Stimulating Bone Growth Using Piezoelectric Ultrasound Transducers on the Edentulous Jaw

Week 4 Report
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The forceps we ordered a while back finally arrived last Thursday night, but the order was unfortunately not correct once again. The forceps ordered were the standard size, instead of the micro ones that we had wanted, so I had them sent back to get the correct ones. Soon after, I found out that those ones were actually sold out and it would be several more weeks before they would be available. I searched online and found another option, from the Salvin Dental Specialties, Inc., which offered micro tissue forceps with 0.5mm tips for $58.90 + tax/shipping (Fig. 1). We ordered two, but when they arrived on Wednesday we found that only one was purchased. It is getting frustrating that our orders are not being placed as we are asking for, but there is not very much that we can do about it. Hopefully, we don’t run into any more issues, because another setback could cause a big strain on our projected timeline.

![Image of forceps](image_url)

Figure 1: Microforceps ordered from Salvin Dental Specialties, Inc.

Last Friday, Sarah and I had a lesson from Abijit Debroy and Yamalia Roberts, two of the graduate students in Dr. Kotha’s lab, on the procedure for cryosectioning. Cryosectioning involves setting a tissue sample in PEG at sub-zero temperatures and using a machine (Fig. 2) to
slice thin samples off that can be placed on a slide and examined. The machine in our lab was set to maintain a temperature of negative twenty degrees Celsius and can slice samples as thin as five micrometers. Following is the procedure for cryosectioning:

i) Place a thin layer of PEG on a prechilled plate and put the sample on it.

ii) Cover around and over the sample with more PEG.

iii) After the PEG starts to set, flatten it with a metallic cylinder.

iv) Place the plate on the moving table and touch off to the blade.

v) Set the ‘Trim’ value to the desired thickness and cut away until the sample is cut down to where the sample is going to come from.
vi) Set the ‘Fine’ value to the desired thickness and place a strip of tape of the sample to keep it intact while the blade is cutting.

vii) Place the thin sample on a prechilled slide and examine under a microscope.

The crysectioning machine will come into play once we are done with experimentation and need to examine the bone samples from the jaws of the mice. We will stain the bone after sectioning it to figure out how much resorption was taking place.

On Wednesday, we met with Jason Farnsworth from OAR, the Office of Animal Research, and were given a tour of the Animal Research Lab in the basement of the Biology/Pharmacy Building. This tour was mandatory in order to gain access to the lab, so that we can start our experimentation as soon as possible. We will also need to take a hands-on animal training session with him, where he will adapt the class to the specific procedures that we will be undertaking. Hopefully, we will be able to take that class early next week, which will allow us to gain the necessary access to get in and start practicing on live mice. Once we have done that, we will be able to start our experiments. Mr. Farnsworth’s tour brought us around the entire facility, and taught us about the clean room Tier System, how to remove and replace cages from the wall racks, where to go to euthanize the mice, and the numbering system for the cages.

This week, I also looked into how to create a timer circuit with a microprocessor. I found out about the 555 timer, which is a very commonly used IC. The circuit incorporates the microprocessor, a resistor, and a capacitor (Fig. 4). Based on the values of the resistor and capacitor, the time that the timer runs for will vary. This is Figure 4: The 555 Circuit.
based on an equation that states that the time of the output pulse is equal to the resistor times the capacitance times 1.1 (Equation 1). If we can figure out the logistics, I feel that this circuit will be the best way to control the time of ultrasound production.

\[ T = 1.1 \times R \times C \]

Equation 1: The time the 555 circuit runs an output pulse for.

Reference:

‘555 Time/Oscillator Tutorial.’ http://www.uoguelph.ca/~antoon/gadgets/555/555.html