replaced with new stepper motors that can withstand higher torque and will be able to generate constant strain.
- Calibration will be repeated with the new motors. We expect better values after the second round.

References

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