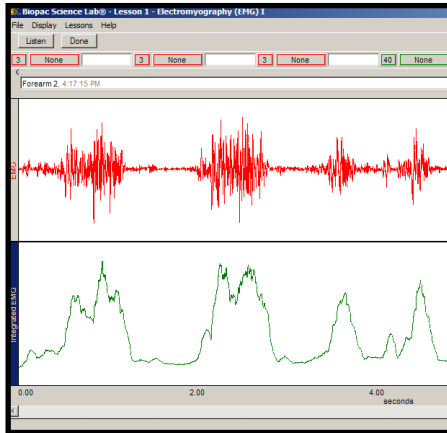




# **Biopac Student Lab** **Home Lesson Guide**



***BSL 4 software guides students to record great life science data from their own bodies. BSL Lessons include active learning segments for student-designed experiments. Additional lessons are available in BSL 2-channel (MP46) and 4-channel (MP36) systems.***



## ***L01 Electromyography (EMG) I***

EMG I investigates the properties of skeletal muscle. Students record and analyze raw and integrated EMG signals associated with the maximum clench strength for dominant and non-dominant hands.

Lesson objectives:

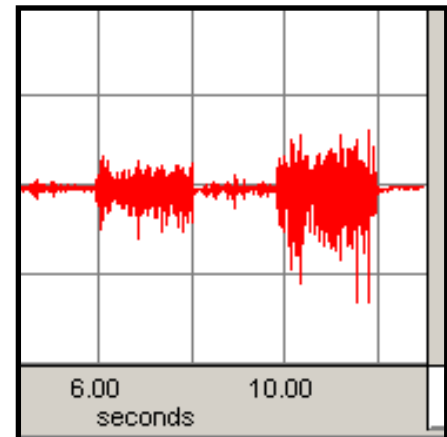
- To observe and record skeletal muscle tonus as reflected by a basal level of electrical activity associated with the muscle in a resting state.
- To record maximum clench strength for right and left hands.
- To observe, record, and correlate motor unit recruitment with increased power of skeletal muscle contraction.
- To listen to EMG “sounds” and correlate sound intensity with motor unit recruitment.

## ***L02 Electromyography (EMG) II***

EMG II examines motor unit recruitment and skeletal muscle fatigue using hand weights or household items. Students examine the level of motor unit recruitment associated with the amount of applied force.

Lesson objectives:

- To record EMG response to increased weights lifted by dominant and non-dominant arms.
- To compare differences between male and female students.
- To observe, record, and correlate motor unit recruitment with increased mechanical work by skeletal muscle.
- To record EMG and Integrated EMG when inducing fatigue.

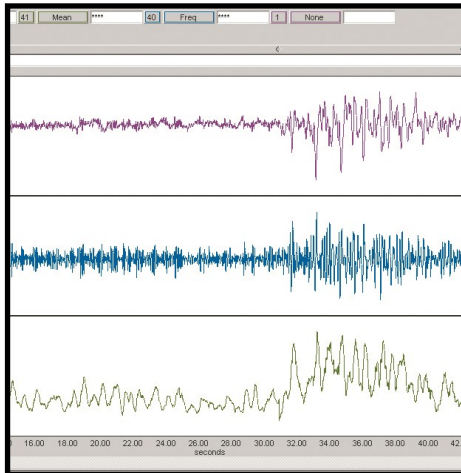


## ***L03 Electroencephalography (EEG) I***

EEG I introduces electroencephalographic recording techniques by examining how alpha, beta, delta, and theta rhythms vary in the occipital lobe while performing different tasks.

Lesson objectives:

- To record an EEG while awake and resting with eyes open and eyes closed.
- To identify and examine alpha, beta, delta, and theta components of the EEG complex.



## L04 Electroencephalography (EEG) II

EEG II explores how the brain receives, integrates, and processes sensory information by examining raw, alpha wave, and alpha-RMS activity from the occipital lobe while completing different tasks.

Lesson objectives:

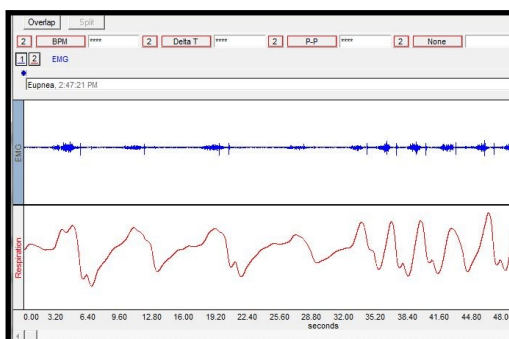
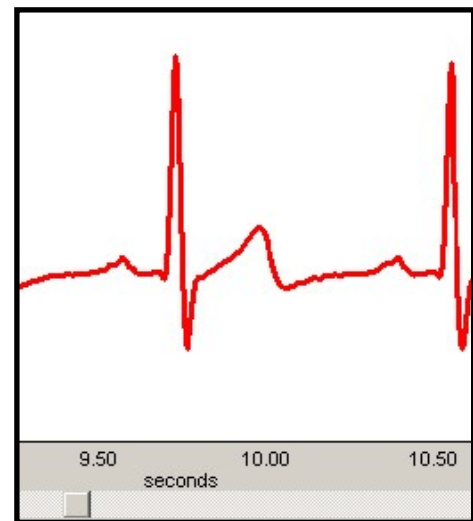
- To record an EEG while awake and resting under the following conditions:
  - ◊ Relaxed with eyes closed.
  - ◊ Performing mental arithmetic with eyes closed.
  - ◊ Hyperventilating.
  - ◊ Relaxed with eyes open.
- To examine differences in the level of alpha rhythm activity during mental arithmetic and hyperventilation, compared to the control condition of eyes closed and relaxed.

