

# Engineering Student Technology Committee

<http://www.engr.colostate.edu/ESTC>

**College of Engineering**

**Colorado State University**

**1. Title of Proposal:** BioRadios for the Biomedical Engineering Teaching Laboratory

## **2. Proposal Participants:**

*Primary Contact for Proposal*

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Department/Major: School of Biomedical Engineering \_\_\_\_\_

*Check One:*     **Faculty**     **Staff**     **Student**

*Additional proposal participants*

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Department/Major: School of Biomedical Engineering \_\_\_\_\_

*Check One:*     **Faculty**     **Staff**     **Student**

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Department/Major: School of Biomedical Engineering \_\_\_\_\_

*Check One:*     **Faculty**     **Staff**     **Student**

## **3. Proposal Abstract (limit to 100 words):**

Approximately 50-100 students each year will take Problems Based Learning Laboratory (BIOM300) in the Biomedical Engineering Teaching Laboratory in Scott. We request funds for 3 BioRadio150 units to be used with existing computers in the lab. The BioRadio150 is a wireless computer-connected electromyograph (EMG) instrument for recording and analyzing EMG data from subjects' brain, heart, or muscle. Currently we have only 3 BioRadios, shared between 9 groups. The limited number causes long waiting periods for students. Continued increasing enrollments will increase the number of groups and thus wait times. Hence, it is critical to obtain at least 3 additional BioRadios.

## **4. Proposal Budget**

*List of items to purchase and cost of each*

1. Three BioRadio-150 Units at \$3,750 each.

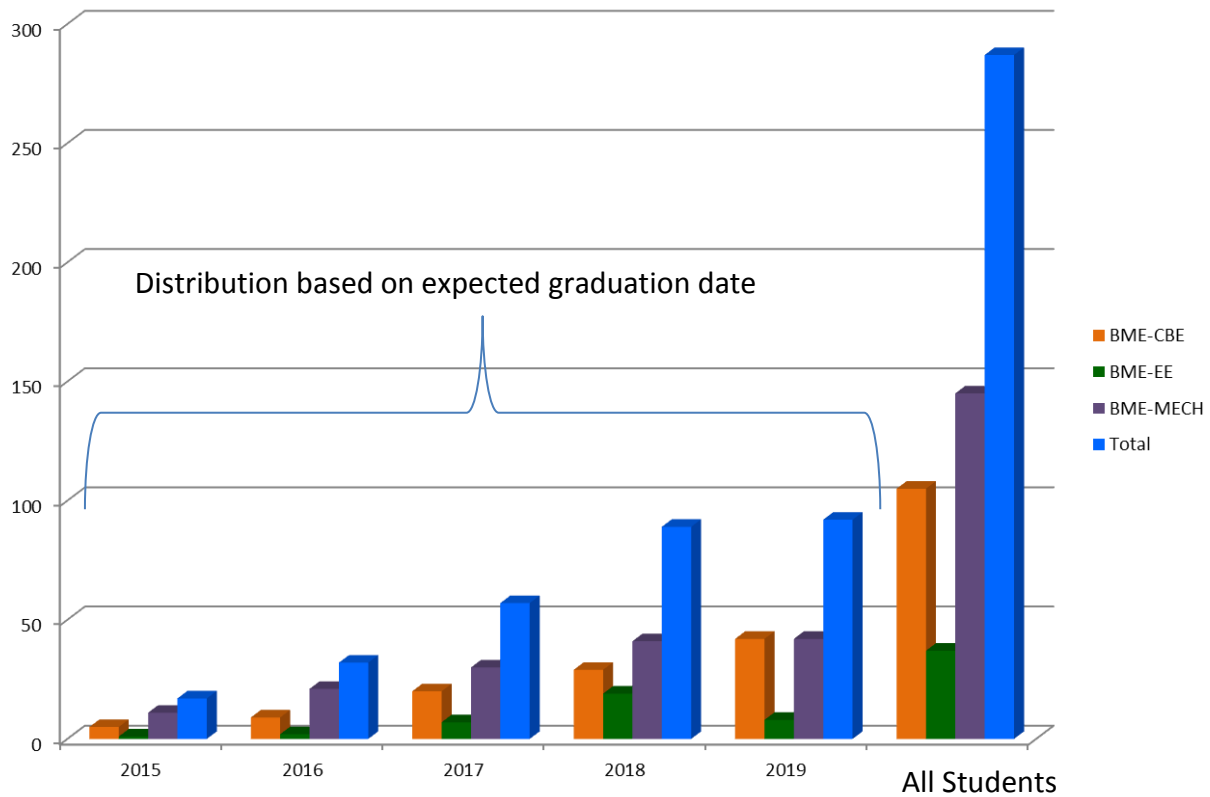
*Dollar or percentage amount requested from ESTC: \$11,250*

