

Improving Acute Compartment Syndrome diagnostic technology with an Ion-Sensitive Field Effect Transistor

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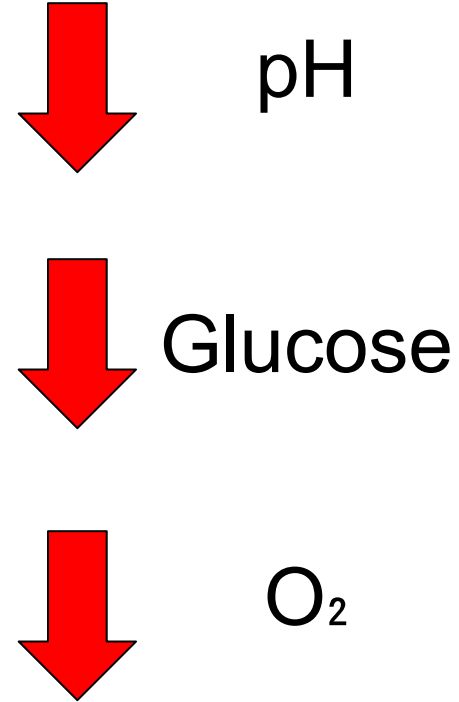
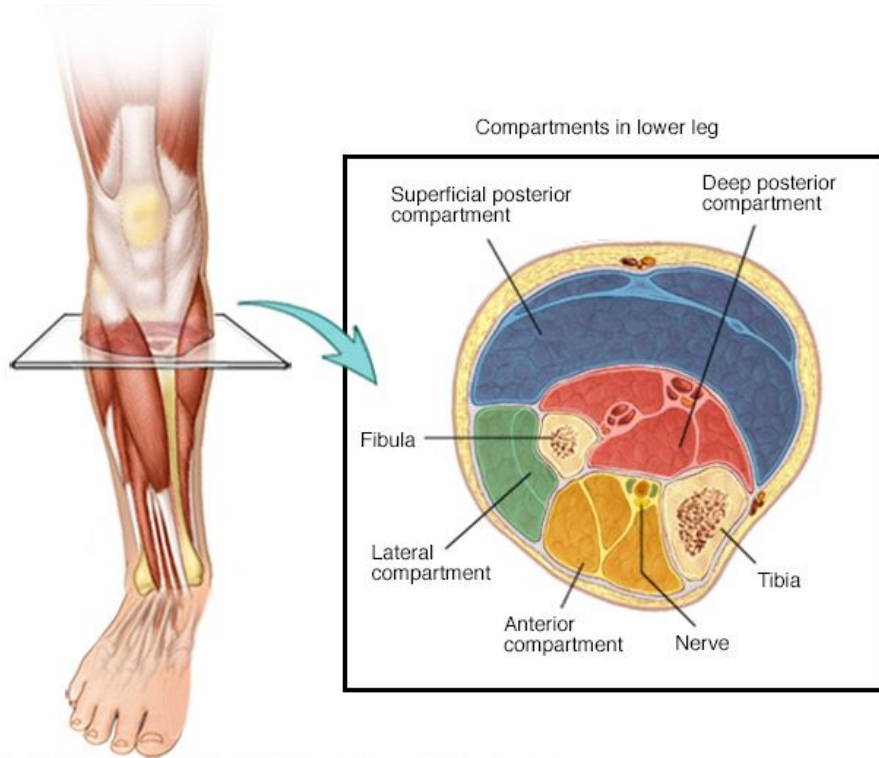
Client: Dr. Christopher Doro

Advisor: Professor Jeremy Rogers





Acute Compartment Syndrome



35%

False-positive diagnosis

(Doro et al)



Client Objectives



Dr. Christopher Doro

UW Health Orthopedics
and Rehabilitation

- Continuous biochemical marker monitoring
 - 1 sample/10 minutes
 - Up to 2 hours
- Depth below skin
 - 1-5 cm
- Standard of care
 - 16 gauge needle (1.194 mm)

Previous Semester

- Tested the efficacy of an ISFET pH sensor versus a standard glass bulb pH sensor in a meat sample (Fig. 1)
- Tested the influence of variable K⁺ concentrations on pH readings
 - Mimics *in vivo* variation during muscle ischemia