## L05 Electrocardiography (ECG) I

ECG I introduces the heart's electrical signals—specifically a lead II ECG recording. Students correlate the electrical events of the ECG (P, Q, R, S, and T components) with the mechanical events of the cardiac cycle. Students also perform tasks designed to promote changes in their own ECG complex and analyze the results.

Lesson objectives:

- To become familiar with the electrocardiograph as a primary tool for evaluating electrical events within the heart.
- To correlate electrical events as displayed on the ECG with the mechanical events that occur during the cardiac cycle.
- To observe rate and rhythm changes in the ECG associated with body position and breathing.

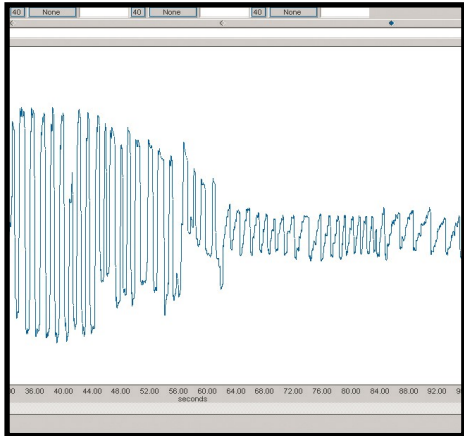


## L08 Respiratory Cycle I

Respiration I examines the changes in respiratory minute volume by recording EMG from respiratory muscles of the thorax while conducting activities associated with voluntarily increasing and decreasing blood carbon dioxide content.

Lesson objectives:

- To observe and record EMGs from thoracic respiratory skeletal muscle during eupnea, or normal unlabored breathing at rest.
- To record changes in the EMG associated with modifications in the rate and depth of the respiratory cycle that occur before, during, and after periods of apnea vera and voluntary apnea and to compare those changes to eupnea.



## L10 Electrooculogram (EOG) I

EOG I examines horizontal eye movement and eye fixation and tracking by recording the duration of saccades and fixation. Students also record spatial position of eye movements.

Lesson objectives:

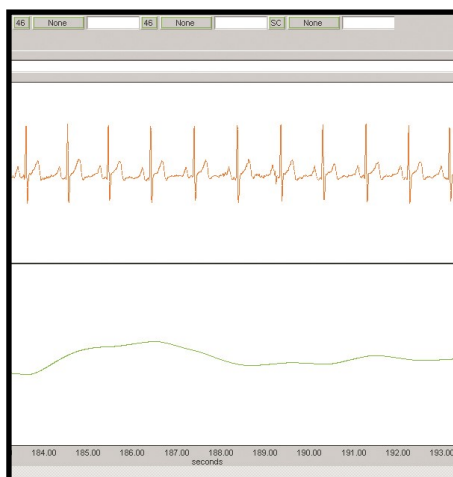
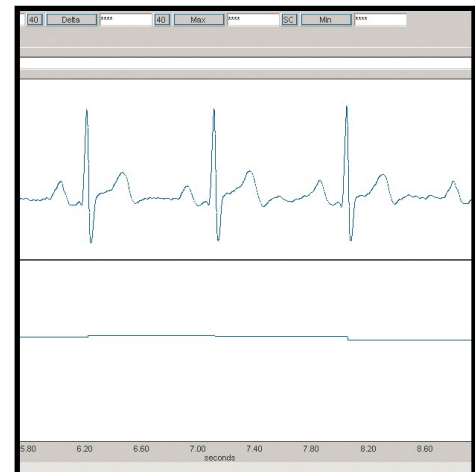
- Record EOG and compare eye movements during real and simulated tracking of a pendulum.
- Record EOG and compare eye movements during real and simulated tracking of an object in the horizontal plane.
- Record and compare the “saccadic” eye movements when reading three different ways; silently (easy), silently (challenging), and aloud (challenging).

## L14 Biofeedback

The Biofeedback lesson explores the concept of biofeedback training and its effect on autonomic control of heart rate. An onscreen, thermometer-style heart rate display rises and falls with changes in heart rate, allowing students to become conscious of their heart rates. Student attempts to influence the reading without physical movement.

Lesson objectives:

- To introduce the concept of biofeedback training for relaxation.
- To measure levels of arousal via heart rate.



## L15 Aerobic Exercise Physiology

In the Aerobic Exercise Physiology lesson, students record ECG and heart rate under a variety of activity conditions. Students see how the electrical activity of the heart and their heart rate vary to meet changing metabolic demands. Students exercise to elevate heart rate.

Lesson objectives:

- To compare and note any changes in the student’s Lead II ECG recorded during different stages of aerobic exercise.
- To assess the effect of aerobic exercise in cardiac autonomic regulation.