Progress Report 8

Week of 10/29/18

Alex Goodman
Work/Research Accomplished:

- Spent time researching RJ-45 adaptors for pH probes with group after advisor meeting
- Continued researching biological applications of ISFET
- **New ISFET catheters encapsulation techniques for brain pH in-vivo monitoring**
    - Huge area of concern for in-vivo ISFET sensors is the encapsulation of the device
        - There is a need to shelter the wires from the body
        - need to encapsulate the wires and metal electrode portion of sensor from the body
        - strong biologic / ionic solutions would affect the wiring and metal parts of the sensor
    - Encapsulating ISFET probe requires
        - small dimensions, flexible and non-toxic
        - needs to be a polymer that can encapsulate all of the unwanted material
        - packaging needs to be preformed at low temperatures to prevent damage to sensor
        - Need a constant voltage supply into the solution, typically done by implementing a reference electrode
    - Plain-chip encapsulation
        - **Ceramic alumina**
            - Easy bonding for gold conducting electrodes
                - gold conductors are bonded to
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Problems:

- n/a

Will Bacon
Work/Research Accomplished:

- Continued researching ISFET technology
    - Looked at ISFETS used *in vivo, ex vivo*, and for non-medicinal purposes (i.e. testing soil or water pH).
- Heavily focused on finding an appropriate commercial ISFET to use for our prototype testing
- Looked at ISFETS already on the market to gauge which would be best suited for our purposes based on the following criteria:
    - Needs to be durable
    - Needs to be sterilizable and thus reusable
    - Must not have significant signal drift within an 8 hour window of use
    - Must be sufficiently small for testing (a diameter less than 10 mm should be fine for the proof-of-concept, prototyping stage)

    - Needs to be affordable (Assuming reusability, the total cost of materials should be under $2,000 for entire testing procedure)
    - Must be highly sensitive within the physiological range of pH (6-8).
    - Must work within the physiological range of temperature, as well as be fairly temperature-independent
- This probe from Topac looks well-suited for our purposes and falls within our price range
    - https://topac.com/phisfet2.html
- Met with Dr. Doro on Wednesday, October 1st
    - Briefed him on ISFET technology as well as why we switched from the dye/optical fiber approach to ISFET
    - Discussed budget as well as next steps in process

Problems:

- None at this time. We need to finalize our order form this coming weekend and send it to the client, so that he can approve of the purchases.

Mark Austin
Work/Research Accomplished:

- Looked into the actual manufacturing of ISFET probes
    - Is it something we could do on our own if necessary?
    - Would it be expensive?
    - Do we have the proper components?
- Researched more on ISFET probes
    - Need to purchase a larger-scale model probe to test the concept and eventually purchase (or possible construct) a smaller probe capable of meeting our own specific size requirements
        - 16 gauge needle
- Began looking into the ability to do testing with raw meat in labs here on campus

Problems/Concerns:

n/a

Kelsey Murphy
Work/Research Accomplished

- Continued research of ISFET probes
    - Concerns with biocompatibility: Need to be safe for patient, and the physiological environment shouldn't affect functionality of the ISFET
    - Looked up examples of implantable ISFET pH probes in the literature. Many involve lab-synthesized materials (usually expensive and require a lot of processing)
    - Found an ISFET in development at University of Edinburgh that would use wireless signalling. This would allow the sensor to be implanted in the

compartment and not be directly attached in the machine, potentially improving comfort levels. Not on the market yet, but wireless signaling is something to keep in mind.

- Looked up probes we could purchase for our proof of concept
    - Most are similar or the same to the Topac one listed above (we would be specifically interested in the LanceFET probe)
        - Topac, Deltatrak, and the European company Sentron all sell similar/the same meters and probes for ~$1500
        - Sentron's probes are specifically listed as being FDA approved - could eliminate a step for us further down the line
    - Also found listings of a much cheaper probe + meter ($600) produced by Hach, but after looking at many sites it looks like it's been discontinued
    - Hach also sells bench-top pH-senstive ISFETs for ~$30 each, but these can't be implanted/inserted (need to drop solution on to them)
- Went with Will to meet with Dr. Doro to explain the new direction of the project and discuss budgeting.

Problems/ To Do

- Submit an ordering list to Dr. Doro by Monday
- Meet with Dr. Doro again for a more in-depth meeting with the whole team
- We won't have a prototype for this show-and-tell thing on Friday, so we'll need to put some sort of presentation together.