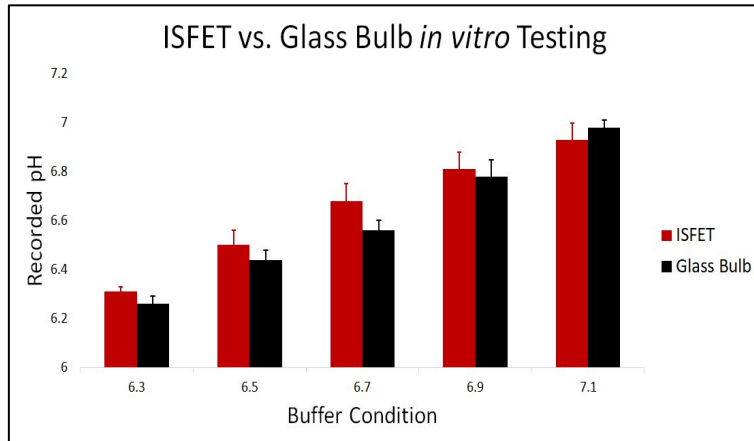


Fig. 1: Recorded pH of ISFET and glass bulb sensors vs. pH of immersive buffer solution

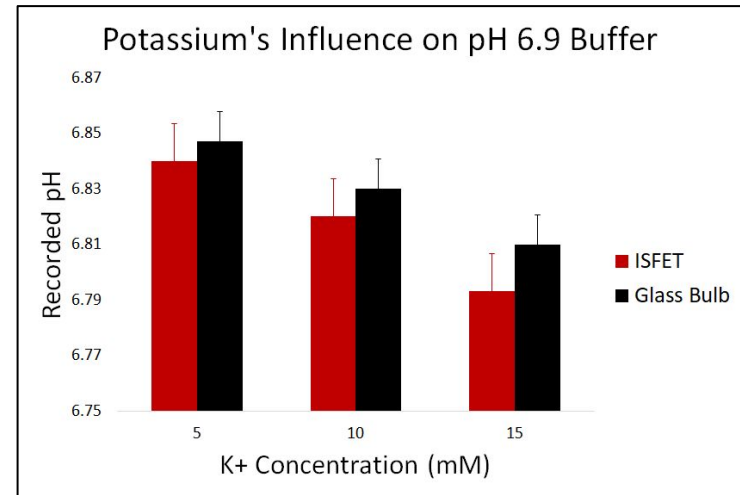
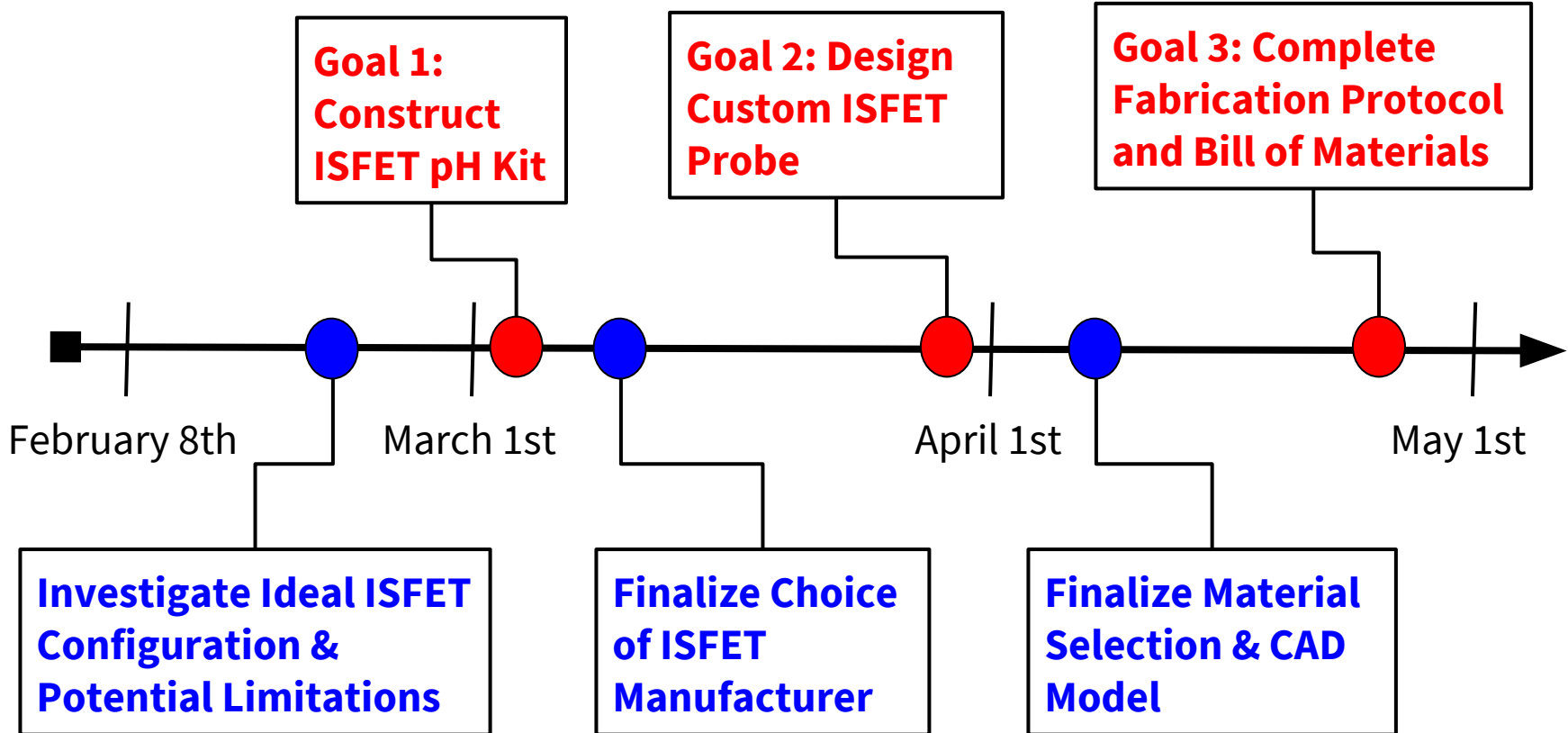