The School of Biomedical Engineering (SBME) has already invested nearly \$50,000 for the initial equipment in the BME Teaching Lab, including the purchase of the existing 3 BioRadios. During 2015 SBME will purchase at least another \$5,000 of additional equipment and supplies for the BME Teaching Lab from its annual operating budget.

**5. Full description of proposal:**

**Overview:** The Scott Bioengineering building is home to the Biomedical Engineering Teaching Laboratory (second floor). Approximately 50-100 students will take Problems Based Learning Laboratory (BIOM300) in this space each year. We request funds to purchase and install 3 BioRadio150 units to be used with existing computers in the lab. The BioRadio150 unit is a wireless computer controlled electromyograph (EMG) machine to observe, record, and analyze EMG data from subjects brain, heart, or muscle depending on the problem / experiment. Currently we have only 3 BioRadios, shared between 9 groups. Each group consists of 3-5 students. The limited number of units negatively impact on the experience due to long waiting periods. Given that the number of groups will increase in the coming academic year due to increasing enrollment, it is critical to obtain at least 3 additional BioRadios.

The following plot shows the rapid growth of students in BME dual-BS degree program as well as the breakdown for different partner majors. Based on deposits from admitted students, we expect an entering freshman class of over 100 students this fall. Additionally, the approximately 100 students minoring in BME are permitted to take BIOM 300 if space is available.



### **BIOM 300 Description(overview):**

The title of the course is Problem Based Learning Laboratory. The course is overall designed to provide first hand exposure to the students to interdisciplinary thinking and mind-set through a series of open ended biomedical engineering problems over the semester.

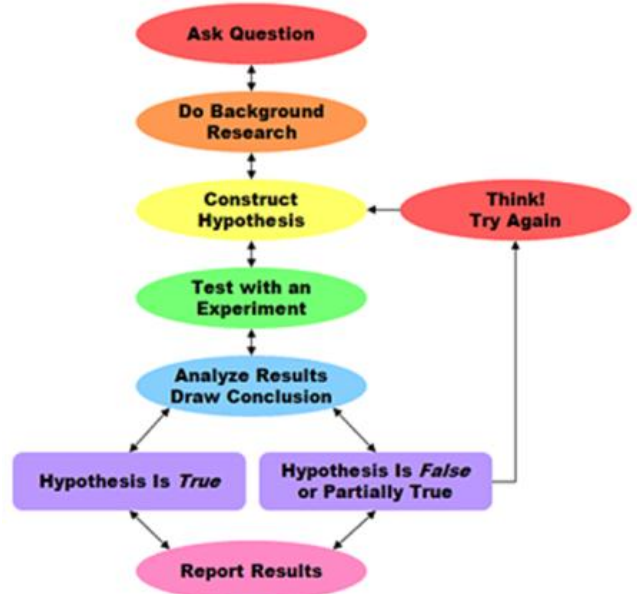
### **COURSE OBJECTIVES**

The main objectives of the course are:

1. Teach students the scientific method
2. Expose students to the main areas of biomedical engineering
3. Provide laboratory experience
4. Develop communication and teamwork skills
5. Learn problem solving strategies

Although all of the objectives are important the main objective of the course is to teach the students the scientific method while exposing them to proper laboratory methods and the main areas of biomedical engineering. Students will leave the class with a working knowledge of the scientific method that can be applied in academic and industrial settings. The students will gain this experience as they team up to develop and execute experiments to solve assigned problems. In this process, they will develop research, communication, teamwork skills, problem solving strategies, and gain laboratory experience.

| <b>The Scientific Method</b>                  | <b>The Engineering Design Process</b>                            |
|---|--|
| State your question                           | Define the problem   |
| Do background research                        | Do background research   |
| Formulate your hypothesis, identify variables | Specify requirements   |
| Design experiment, establish procedure        | Create alternative solutions, choose the best one and develop it |
| Test your hypothesis by doing an experiment   | Build a prototype  |
| Analyze your results and draw conclusions     | Test and redesign as necessary                                   |
| Communicate results                           | Communicate results  |



The areas of biomedical engineering to be covered in the course include:

- Biomechanics
- Biomaterials
- Tissue engineering
- Biomolecular engineering
- Biomedical devices
- Biomedical imaging
- Diagnostics

In addition to supporting BIOM 300, equipment in the BME Teaching Lab is available for BME senior design as well as other classes that use the facility, such as CBE 101.

