Multi-chamber culture insert for connected neuronal aggregates

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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.

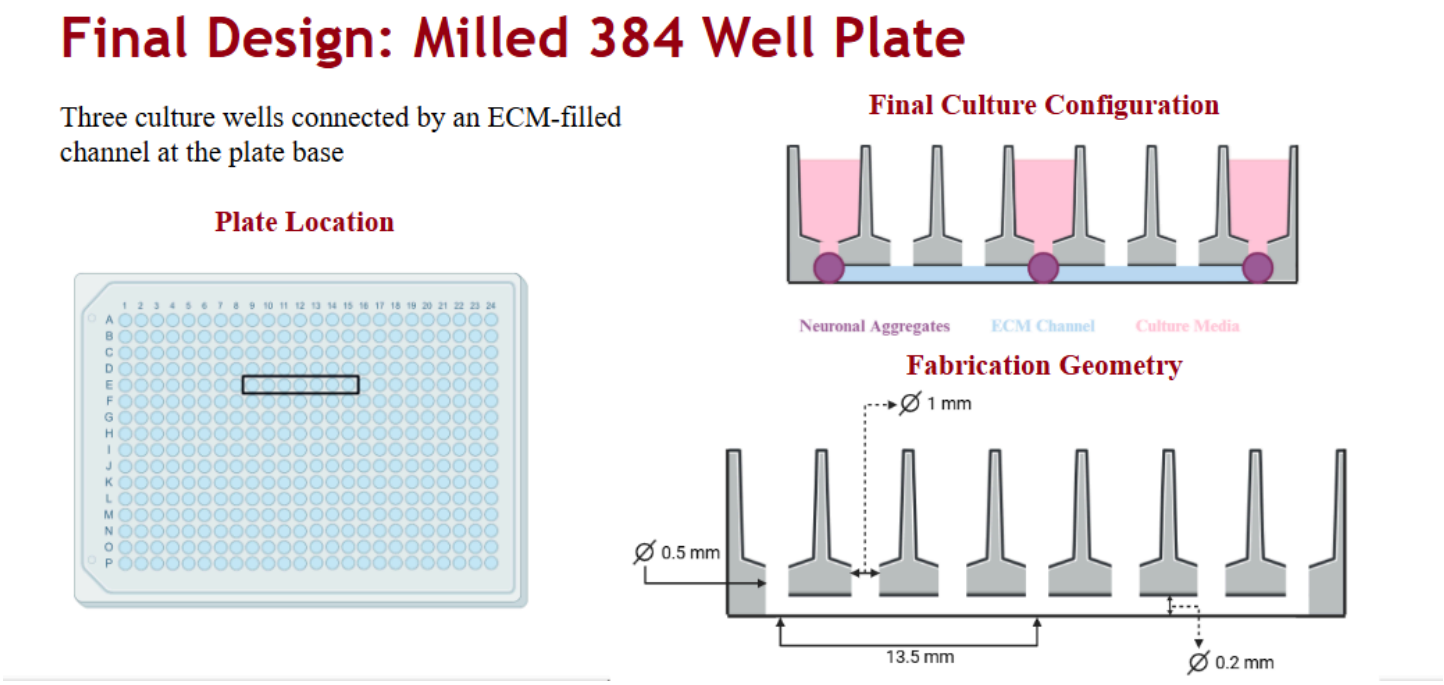
Brief status update

The team has been working on testing ECM loading and media transfer within the device. Within the past week, dimensions of the well plate have been optimized and we are in the process of testing those. Additionally, we are starting to make a funnel like insert design on Fusion that can be utilized in the centrifugation process of the workflow.

Difficulties / advice requests

- N/A

Current design



Will update this figure later on once we decide on geometry that works.

- Current design
  - 1 mm port diameters
  - 1 well or no well spacing in between aggregates
  - 0.35 mm channel diameter

Materials and expenses

Item	Description	Manufac-turer	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. Meet with client to give device for testing
2. Continue testing

Next week's individual goals

- Greta
  - Conduct diffusion testing
  - Conduct research into methods of spinning the aggregates down into place
- Eli
  - Continue design iteration
  - Conduct diffusion testing
- Sam
  - Consider show-and-tell feedback
  - Work on design iterations
- Safia
  - Conduct diffusion testing
  - Finish designing negatives for funnel insert on fusion
- Sri
  - Pursue further testing and use feedback from mentor and show-and-tell to make adjustments necessary
  - Continue research to fill gaps in design that are evident
- Sophia
  - Continue testing
  - Look more into funnel insert designs

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	X	X	X	X						
Preliminary Designing				X	X										
Final Design Prototyping						X	X	X	X						
Testing															
Deliverables															
Progress Reports		X	X	X	X	X	X	X	X						

BME Design: 200, 300

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

- Greta
  - Continue testing device
  - Fabricate second device and look into ways to optimize device/tape geometry for better confinement
- Eli
  - Fabricate another device for client
  - Continue testing
- Sam
  - Prepare for prototype and show and tell.
  - Research better adhesives for our device.
  - Continue testing.
- Safia
  - Develop testing protocols further and begin testing.
  - Look into methods of getting ECM into ports, such as with needle syringes.
- Sri
  - Research more testing methods for the design
  - See if we can optimize design and design channels of other sizes
- Sophia
  - Develop a testing plan/procedure
  - Look into laser cutting option, if necessary
  - Research other possible channel sizes

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (
Greta	10/27	Mill and clean well plate	2	5.75	40
	10/28	Met with team to prepare for show and tell and plan testing	1.5		
	10/29	Laser cut tape and met with team to test ECM loading	2.25		
Eli	10/26	Redesigned well plate	1	5	34.25
	10/28	Redesigned tape file	0.5		
	10/28	Prepared for show and tell with team	1.5		
	10/29	Conducted more loading testing	2		
Sam	10/28	Prepared for testing and show-and-tell with team	1.5	3.5	34.5
	10/29	Conducted loading testing with team	2		
Safia	10/28	Met with team to prepare for show and tell	1	5	34..5

	10/28	Started designing a funnel in fusion.	2		
	10/29	Finished designing funnel in fusion	0.5		
	10/29	Researched aloe vera alternative to test with and interaction of cytotoxic plastic with cell culture. Wrote responses	1.5		
Sri	10/28	Prepared for show-and-tell w/ team (wrote a script)) and did some research on resin and cytotoxicity	1.75	4.25	32
	10/29	Analyzed research articles and performed testing with the team	2.5		
Sophia	10/28	Met with team to prep for show and tell and looked into laser cutter specifications	1.5	3	31.5
	10/28	Looked into cellular models	0.5		
	10/29	Looked into other ECM models for different cellular models	1		