Learning Goals and Outcomes for LabScribe Physiology Exercises

The iWorx 214 and LabScribe V2.0 Tutorial Chapter

Experiment T-1: LabScribe Tutorial

Learning Goals:

1. Students will be able to successfully operate both the iWorx A/D converter and the LabScribe software.
2. Students will be able to load the appropriate lab settings group and file, exercise, and attached lab courseware in PDF format for use during lab.
3. Students will be able to attach peripheral devices and transducers to the iWorx A/D converter.
4. Students will be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed the Tutorial will:

1. have become skilled in the workings of the LabScribe software.
2. have been able to successfully use the Load Group function to open the lab exercise and pdf courseware.
3. feel comfortable attaching peripheral transducers to the A/D converter.
4. have used the functions available in the Analysis window to determine values for pulse amplitude and heart rate.

Human Heart Chapter

Experiment HH-1: The Electrocardiogram and Peripheral Circulation

Learning Goals:

1. Students will be able to successfully record a three-lead Electrocardiogram (ECG) and examine the relationship of the ECG to the peripheral circulation.
2. Students will be able to record and look at the effects of hot and cold on an ECG and pulse in the extremities.
3. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded a recognizable ECG.
2. have been able to interpret an ECG, especially the individual P and T waves, and the QRS complex.
3. be able to calculate the heart rate of an individual from the recorded data.
4. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
5. have used the functions available in the Analysis window to determine values for arterial pulse amplitude and heart rate, and the amplitudes of various ECG waves.
6. have been able to examine and interpret the effects of hot and cold on peripheral circulation.

Experiment HH-2: The Electrocardiogram and Heart Sounds

Learning Goals:

1. Students will be able to successfully record a three-lead Electrocardiogram (ECG) and listen to heart sounds using a stethoscope.
2. Students will be able to compare the ECG to the heart sounds and determine when the sounds occur during a cardiac cycle.
3. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded a recognizable ECG.
2. have been able to interpret an ECG, especially the individual P and T waves, and the QRS complex.
3. be able to calculate the heart rate of an individual from the recorded data.
4. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
5. have been able to examine and interpret the heart sounds and when they occur in an ECG recording.

Experiment HH-3: Exercise, the Electrocardiogram, and Peripheral Circulation

Learning Goals:

1. Students will be able to successfully record a three-lead Electrocardiogram (ECG) and examine the relationship between the ECG and the peripheral circulation.
2. Students will be able to record and look at the effects of exercise on an ECG and pulse in different subjects during the lab period.
3. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded a recognizable ECG.
2. have been able to interpret an ECG, especially the individual P and T waves, and the QRS complex.
3. be able to calculate the heart rate of an individual from the recorded data.
4. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
5. have used the functions available in the Analysis window to determine values for arterial pulse amplitude and heart rate, and the amplitudes of various ECG waves.
6. have been able to examine and interpret the effects of exercise on ECG and pulse amplitudes and timing.

Experiment HH-4: The Six-Lead Electrocardiogram

Learning Goals:

1. Students will be able to successfully record a six-lead Electrocardiogram (ECG) and interpret a six-lead ECG.
2. Students will interpret data looking at the different ECG leads: I, II, III, aVL, aVR, and aVF.
3. Students will be able to calculate amplitudes of the P, R and T waves; the QRS axis; and the heart angle from the data collected during recording.
4. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded a recognizable six-lead ECG.
2. have been able to interpret an ECG, especially the individual P and T waves, the QRS complex, and answer questions about these waves.
3. be able to calculate the heart angle of an individual from the recorded data.
4. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
5. have used the functions available in the Analysis window to determine values for arterial pulse amplitude and heart rate, and various ECG amplitudes.

Experiment HH-5: The Diving Reflex

Learning Goals:

1. Students will be able to successfully record a pulse using the plethysmograph.
2. Students will be able to record and look at the effects of apnea, and facial immersion into both room temperature and cold water on the pulse wave.
3. As an optional exercise, students will be able to examine the effects of apnea, and facial immersion into both room temperature and cold water on respiration rate and depth.
4. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded a recognizable pulse wave and heart rate trace on a resting individual.
2. have recorded a recognizable pulse wave and heart rate trace on an individual during apnea and facial immersion into room temperature and cold temperature water.
3. be able to calculate the pulse rate of an individual from the recorded data and understand the effects of the diving reflex.
4. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
5. have used the functions available in the Analysis window to determine values necessary for this exercise.
6. as an optional exercise have been able to examine and interpret the effects of apnea, and facial immersion into both room temperature and cold water on respiration rate and depth.