Fig. 2: ISFET and glass bulb pH measurements recorded as a function of K⁺ concentration.

Timeline for Spring Semester

■ = Primary Goal
■ = Complementary Goal



Goal 1: Construct Modular ISFET pH-kit

Benefits

- Control over signal processing
- Hands-on experience with sensor
- Cannibalization of ISFET probe

Drawbacks

- Sensor casing ~ 3mm >> 1.194 mm
- Built for *ex vivo* measurement
- Large reference probe

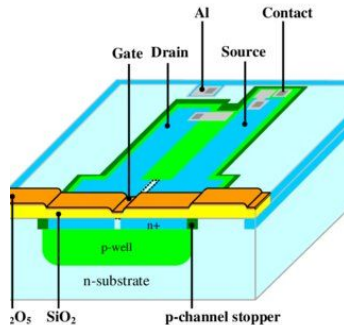


Sentron: ISFET ph-sensor kit, www.sentron.nl

Goal 2: Design custom ISFET probe

ISFET sensor

- Sensor surface area
- Terminal geometry



ISFET Schematic

Electrical Interface

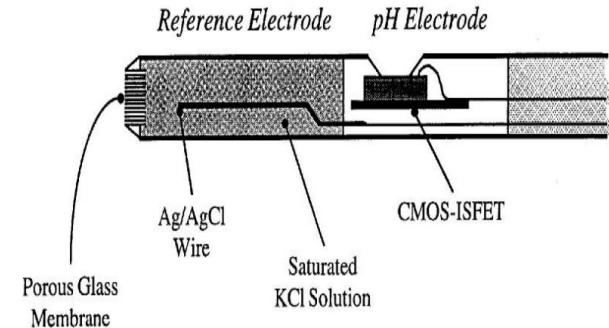
- Current model, FFC adaptor:
 - 2.5 mm (w) x 6cm (l)
- Functionality vs. size



