

## Progress Report 1: October 19 – October 25

*Title: Device to monitor/control differentiation of stem cells to pancreas*  
*Client: Victoria Browning Ph.D.*  
*Advisor: Naomi Chesler Ph.D.*  
*Team Members: Dhaval Desai (Communications)*  
*Kyle Herzog (Team Leader)*  
*Tim Pearce (BSAC)*  
*Jon Baran (BWIG)*

### Problem Statement

Embryonic stem cells (ESCs) have the capacity to differentiate into every cell type in the body, and therefore can theoretically be used to generate cells and tissues to cure a variety of diseases. Our client in the Odorico Lab (Department of Surgery) has derived foregut-committed cell lines from ESCs (which correspond to progenitor cells of the gut region that develops primarily into pancreas) and would like to differentiate these ESCs into insulin-producing pancreatic beta-like cells. These cells could replace or supplement transplanted donor beta cells. The mechanisms required to differentiate ESCs into these pancreatic cells is currently unknown, and this device would aid in researching such mechanisms. Our client would like to test a large number of growth factors for their ability to affect conversion of these precursor cells to mature insulin-secreting cells. In addition, a recapitulation of the 3-dimensional embryonic environment to prompt cells to adopt a pancreatic cell fate, perhaps using a Matrigel substrate, is desirable. A small scale cell culture using microfluidics to set up growth factor gradients is one approach that could be successful.

### Restatement of Team's Goals

- Give mid semester presentation on Friday (Dhaval, Kyle, Tim, Jon)
- Finish work on design notebooks for mid semester evaluation (Dhaval, Kyle, Tim, Jon)
- Complete mid semester peer evaluations (Dhaval, Kyle, Tim, Jon)
- Meeting Wednesday night to start putting together our first non-flow system (Dhaval, Kyle, Tim, Jon)
- Jon has also begun work on a Matlab program that will help us analyze the diffusion occurring in our system (Jon)
- Update website (Jon)
- Complete progress report (Kyle)

### Summary of Team Accomplishments

- We gave out mid semester presentation on Friday and all went swimmingly.
- We spent the remainder of Friday and the next couple of days through Wednesday working on our mid semester peer and self evaluations and also updating our notebooks so they will be ready to hand in for our mid semester evaluations.
- We met as a team on Wednesday to begin constructing the mask for our first prototype. But while we were there we began discussing the possibility of using the 3D set up as opposed to the 2D set up and we made some realizations
  - Dr. Browning had said that a 3D set up would be better for their experiments
  - The 3D set up is even simpler to construct than the 2D set up, which we realized after beginning to analyze some of the necessary calculations
  - The 3D set up's calculations are much more straight forwardAfter taking all of these things into consideration we are now considering going with the 3D set up, so we have emailed Dr. Browning and Erwin to set up meetings to discuss things like required amount of Matrigel and any necessary precautions needed for imaging.
- Kyle completed the PDS, and Jon updated the website.

### Statement of Team's Goals

- Begin work on prototype, specifically work on mask for our design
- Meet with Dr. Chesler on Friday to discuss our presentation

### Project Schedule

September 7	Form team, select project, contact client, email team roles to advisor
September 14	Background and research on project, create problem statement, begin PDS
September 21	Brainstorming, begin developing designs
September 28	Brainstorming

October 5	Finalize three alternative designs
October 12	Work on mid-semester presentation (oral and power point)
October 19	Mid-semester presentations
October 25	Submit design notebooks for advisor review
October 26	Design on final design
November 2	Work on design
November 9	Work on design
November 16	Work on design
November 23	Thanksgiving break
November 30	Work on poster presentation
December 7	Final poster presentation, put poster presentation on team web site by 10:00am
December 12	Hand in written report and notebook to advisor
December 14	Final meeting with advisors

### Project Difficulties

- Setting up a maintainable gradient on such a small scale could be very challenging, and all of the possible methods are considerably complicated and will require significant research
- If we decide to go with a non-flow system there has been relatively little research performed on such a system so much of the work would have to be trial and error

### Activities

- **Dhaval (Communications)**
  - Presentations (2 hr)
  - Notebook and peer evaluations (3 hr)
  - Team meeting (2.0 hr)
  - Total: 7.0 hrs
- **Kyle (Team Leader)**
  - Presentations (2 hr)
  - Notebook and peer evaluations (1 hr)
  - Team meeting (2.0 hr)
  - Progress report (0.5 hrs)
  - Total: 5.5 hrs
- **Tim (BSAC)**
  - Presentations (2 hr)
  - Notebook and peer evaluations (3 hr)
  - Team meeting (2.0 hr)
  - Total: 7.0 hrs
- **Jon (BWIG)**
  - Presentations (2 hr)
  - Notebook and peer evaluations (3 hr)
  - Team meeting (2.0 hr)
  - Website (0.5 hr)
  - Matlab (1 hr)
  - Total: 8.5 hrs
- **Total Team Hours for this Week: 28.0 hrs**
- **Running Total for Each Member:**
  - Dhaval – 29.5 hrs
  - Kyle – 31.5 hrs
  - Tim – 29 hrs
  - Jon – 28.5 hrs

### Project Timeline (next page)

Task	September			October			November				December				
	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14
<b>Preliminary Steps</b>															
Assign team roles	█														
<b>Meetings</b>															
Meeting with client	█		█												
Friday team meetings	█	█	█	█	█	█									
Meetings outside of class	█	█	█		█		█								
Semester wrap up with advisor and final client meeting															
<b>Design (pre-mid-semester)</b>															
Brainstorming design ideas	█		█	█	█	█		█							
Researching articles / products	█	█	█	█											
<b>Design (post-mid-semester)</b>															
Researching materials and cost		█	█	█											
Prototype building								█							
Prototype testing								▨							
<b>Deliverables</b>															
Progress Reports	▨	▨	▨	▨	▨	▨	▨	▨							
Project Design Specification	█	█	█	█			█								
Mid-semester presentation							█	█							
Final presentation															
Final paper															
<b>Other duties</b>															
BSAC meetings		█		█		█									
Updating website				▨	▨	▨	▨								
Contacting client/suppliers	▨		▨	▨		▨	▨								

<b>Key:</b>	█ Dhaval	▨ Kyle	▨ Tim	▨ Jon	█ All
	█ Holiday(s)				

Only individual tasks are indicated with special gradients

**Expenses**

There are no expenses to be reported.