## Equipment description

### BIO RADIO

The BioRadio is a data acquisition device which can be used to measure physiological signals. It is especially well suited for use as an accelerometer and EMG machine. More features (force plates, O<sub>2</sub> sensors, respiratory measurements, thermometers, etc.) can be added by buying associated accessories. The BioRadio communicates wireless with a computer via a USB transmitter. It is light weight and can clip onto clothing, allowing for experimentation involving movement of the test subject. The expected usable life of the durable BioRadios is in excess of ten years. There are currently three units devoted to BIOM 300.

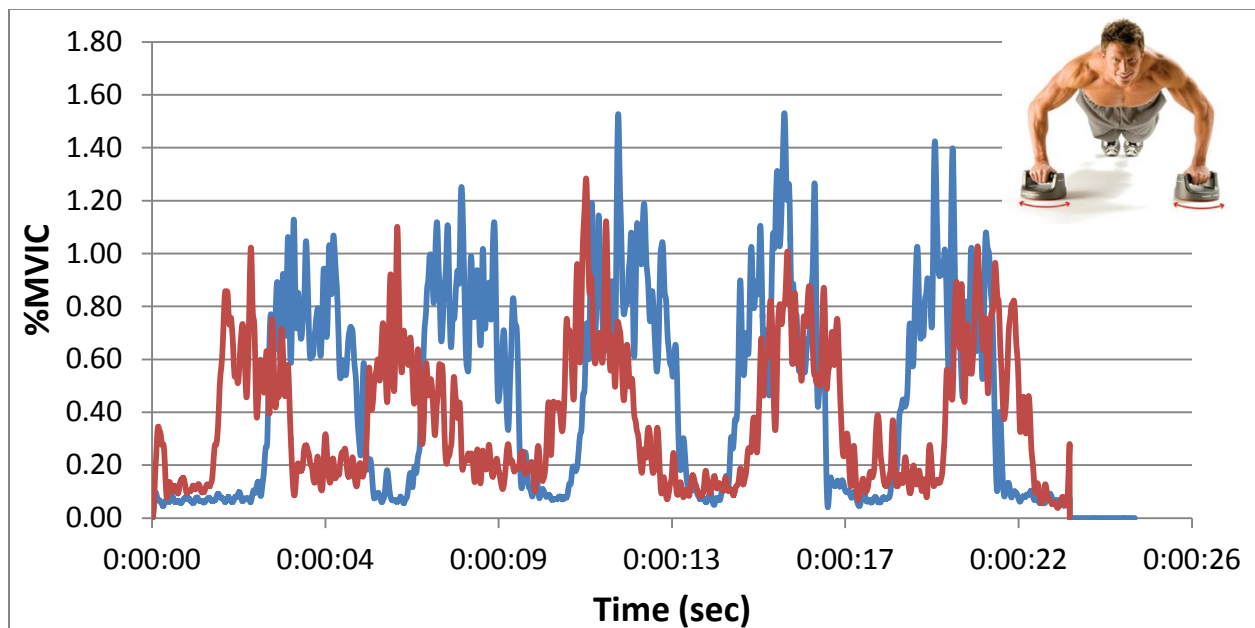
The user's guide for the BioRadio can be found [here](#).

The instructions for setting up EMG on the BioRadio can be found [here](#).

The instructions for setting up ECG on the BioRadio can be found [here](#).

The BioRadio comes with its own software, which is on a CD stored in the BioRadio carrying case. The BioRadio also comes with drivers which allow it to run on Matlab and LabView. They are included in the BioRadio folder in the Equipment folder. Note that the included software can be installed on an infinite number of computers, which allows students to install it on their own laptops.

An example of EMG data acquired by students using a BioRadio in a BIOM 300 experiment comparing muscle activation with (red) and without (blue) Perfect Pushup® exercise aids is shown below.



Courtesy Haley King.

### Summary

In summary, we request \$11,250 to purchase 3 additional BioRadios to serve the rapidly expanding student enrollment in the new Biomedical Engineering Teaching Laboratory.