Progress Report

Week of 10/15/18

Alex Goodman
Work/Research Accomplished:

- Shifted focus on ISFET sensors to build a pH sensor
    - Understand the basic principle behind them - less important than finding one that actually works / we can test
- Goal: Looking to buy an ISFET sensor from a manufacturer and then perform all of our calibration in-house.
- Contacted Sentron - manufacturer of customized ISFET pH sensors
    - https://www.sentron.nl/
    - Attempted to get quote on microsensor. Waiting to hear back
- Contacted Hach to ask about their ISFET micro sensor
    - 3.8 mm diameter (too large)
    - https://www.hach.com/isfet-ph-stainless-steel-tube-micro-probe/product-details?id=7640516436
    - They don't sell sensors independently
- Contacted Seabird scientific to inquire about their ISFET sensors
    - https://www.seabird.com/seafet-v2-ocean-ph-sensor/product-details?id=54627921732
    - Problem: Diameter of probe is 16.2 cm (oceanic applications)
    - Solutions: They buy their sensors directly from *Honeywell*
- Contacted Honeywell, supposed supplier of ISET
    - No answer, need to call back
    - https://www.honeywellprocess.com/en-US/contact-us/pages/find-a-contact.aspx
- Sentron and Honeywell are two viable contenders

Problems:

- **Will keep attempting to find ISFET sensor (first priority)**
- **Will worry about calibration and all that later**
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Will Bacon
Work/Research Accomplished:

- Looked at other potential pH indicators that could be used since BCECF is no longer considered to be viable
- Napthalimide dye
    - Has a pKa of 6.5 making it sensitive to changes in pH within the physiological range
    - Uses principles of fluorescent spectroscopy

        - Reversible fluorescence depending on pH of sample
        - 1-methylpiperazine functional group detects pH changes
        - Dye absorbs and emits light within visible portion of spectrum
    - Dye can be covalently immobilized on a sol-gel
        - Prevents leaching and contamination
        - 6-amino-hexanoic acid functional group binds to amino-functionalized sol-gel
    - Sol-gel can be mechanically stable and transparent to allow for the passage of light, both attractive qualities
    - Variations in film thickness, treatment process, and dye concentration all affect signal processing
    - Protocol exists for immobilizing this dye on a sol-gel
- Bromocresol purple
    - Similar to previous dye except uses visible light spectroscopy
    - pKa of 6.3, which is a bit low
    - Protocol exists for immobilization to sol-gel
- After consulting with professor Williams, we will be moving toward an ISFET approach, thus next week I will switch my focus toward researching ISFET technology

Problems:

- Napthalimide dye is not commercially available and is difficult to synthesize
- Bromocresol purple has a pKa that is too low to be relevant for our purposes

Mark Austin
Work/Research Accomplished:

- Looked further into ISFET sensor monitoring
- Spoke briefly with Dr. Amit Nimunkar to brush up on transistors and MOSFET circuit analysis
    - Referred me to some literature on ISFET sensors
- Best bet is to find/construct a cheap semblance of an ISFET sensor and attempt to prove the concept before moving forward with purchasing an expensive one
    - Look into digikey, mouser and sparkfun for these
    - Not entirely sure if any of these small component manufacturers will have carry something like this, which would make it more difficult to prove the concept prior to proceeding

Problems/Concerns:

- I'm having trouble finding a cheap ISFET sensor through digikey and sparkfun and will have to try to contact mouser as they have a product that might suffice but will need to look into further

    - https://www.mouser.com/ProductDetail/STMicroelectronics/ISOFT?qs=%2fha2pyFadugj%252boxeBTLJaxBa4g6bXZCkD74iTxldm5Y%3d

Kelsey Murphy
Work/Research Accomplished

- Searched for another pH indicator to replace BCECF
    - ThermoFisher pHrodo Red and Green are similar to BCECF
        - Used to detect intracellular changes in pH during cell reactions
        - Couldn't find any associated immobilization protocols
    - Also looked at paper Will found about sol-gel dye (see above)
- Met with Williams on Tuesday to talk about ISFET
    - Looks like a better way to go than immobilized pH dye
- Switched research to ISFET
    - Not familiar with electronics, so I looked up transistors, FETs, and ISFETs
        - To make pH-sensitive, would replace gate with a hydrogen-ion-sensitive membrane that would cause a change in voltage

Problems

- Switching tack in the middle of the semester is never great, but I think we're headed in a better direction with this.