

Intracranial EEG Phantom for Brain Stimulation Studies

Date: 10/30/2025

Client: Dr. Raheel Ahmed

Alternative Contact: Dr. Arun Karumattu Manattu

Advisor: Dr. Paul Campagnola

Team:

Avery Schuda (*Team Leader*)

Lilly Mackenzie (*Communicator*)

Helene Schroeder (*BSAC*)

Orla Ryan (*BWIG*)

Corissa Hutmaker (*BPAG*)

Problem statement

Intracranial electroencephalography (iEEG) is routinely used in surgical planning for individuals with uncontrolled seizures. Transcranial magnetic stimulation (TMS) may provide complementary information for mapping out critical brain regions that should be avoided during surgery, however, there are still safety concerns around the use of TMS in patients with iEEG. The major safety concerns are the induction of electrical currents, heating, and displacement of the implanted electrodes. The goal of this project is to develop a phantom that can be used to simulate the effect of TMS on electrode currents, temperatures, and changes in position.

Brief status update

This week the team fabricated hydrogels with varied agar and salt concentrations. Following this we began experimentation on the rheometer to test shear modulus and other mechanical properties. We also met to discuss creating a temperature measurement system similar to a Thermaline system. The team decided to not 3D print the box gel phantom as the cost outweighs any testing benefit, instead deciding to focus on testing mechanical, thermal, and electrical properties of the gel. Finally, the team collaborated to create an elevator pitch and questions for peers for show and tell this Friday.

Difficulties / advice requests

The team is still awaiting CT scans to begin designing the skull portion of the phantom.

Major team goals for the next week

1. Attend show and tell
2. Continue fabricating hydrogels
3. Begin rheological testing
4. Obtain CT scans from client
5. Create a temperature measurement system

Next week's individual goals

- Avery
 - Begin processing CT scans into workable CAD file
 - Continue fabricating hydrogels
 - Update testing plans
- Lilly
 - Fabricate more hydrogels and determine crosslinker chemistry
 - Begin working with CT scans for printable CAD files
- Helene
 - Continue fabrication with the team
 - Work on the plan for our outreach event
- Orla
 - Assist in fabricating, writing protocols for, and testing hydrogels
 - Start formatting final deliverables
 - Draft outreach plan
- Corissa
 - Continue fabricating more gels
 - Help with testing mechanical properties of gels
 - Start working on outreach event plans

Timeline

[illegible]

Progress Reports		X	X	X	X	X	X	X	X						
PDS			X												
Prelim Presentation					X										
Final Poster															
Final Report/Notebook															
Meetings															
Client		X			X			X							
Advisor	X	X	X	X	X		X	X							
Website															
Update	X	X	X	X	X	X	X	X	X						

Filled boxes = projected timeline
X = task was worked on or completed

Previous week's goals and accomplishments

- Avery
 - Worked with team to fabricate hydrogels with varied salt and agar content
 - Started experimenting with testing on the rheometer
 - Created show and tell pitch with team
- Lilly
 - Fabricated several iterations of agar/NaCl hydrogels
 - Met with Dr. Puccinelli to discuss crosslinking possibilities
 - Began establishing testing protocols for rheometer testing
- Helene
 - Brainstormed with the team on outreach and temperature testing
 - Began working with the rheometer for hydrogel testing
- Orla
 - Met with team to discuss outreach, current status of fabrication, and rheometer exploration
 - Wrote up show and tell pitch
 - Brainstormed for outreach
- Corissa
 - Fabricated initial hydrogels with team
 - Started working with rheometer to ensure it will work for hydrogel testing
 - Prepared for show and tell

Current design

N/A

Materials and expenses

Item	Description	Manufac-turer	Mft Pt#	Vendor	Vendor Cat#	Date	#	Cost Each	Total	Link
3D prints										
Formlabs BioMed Clear Sample Swatch	Step wedge with thicknesses of 0.1, 0.2, and 0.3 inches for prelim presentation prop	UW Design and Innovation Lab	N/A	N/A	N/A	10/1	1	\$7.14	\$7.14	
									\$0.00	
Hydrogel Materials										
Agar Powder, 500g	500g of agar powder for initial brain phantom fabrication	Thermo Fisher Scientific	A10752.36	Thermo Fisher Scientific	A10752.36	10/20	1	\$128.65	\$149.15	https://www.thermofisher.com/order/catalog/product/A10752.36
									\$0.00	
								TOTAL:	\$156.29	