Bone marrow microenvironment culturing system for mesenchymal stem cells

msc_culture

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Date: 3/17/17 – 3/30/17

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:

- Biomaterial experimentation
- Finalize cell evaluation plan with Li lab
- Finish bioreactor fabrication

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:

- Biomaterial
    - Contacted Tony Berger about gels not solidifying and he said it is difficult to get stiffnesses below 1 kPa
        - Our plan is to fabricate gels with as low of stiffness as possible so that we can start cell evaluation
    - Currently troubleshooting salt leaching, as the salt solution has been dispersing into a ring instead of distributing throughout the well, which causes uneven polymerization
- Bioreactor
    - We plan to do some fabrication tonight at our team meeting, so should have updates for you tomorrow at the Advisor meeting
- Michelle wrote the Outreach deliverables!

Activities:

Person	Task	Time	Weekly Total	Sem. Total
Taylor	-Progress report	-0.5hr	0.5 hr	40.5 hr
Veronica	-Email with Tony Berger -Gel fabrication -Salt leaching and dialysis research	-0.5hr -2hr -2hr	4.5 hr	36 hr
Michelle	-Outreach deliverables -Meeting with Ron	-2hr -1.5hr	3.5 hr	32 hr
Maddie	-Meeting with Ron	-1.5hr	1.5 hr	22.5 hr
Team	-Advisor Meeting -Team Meeting	-0.5hr -2hr	2.5 hr	17.5 hr

Goals for This Week:

- Finalize cell evaluation plan with Li lab
    - Plan to set up a meeting with Dr. Li and the grad student we'll be working with to discuss
- Fabricate multiple biomaterial stiffnesses, freeze
    - Include RGD
- Finish bioreactor fabrication
    - Validate gas sensors
- Bioreactor validation
    - Gas concentration maintenance over 24 hours
    - Return to set concentration after disturbance (door opening)

Schedule for Upcoming Week:

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

Difficulties:

- Having technical issues with biomaterial fabrication
    - Salt leaching
    - Gels not polymerizing
    - Each replicate takes up a lot of material

Project Schedule/Timeline:

Color Key: Deliverables Bioreactor Biomaterial Outreach Questions

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

- Finalize cell evaluation plan with Li lab
- Fabricate multiple biomaterial stiffnesses, freeze
    - Include RGD
- Finish bioreactor fabrication
- Bioreactor validation
    - Gas concentration maintenance over 24 hours
    - Return to set concentration after disturbance

Fri 4/7 - Thurs 4/13

- Start cell evaluation on biomaterial
- Begin cell evaluation on bioreactor
- Begin working on poster, final report

Fri 4/14 - Thurs 4/20

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