

## **Bone marrow microenvironment culturing system for mesenchymal stem cells**

### **msc\_culture**

**Client:** Dr. Wan-Ju Li

**Advisor:** Dr. Tracy Puccinelli

**Team:** Taylor Marohl [tmarohl@wisc.edu] (920) 412-8765 (Leader)

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**Date:** 2/10/17 – 2/16/17

#### **Problem Statement:**

Mesenchymal stem cells (MSCs) are widely studied for their valuable multipotent character that could enable tissue regeneration, especially in orthopedic injuries. Unfortunately, the yield of MSCs through extraction from bone marrow is low, and cells must be expanded in culture without the risk of spontaneous differentiation. Current culture methods are variable in their ability to maintain MSCs in a multipotent state, and do not adequately attempt to recreate the physiological conditions that prevent differentiation. For this reason, there is a need for a culture system that allows researchers to sustain multipotency in their cells by mimicking the bone marrow microenvironment through substrate stiffness and oxygen concentration.

#### **Last Week's Goals:**

- Start biomaterial experimentation
- Finalize bioreactor design and order all materials
- Create a SolidWorks sketch of the bioreactor
- Finish Midsemester Presentation for Friday
- Work on Midsemester Paper

#### **Summary of Individual/Team Role Accomplishments:**

- **Taylor Marohl:** Wrote progress report.
- **Veronica Porubsky:** Ordered materials and communicated with the client.
- **Michelle Tong:** Attended BSAC meeting.
- **Maddie Meier:** Updated website.

#### **Summary of Design Accomplishments/Literature Search:**

- Maddie and Michelle met with the Instrumentation specialist in the Li lab
  - He is willing to help us with our project as he is able
- Michelle and Taylor met with Charles Allhands in the Student Shop to discuss fabrication of the oxygen chamber
  - He recommended using commercially available “chambers” instead of trying to fabricate one from scratch, reminding us that engineers don’t create their final product on the first try
  - We plan to obtain food-grade containers (which will be air-tight and safe for use with cells) and modify them to include a sealable door and holes for gas lines in and out

- This will allow us to focus more heavily on the circuit and gas components of the project, which are the main design components

**Activities:**

Person	Task	Time	Weekly Total	Sem. Total
Taylor	-Student shop meeting -SolidWorks design -Midsemester presentation prep	-0.5hr -2.5hr -3hr	6 hr	18.5 hr
Veronica	-Biomaterial presentation work/research	-3hr	3 hr	14 hr
Michelle	-BSAC (1/27, 2/10) -Meeting with Ron -Solidworks/fabrication work -Student shop meeting	-2hr -0.5hr -1.5hr -0.5hr	4.5 hr	15.5 hr
Maddie	-Meeting with Ron -Solidworks/fabrication work	-0.5hr -1.5hr	2 hr	11.5 hr
Team	-Team Meeting -Advisor Meeting	-1.5 hr -0.5 hr	2hr	11.5hr

**Goals for This Week:**

- Experiment with biomaterial
- Begin bioreactor fabrication
- Finish midsemester paper

**Schedule for Upcoming Week :**

- **Friday 2:30pm** Advisor Meeting
- **Thursday 6:00pm** Team Meeting

**Difficulties:**

- We have not been able to start biomaterial fabrication yet due to the late arrival of a reagent and our focus on the midsemester presentation
- We think we should be set to get started with fabrication of our bioreactor, we just need to order materials and get going

**Project Schedule/Timeline:**

Color Key:     **Deliverables**     **Bioreactor**     **Biomaterial**     **Outreach**     **Questions**

**Mon 1/16 - Sun 1/22**

- **Discuss O2 bioreactor ideas (Maddie)**
  - **Take the week to research/plan any updates**
- **Update on biomaterial**
  - **Need to formulate a rationale for choosing our stiffness goal (100-200 Pa) so it can be included in our paper.**

- Ask Dr. Puccinelli about format of midsemester report (scientific publication?)
- Plan Outreach project

#### Mon 1/23 - Sun 1/29

- Plan a client meeting
- Meet with Dr. Nimunkar/Bioinstrumentation TA to discuss bioreactor ideas/difficulties
- Design matrix for bioreactor
  - Decide on design, start discussing/researching materials
- Order new biomaterial materials, hopefully they arrive this week
- Finish planning Outreach project

#### Fri 1/27 - Thurs 2/2

- Conduct outreach at Bayview Community Center on Tues (1/31) from 3:45-4:45pm
- Michelle - start MSC cell training in Li lab
- Finalize biomaterial protocol
- Meet with Dr. Nimunkar/Bioinstrumentation TA to discuss bioreactor ideas/difficulties
- PDS due Friday 2/3
- Begin preparing midsemester paper

#### Fri 2/3 - Thurs 2/9 (VERONICA GONE 2/8-2/10)

- Biomaterials delivered, start experimentation
- Bioreactor design matrix, finalize bioreactor design, discuss materials
- Continue working on midsemester paper, start working on presentation

#### Fri 2/10 - Thurs 2/16 (MADDIE OUT 2/15-2/16)

- Biomaterial experimentation
- Order bioreactor materials
- Bioreactor Soliworks
- **MIDSEMESTER PRESENTATION Friday 2/17**
- Finish midsemester paper

#### Fri 2/17 - Thurs 2/23 (VERONICA GONE 2/21-2/25)

- Begin bioreactor fabrication
- **MIDSEMESTER PAPER DUE Wednesday 2/22**

#### Fri 2/24 - Thurs 3/2 (VERONICA GONE 3/1-3/5)

- Biomaterial experimentation
- Continue bioreactor fabrication

#### Fri 3/3 - Thurs 3/9

- Fabricate multiple biomaterial stiffnesses, freeze
- Finish bioreactor fabrication

#### Fri 3/10 - Thurs 3/16

- Start cell evaluation on biomaterial
- Bioreactor validation

#### Fri 3/17 - Thurs 3/23

- Continue cell evaluation on biomaterial
- **SPRING BREAK**

Fri 3/24 - Thurs 3/30

- Finish cell evaluation on biomaterial, analyze data
- Begin cell evaluation on bioreactor

Fri 3/31 - Thurs 4/6 (MADDIE GONE THIS WEEK)

- Continue cell evaluation on bioreactor

Fri 4/7 - Thurs 4/13

- Finish cell evaluation on bioreactor, analyze data
- Begin working on poster, final report

Fri 4/14 - Thurs 4/20

- Finish poster, continue working on final report

Fri 4/21 - Thurs 4/27

- **Fri 4/28 FINAL POSTER PRESENTATION Friday 4/28**
- Finish final report

Fri 4/28 - Thurs 5/4

- **Wed 5/3 FINAL REPORT DUE Wednesday 5/3**