# Student Designed Laboratory

Introduction

Throughout the course of this lab book you have learned how to record and process various physiological signals. You have learned how these signals can be used for both diagnosis and control. You should now feel comfortable using the BioRadio to monitor and record ECG, EEG, EMG, EOG, and respiration. In this laboratory you will use that knowledge and apply it to a biomedical engineering problem of your own design. You should design your own application for the BioRadio, form a hypothesis, and prove or disprove it using the tools you have developed throughout this course. It is possible that you could monitor one or more of the signals that you have learned about already and apply it to a new application, or you may want to try and monitor a signal not discussed in this laboratory book. The BioRadio can be used to monitor and record any signal within the specifications of the device.
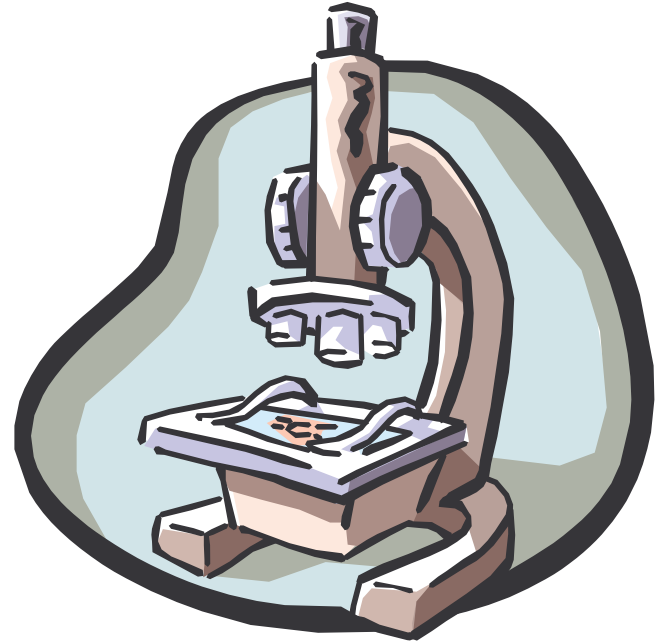
Ideally, you should use the BioRadio LabVIEW™ or MATLAB® drivers to create your own software for this laboratory session. If you do not already have them, you can download the drivers from the CLEVMED website (www.clevemed.com).

Here are some things to keep in mind when formulating your hypothesis:

1. The BioRadio is not a tethered device. Therefore, you could do an experiment in locations not allowed with tethered equipment. Loading the BioRadio software onto a laptop computer makes this a portable device. Some examples you might want to attempt include improving sports performance: place kicking a football, swinging bat, kicking a soccer ball, running out of the blocks, basketball free throws, etc. For any of these types of experiments keep in mind that you need to minimize movement artifact.

2. You may want to use the BioRadio to monitor a signal already covered and then go above and beyond the processing discussed in this book to analyze the data.

3. For the purposes of the laboratories in this book, the only mechanical sensors we used were the piezoelectric effort belt and the thermistor. However, any external sensor could be used with the BioRadio as long as the sensors have an output no greater than +/- 1.25 Volts. There may be some other signal you wish to monitor in which you are capable of scaling the output to this level. An example is an accelerometer for motion analysis.

Equipment required:
- BioRadio
- CleveLabs Lab Kit
- BioRadio User's Guide
- Any other items defined by the students

Background

As a part of the lab project you are completing you should perform a literature review on the topic that you are investigating. You should provide information on any previous work that has been done in this area relevant to your hypothesis.

Experimental Methods

Experimental Setup

The experimental setup that you use should be well documented. Another researcher should be able to read the experimental setup section of your lab report and repeat your experiment using the BioRadio. As part of your experimental setup you should be sure to include all of the methods you undertook to prevent sources of noise from causing artifact in your data. Careful note should be taken of the BioRadio channels that were used, the configuration of those channels, and the sampling rate and resolution used for the experiment.

Procedure and Data Collection

Your lab report should include a detailed methods section that outlines the steps taken once the device was setup on the subject. Any tasks performed by the subject should be outlined in detail.

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Data Analysis

You have learned how each of the signals in this laboratory can be processed to obtain useful information. You may want to use the filtering available in the BioRadio Capture software or your own filtering algorithms (either in real-time or post processing). Remember that if you are using BioRadio Capture to collect data for this lab, you can export the data to an ASCII file and then use a program such as MATLAB to analyze the collected data. Several plots of your data should be made to illustrate your findings.

Discussion

The discussion should include the results of your testing. You should be able to prove or disprove the hypothesis you made from your results. In addition, the discussion should include any problems that you encountered or "strange" data and possible explanations.