FFC Adaptor, Digikey

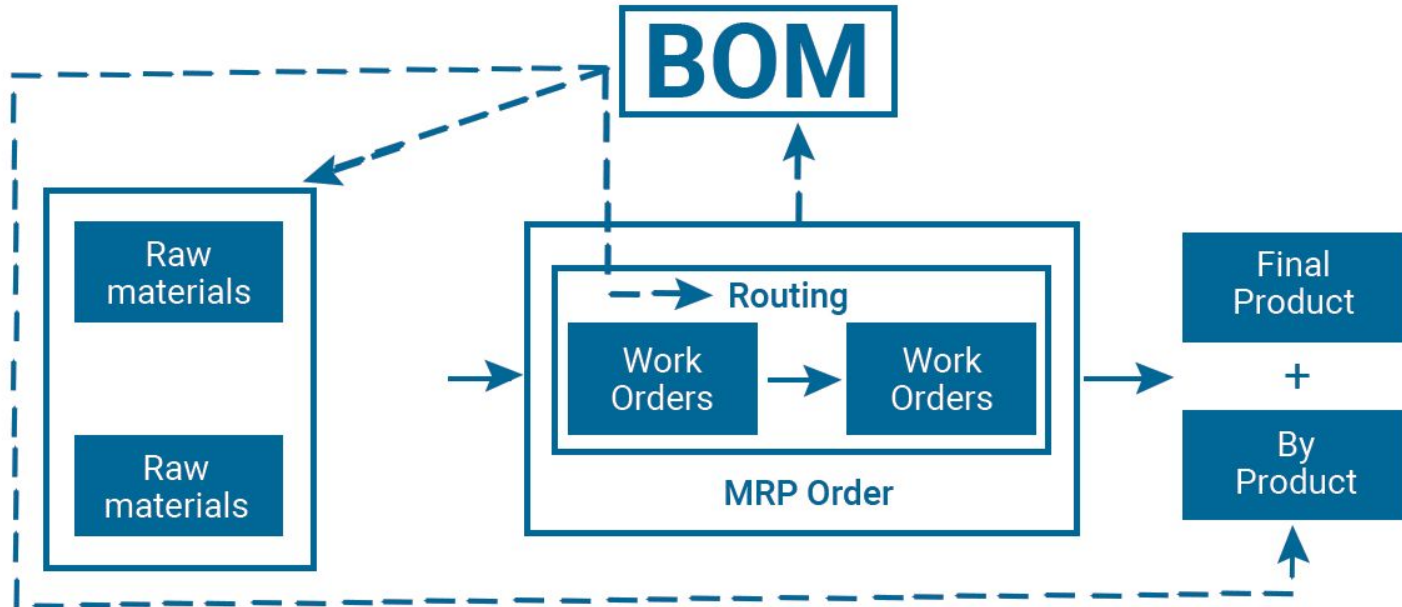
Probe Configuration

- Bioinert casing < 1.194 mm
- Reference electrode location



Cross section of theoretical ISFET probe configuration

Goal 3: Complete Bill of Materials and Fabrication Protocol



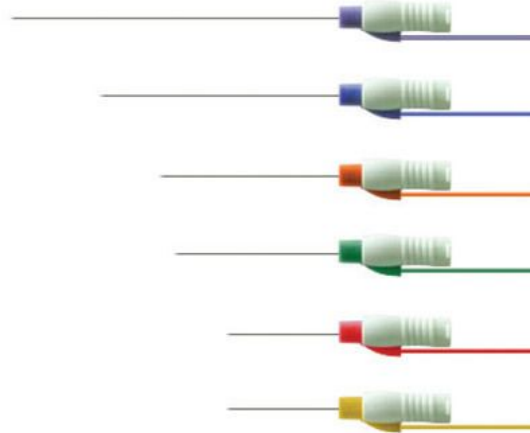
Down the Line: Regulatory Approval

“Not quite” predicates:



Gastrointestinal pH Catheter

www.laborie.com



EMG Electrodes

www.ternimed.de

510(k) or PMA

Past Expenses

Item	Description	Cost (\$)
Glass bulb pH probe	Control - used in Dr. Doro's original diagnostic study	607.50
Water resistant pH meter	Reports measured pH value	760.00
Heavy duty piercing probe	ISFET pH probe	664.00
Thermometer	Temperature monitoring	10.54
Perforated bags	Encasement of meat model during experiments	11.89
Total		2054.03

Predicted Spring Expenses

Item	Description	Cost (\$)
Modular ISFET kit	Modules for cannibalization <ul style="list-style-type: none">- ISFET sensors- Reference electrodes- Analog, AD Converter and USB Interface modules	1100
Meat	Samples for testing measurements in physiological	10
Total		1110

Questions?