Experiment HH-6: Heart Rate Variability (HRV)

Learning Goals:

1. Students will be able to successfully record a three-lead Electrocardiogram (ECG) and examine heart rate variability (HRV) while resting, after exercise and during a psychological test.
2. Students will be able to record and look at the effects of exercise and a stressful test on HRV.
3. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded a recognizable ECG and be able to calculate the heart rate of an individual from the recorded data.
2. have been able to interpret an ECG, especially the individual P and T waves, and the QRS complex.
3. be able to interpret data to look at HRV after exercise and during a psychological test.
4. answered questions about HRV and how HRV is influenced during times of “stress”.
5. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

Human Circulation Chapter

Experiment HC-1: Blood Pressure, Peripheral Circulation, and Body Position

Learning Goals:

1. Students will be able to successfully record pulse waves using a plethysmograph, and blood pressure using a non-invasive blood pressure cuff (sphygmomanometer).
2. Students will be able to interpret data from these recordings and understand the difference between systolic and diastolic blood pressure.
3. Students will look at the effects of different cuff and body positions on pulse and blood pressure.
4. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have successfully calibrated a non-invasive blood pressure cuff.
2. have recorded recognizable pulse and blood pressure waves and be able to calculate the pulse rate and blood pressure of an individual from the recorded data.
3. have been able to interpret the effects of different cuff and body positions on both pulse and blood pressure.
4. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

Experiment HC-2: Blood Pressure, Peripheral Circulation, and Imposed Conditions

Learning Goals:

1. Students will be able to successfully record pulse waves using a plethysmograph, and blood pressure using a non-invasive blood pressure cuff (sphygmomanometer).
2. Students will be able to interpret data from these recordings and understand the difference between systolic and diastolic blood pressure.
3. Students will look at the effects of imposed conditions doing either short- or long- term experiments. The effects of food additives, exercise, apnea and temperature changes may be examined.
4. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have successfully calibrated a non-invasive blood pressure cuff.
2. have recorded recognizable pulse and blood pressure waves and be able to calculate the pulse rate and blood pressure of an individual from the recorded data.
3. have been able to interpret the effects of different imposed conditions on both pulse and blood pressure.
4. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

Experiment HC-3: Pulse Wave Velocity

Learning Goals:

1. Students will be able to successfully record pulse waves using a plethysmograph and a three-lead electrocardiogram (ECG).
2. Students will be able to interpret data from these recordings and understand the amplitudes and values of the ECG waves.
3. Students calculate pulse wave velocity from the ECG and pulse recording data in a resting subject and in subjects after exercise.
4. Students can perform an optional exercise to determine the effect of different temperatures on the pulse wave velocity.
5. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have successfully recorded pulse waves and an ECG.
2. have been able to calculate the pulse rate and ECG amplitudes of an individual from the recorded data.
3. have been able to calculate the normal resting pulse wave velocity (PWV) and the PWV after hand exercises.
4. been able to calculate the normal resting pulse wave velocity (PWV) and the PWV after the forearm has been exposed to different temperatures (Optional).
5. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

Experiment HC-4: Pulse Contour Analysis

Learning Goals:

1. Students will be able to successfully record pulse waves using a plethysmograph and blood pressure using a non-invasive blood pressure cuff (sphygmomanometer).
2. Students will be able to interpret data from these recordings and understand the difference between systolic and diastolic blood pressure.
3. Students will determine the arterial stiffness, vascular tone, and blood pressures of individual subjects.
4. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have successfully calibrated a non-invasive blood pressure cuff.
2. have recorded recognizable pulse and blood pressure waves and be able to calculate the pulse rate and blood pressure of an individual from the recorded data.
3. interpret the collected data to determine the Student Stiffness Index (SSI) of the subject's major arteries.
4. determine the Student Reflection Index (SRI), the indicator of vascular tone in the subject's large vessels.
5. understand systolic and diastolic blood pressure and make a determination as to whether the subject is hypo-, hyper- or normo-tensive.
6. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

Human Exercise Chapter

Experiment HE-1: Metabolic and Thermal Response to Exercise

Learning Goals:

1. Students will be able to successfully record a pulse using the plethysmograph.
2. Students will be able to calibrate the temperature sensor to accurately measure body skin temperature.
3. Students will be able to examine sweat gland density of subjects at rest.
4. Students should be able to measure the changes in the heart rate, skin temperature, core temperature, and active sweat gland density of subjects during exercise and recovery from exercise.
5. Students will be able to perform a variety of mathematical calculations to determine the amount of work performed, energy used, oxygen consumed, net mechanical efficiency, heat storage, and evaporative heat loss during the course of the experiment.
6. Students will then determine a subject's metabolic and thermal response at rest and during exercise; and calculate relative cardiac health by looking at recovery from exercise.
7. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded both a recognizable pulse wave and skin temperature trace on a resting individual.
2. have recorded a recognizable pulse wave and skin temperature trace on an individual during and after exercise.
3. be able to determine the pulse rate of an individual from the recorded data and understand the effects of exercise on pulse rate and body temperature.
4. calculate net mechanical efficiency and evaporative heat loss in order to understand the metabolic and thermal responses to exercise.
5. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

6. have used the functions available in the Analysis window to determine values necessary for this exercise.
7. as an additional analysis, have calculated the subject's relative cardiac health by examining the time it takes the subject's heart rate to return to normal after exercising.

