

Multi-chamber culture insert for connected neuronal aggregates

Date: 10/01/2026

Client: Dr. Jason Brant

Advisor: Prof. Mehmet Orman

Team:

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Problem statement

Common devices used in biological research, including well plates and petri dishes, are readily accessible, provide easy platforms for addition of cells, media, and reagents, and allow for observation using standard laboratory microscopes; however, they fail in their ability to model the complex physiological environments of the human body. In recent decades, there has been a large push toward the development of microphysiological systems used for research, for example, the Organ-on-a-Chip platforms. The ability to model complex tissue environments is incredibly important for the study of the auditory pathway because of its dynamic environment. 2D systems completely isolate cells from the complex physical forces, specialized microenvironments, and 3D neural networks that are vital to the transduction of sound to the brain. The multi-chamber culture insert device provides a more dynamic platform to study the growth and interactions of neuronal cell bodies on a 3D platform. The device allows for growth and interaction of neuronal cell aggregates in a structured manner. The device separates a well plate chamber into distinct sections each holding a neuronal aggregate. The device allows for growth of neurons between chambers, but separates the media in each chamber, allowing for independent treatments of aggregates.

Brief status update

The team has been continuing research on the background of the project and completed the preliminary presentation. The final design has been chosen based on critical criteria from the design matrix. We plan to complete the final report next week and move into prototyping soon after.

Difficulties / advice requests

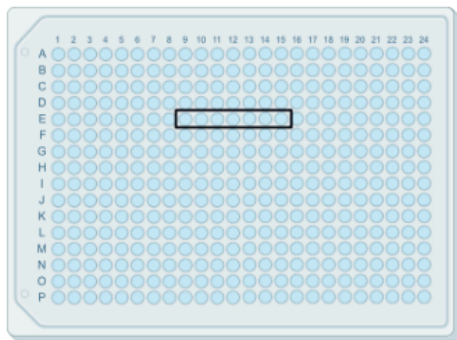
- N/A

Current design

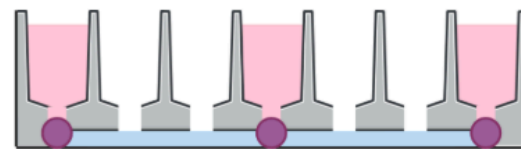
Final Design: Milled 384 Well Plate

Three culture wells connected by an ECM-filled channel at the plate base

Plate Location

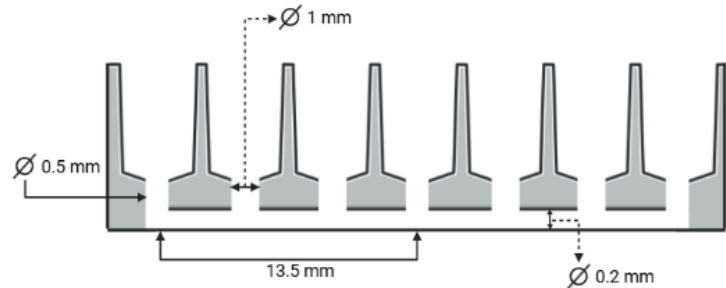


Final Culture Configuration



Neuronal Aggregates ECM Channel Culture Media

Fabrication Geometry



Materials and expenses

Item	Description	Manufacturer	Mft Pt#	Vendor	Vendor Cat#	Date	#	Cost Each	Total	Link
Category 1										
									\$0.00	
									\$0.00	
Category 2										
									\$0.00	
									\$0.00	
								TOTAL:	\$0.00	

Major team goals for the next week

1. Complete preliminary report
2. Create a plan to begin fabricating and prototyping the first design

Next week's individual goals

- Greta
 - Complete preliminary report
 - Begin designing a CAD file for milled well plate
 - Research fabrication techniques and necessary additional materials needed for well plate fabrication.
- Eli
 - Complete preliminary report
 - Research necessary topics for preliminary report
- Sam
 - Complete preliminary report
 - Conduct research for preliminary report
 - Look into fabrication methods
- Safia
 - Write preliminary report
 - Research more about the milled well plate design, how to fabricate it, how to make it work, etc.
- Sri
 - Help write preliminary report and continue research on design fabrication methods
 - Understand more about the design we are pursuing and see if there's areas of improvement
- Sophia
 - Complete and write preliminary report
 - Do more research as necessary
 - Look more deeply into fabrication methods

Timeline

Task	Sept				Oct					Nov				Dec	
	4	11	18	25	2	9	16	23	30	6	13	20	27	4	9
Project R&D															
Empathize	X	X	X												
Background & Research	X	X	X	X	X										
Preliminary Designing				X	X										
Final Design Prototyping															
Testing															
Deliverables															
Progress Reports		X	X	X	X										

Product Design Specifications			X												
Design Matrix				X											
Prelim presentation & Selection of Final Design					X										
Show and Tell															
Final Poster															
All Deliverables Due															
Meetings															
Client			X	X											
Advisor	X	X	X	X											
Website															
Update	X	X	X	X	X										

Filled boxes = projected timeline

X = task was worked on or completed

Previous week's goals and accomplishments

- Greta
 - Complete preliminary report
 - Complete preliminary presentation
 - Continue research on fabrication and biology aspects of the project.
- Eli
 - Complete preliminary report
 - Complete preliminary presentation
 - Continue research
- Sam
 - Complete preliminary presentation
 - Work with team on presentation skills and rehearsing presentation
 - Continue research into fabrication methods
- Safia
 - Continue research on the already brainstormed fabrication methods
 - Research other possible methods and already existing devices
 - Complete preliminary report and presentation
- Sri
 - Do some research on the silicone grease and its properties for Campenot-inspired insert
 - Work together with team on preliminary presentation and report
 - Help enhance designs for future fabrication
- Sophia
 - Look into less costly options
 - Complete preliminary report and presentation
 - Continue research on possible fabrication methods

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Greta	9/27-10/1	Worked on preliminary presentation and completed research for testing methodologies	2.5	4.5	18.5
	9/27	Created figures on biorender for final design demonstration	1		
	10/1	Met with team to practice presentation	1		
Eli	9/28-10/1	Worked on preliminary presentation	2.5	3.5	16.25
	10/1	Met with team to practice presentation	1		
Sam	9/28-10/1	Worked on preliminary presentation	1	4	17.5
	9/30-10/1	Researched micro-TENNs background and fabrication methods	2		
	10/1	Met with team to practice presentation	1		

Safia	9/29 & 9/30	Worked on preliminary presentation	2	3	16
	10/1	Met with team to work on/practice presentation	1		
Sri	9/29	Worked on finishing up preliminary presentation	2	4.5	18.5
	9/30	Develop a short script for presentation	1.5		
	10/1	Finished up script and did research on design fabrication methods	1		
Sophia	9/29	Created figures for competing designs	0.75	3.25	17
	9/30	Worked on preliminary presentation	1.5		
	10/1	Met with team to discuss presentation	1		