Multidisciplinary Senior Design
Project Readiness Package

Project Title:	Electric Bioreactor
Project Number: (assigned by MSD)	P18082
Primary Customer: (provide name, phone number, and email)	Dr. Bailey and BME department jlbbme@rit.edu
Sponsor(s): (provide name, phone number, email, and amount of support)	Dr. Bailey jlbbme@rit.edu $500 from BME department
Preferred Start Term:	Fall 2017
Faculty Champion: (provide name and email)	Dr. Bailey jlbbme@rit.edu
Other Support:	As applicable
Project Guide: (assigned by MSD)	

Prepared By Date

Received By Date

Project Information

* Overview:

Cell culture is typically performed on two-dimensional plastic surfaces under static conditions. Cells *in vivo* do not live in these conditions and thus studying cells in these conditions is not representative. Culturing cells with varied stimuli that is not simply chemically induced is a challenging task.

An advanced cell culture class (BIME 470) will benefit from the ability to study precardiomyocytes under various levels of electrical stimulation. An ideal culture chamber would maintain sterile, standard culture conditions (5% CO_2, 37°C) while applying an electric field over cultured cells. The ability to view the culture with a microscope is crucial for the purpose of the culture system.

* Preliminary Customer Requirements (CR):

CR		Importance (1 must have, 3 good to have)
1	Maintain proper culture conditions including sterility, temperature, humidity, and CO2	1
2	Maintain pH levels of media	1
3	Maintain cell growth for up to 3 weeks	3
4	Allow for viewing of cells during the experiment	2
5	Easy to clean and sterilize	2
6	Apply a static or cyclic voltage across the culture for up to 3 weeks	1
7	Controllable and adjustable stimulation during the experiment	3
8	Verification of correctly applied voltage	2
9	Safe for student population in a course	1
10	Disassembly allows for collection of culture or culture products	3

* **Preliminary Engineering Requirements (ER)**:

Specification		Ideal Value	CR map
Sterility	Resistant to Ethanol	100%	5,1
	Gas exchange is Filtered	100%	1
	Media is Contained	100%	1
Experimentation	Maintains Media pH	7.4	2
	Fits in Incubator		1
	Fits on Microscope during Experiment		4
	Culture Surface Area	>= 25cm^2	10
	Applies a Voltage	<=5V +/- 0.2V	6
	Measures the Applied Voltage	+/- 0.2V	8
	Quickly Adjustable Applied Voltage	<1min	7
Usability	Assembly Time (including seeding cells)	<= 60min	5,9
	Disassembly Time	<= 30min	9
	Software Use Straightforward	No questions from a 3rd year BME student	9
Safety	Shock Hazard during normal operation including moving for media exchange or viewing on microscope	none	9

* **Constraints:**

Must fit generic, EVOS, and Leica microscopes used for class
Must use LabVIEW and MyDaq to control and monitor conditions

* **Project Deliverables:**

Minimum requirements:

- All design documents (e.g., concepts, analysis, detailed drawings/schematics, BOM, test results)
- working prototype
- technical paper
- poster
- All teams finishing during the spring term are expected to participate in ImagineRIT

† **Budget Information:**

Items	Projected Cost
Materials	$300
Sensors	$100
Cell culture disposables	$100
Software	provided

* **Intellectual Property:**
Describe any IP concerns or limitations. According to RIT policy, students have the right to retain any IP they generate during a course, but some students voluntarily agree to be placed on projects where they will be asked to assign their IP. If a sponsor wishes to have a team assign their IP, we need to know ahead of time so that we can place appropriate students on the team.

In order to ensure that students can discuss their projects openly during presentations and job interviews, we ask that no more than ~20% of the project be considered confidential.

Project Resources

† **Required Resources (besides student staffing):**
Describe the resources necessary for successful project completion. When the resource is secured, the responsible person should initial and date to acknowledge that they have agreed to provide this support. We assume that all teams with ME/ISE students will have access to the ME Machine Shop and all teams with EE students will have access to the EE Senior Design Lab, so it is not necessary to list these. Limit this list to specialized expertise, space, equipment, and materials.

Faculty list individuals and their area of expertise (people who can provide specialized knowledge unique to your project, e.g., faculty you will need to consult for more than a basic technical question during office hours)	**Initial/ date**
Environment (e.g., a specific lab with specialized equipment/facilities, space for very large or oily/greasy projects, space for projects that generate airborne debris or hazardous gases, specific electrical requirements such as 3-phase power)	**Initial/ date**
Equipment (specific computing, test, measurement, or construction equipment that the team will need to borrow, e.g., CMM, SEM,)	**Initial/ date**
Materials (materials that will be consumed during the course of the project, e.g., test samples from customer, specialized raw material for construction, chemicals that must be purchased and stored)	**Initial/ date**
Other	**Initial/ date**

† **Anticipated Staffing By Discipline:**
Indicate the requested staffing for each discipline, along with a brief explanation of the associated activities. "Other" includes students from any department on campus besides those explicitly listed. For example, we have done projects with students from Industrial Design, Business, Software Engineering, Civil Engineering Technology, and Information Technology. **If you have recruited students to work on this project (including student-initiated projects), include their names here.**

Dept.	# Req.	Expected Activities
BME	2	Knowledge of requirements for cell culture Testing chamber
CE		

EE		
ISE		
ME	2	Design and assembly of chamber Create LabVIEW program to control and display parameters
Other		