

Brain Phantom for iEEG and TMS Testing

"The Brainiacs"

BME 200/300

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Raheel Ahmed M.D., Ph.D.,

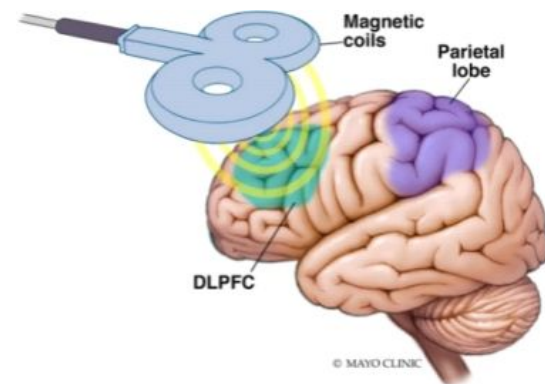
- Director of Pediatric Surgical Epilepsy
- Pediatric neurosurgeon at the American Family Children's Hospital.
- Associate Professor at CHS



[1]

TMS and iEEG are safe apart, but unsure together

- TMS changes excitability of neurons
- iEEG reads voltage from the brain
- Brain phantoms are used as models



Picture of a typical TMS coil [2]

Brain Phantom's Top Priority Should be to Accurately Mimic Brain and Skull Tissue

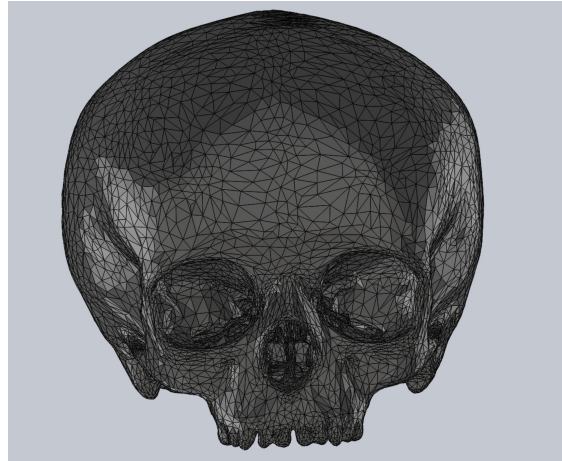
- Durable
- Three segments
- Accurate electrical and physical properties



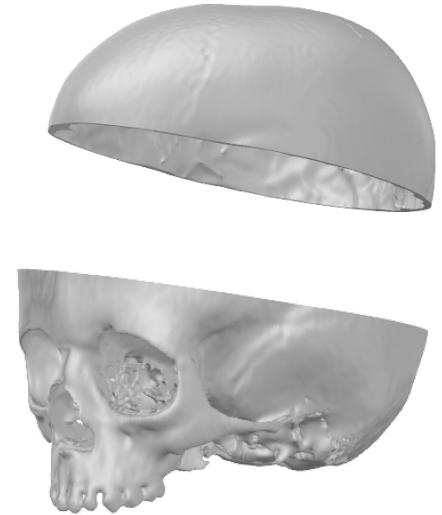
Skull Design Matrix

	PMMA (polymethyl methacrylate)	Gypsum	Plastic Clay
Electrical conductance (5)	5 (25)	5 (25)	5 (25)
Ease of fabrication (4)	4 (16)	3 (12)	1 (4)
Thermal conductance (5)	4 (20)	5 (25)	4 (20)
Shelf life (3)	5 (15)	5 (15)	3 (9)
Cost (2)	5 (10)	3(6)	4 (8)
TOTAL	86	83	66

Polymethyl Methacrylate Has the Best Properties for Model Skull



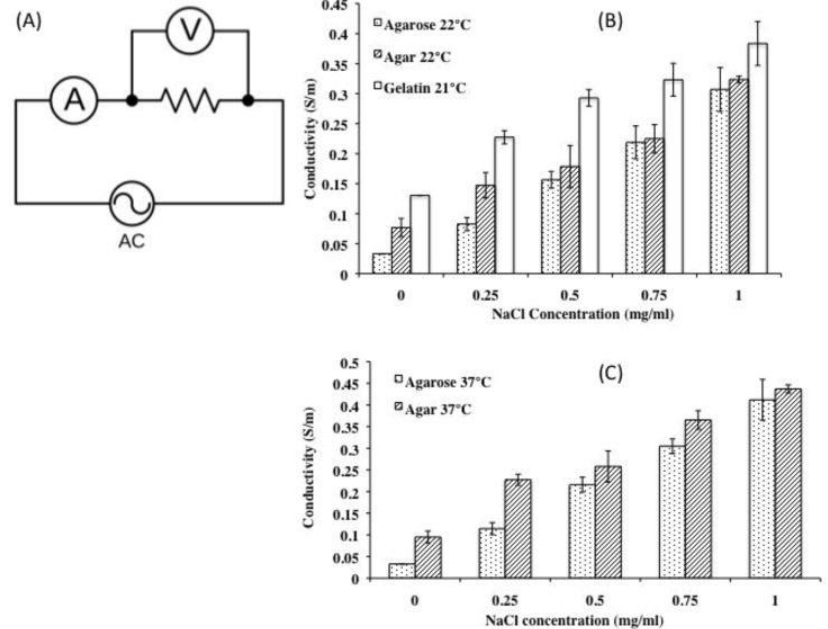
Previous team's 3D printed skull



Grey and White Matter Design Matrix

	Polyvinyl Alcohol Cryogel	Agar	Gelatin
Electrical Conductance (5)	5 (25)	5 (25)	5 (25)
Thermal Conductance (5)	5 (25)	5 (25)	5 (25)
Shelf Life (4)	4 (16)	2 (8)	2 (8)
Ease of Fabrication (4)	2 (8)	4 (16)	4 (16)
Cost (2)	4 (8)	3 (6)	5 (10)
TOTAL	82	80	84

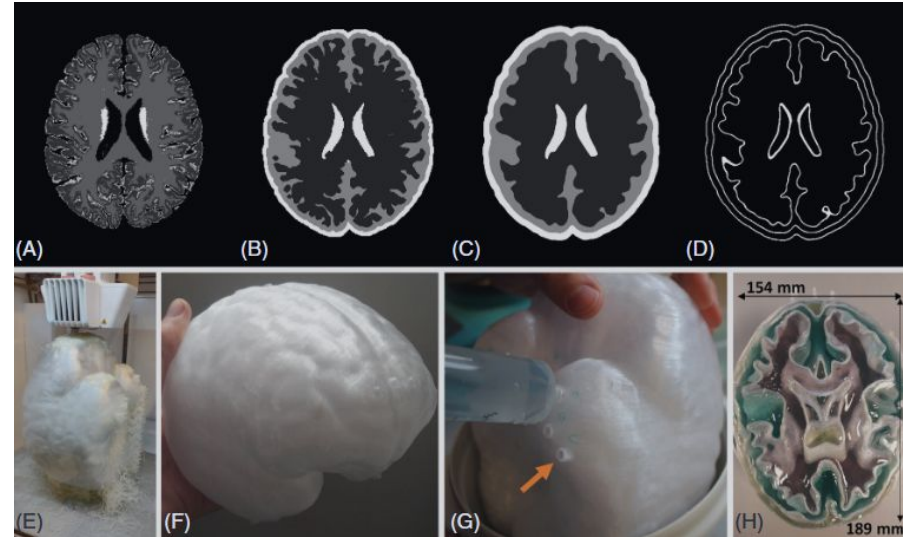
Gelatin Can Mimic Properties of Grey and White Matter and is Easy to Use



Electrical conductivity at different NaCl concentrations [12]

Polymethyl Methacrylate in conjunction with Gelatin (working title)

- Reuse Poly-Methacrylate for Skull
- Different gelatin concentrations for grey and white matter
- Segmented molds for grey and white matter



[11]

Work With Previous Prototype is Necessary to Create Our Own

- Performs TMS testing on previous model
- Fabricate and test first prototype
- Measure temperature changes and electrode displacement
- Refine design based on testing

Acknowledgements

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Questions?



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