Experiment HE-2: Recovery from Exercise

Learning Goals:

1. Students will be able to successfully record a pulse using the plethysmograph.
2. Students should be able to measure the changes in the heart rate during exercise and recovery from exercise.
3. Students will be able to determine a subject's overall "Fitness Rating" based on the time it takes the heart rate to return to normal after exercise.
4. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded a recognizable pulse wave at rest.
2. have recorded a recognizable pulse wave on an individual during and after exercise.
3. be able to determine the pulse rate of an individual from the recorded data and understand the effects of exercise on pulse rate.
4. determine a subject's overall fitness and heart health after examining pulse rate recovery from exercise.
5. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
6. have used the functions available in the Analysis window to determine values necessary for this exercise.

Human Kidney Chapter

Experiment HK-1: Human Kidney

Learning Goals:

1. Students will be able to successfully follow experimental procedure for human subjects.
2. Students will gain understanding of the functionality of the human kidney.
3. Students will understand the osmoregulatory controls in the human body.
4. Students will learn accuracy and measuring procedures for urine output.
5. Students will understand the concepts and importance of specific gravity, urinary flow rate, pH, and urinary glucose levels.

Outcomes: Students who have successfully completed this exercise will:

1. have successfully followed laboratory procedures using human subjects and calculated the volumes of solutions to be ingested by these subjects.
2. understand the function of human diuretic hormone (ADH) in the functioning of the kidney.
3. be able to relate different types of fluid intake to overall urine output.
4. be able to calculate specific gravity and understand how it relates to urine concentration.
5. understand and be able to calculate urinary flow rate for different individuals.
6. be able to accurately discuss the importance of urine pH and glucose levels in the healthy functioning of the human kidney.

Human Nerve Chapter

Experiment HN-1: Auditory and Visual Reflexes

Learning Goals:

1. Students will gain an understanding of a reflex arc and how the spinal cord and peripheral nerves function in the human body

2. Students will be able to successfully record responses from subjects to auditory and visual stimuli.
3. Students should be able to measure the response time of their subjects to different cues and relate it to the functioning of the spinal nerves.
4. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. understand and be able to draw a reflex arc.
2. have recorded responses of subjects to both auditory and visual stimuli.
3. determine a subject's response time to various cues.
4. be able to determine the effect of different types of auditory cues on response time.
5. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
6. have used the functions available in the Analysis window to determine values necessary for this exercise.

Experiment HN-2: Stretch Receptors and Reflexes

Learning Goals:

1. Students will successfully trigger and record electromyograms (EMGs) using a reflex hammer and iWorx software, respectively.
2. Students will gain an understanding of the muscles in the leg and how they work and respond to stimuli.
3. Students will gain an understanding of the both the Achilles and patellar stretch reflexes and the reflex arc.
4. Students should be able to measure the conduction times and nerve velocities for the Achilles and patellar reflexes using electromyograms (EMGs).
5. Students will measure the effect of pre-existing tension in the effector muscle, or motor activity in other muscle groups, upon reflex responses.
6. Students will also study the coordination of motor activity in antagonistic muscles.
7. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. understand and be able to draw a reflex arc.
2. have recorded EMG responses of subjects to stimulation of the Achilles and patellar tendons using a reflex hammer.
3. be able to determine the conduction times and nerve velocities using EMG recordings.
4. have measured the effect of pre-existing tension on muscles or muscle groups.
5. have gained understanding of the reasons for different conduction and reaction times of reflexes at different locations on the human body.
6. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
7. have used the functions available in the Analysis window to determine values necessary for this exercise.

Human Muscle Chapter

Experiment HM-1: Grip Strength and Electromyogram (EMG) Activity

Learning Goals:

1. Students will successfully record electromyograms (EMGs).
2. Students will learn how to calibrate a dynamometer and convert pounds to kilograms.
3. Students will gain an understanding of the relationship between the electric current from the nerves and the response of the muscle or muscle group being innervated.
4. Students should be able to measure the EMG produced and corresponding muscle force.

5. Students will measure the force produced by the muscle in both the dominant and non-dominant forearms.
6. Students will also study and measure the effect of fatigue on the muscles in the dominant and non-dominant forearms. Comparison of the measurement will also be examined.
7. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. understand and be able to record an EMG.
2. understand how nerves send electrical signals to muscles to cause a response.
3. be able to determine the relationship between the nerve impulses and the resulting EMG recording.
4. have gained understanding of the reasons for different responses in the dominant and non-dominant forearm, and the correlation between fatigue and muscle strength.
5. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
6. have used the functions available in the Analysis window to determine values necessary for this exercise.

Experiment HM-2: Electromyogram (EMG) Activity in Antagonistic Muscles

Learning Goals:

1. Students will successfully record electromyograms (EMGs) from antagonistic muscle groups in both the forearm and lower leg.
2. Students will learn how levers, fulcrums, and load affect the workings of antagonistic muscles.
3. Students will gain an understanding of the muscle groups involved in flexion, extension, dorsiflexion and plantar flexion.
4. Students will use weights to put load on muscles groups while examining changes in the EMG.
5. Students will gain an understanding of the relationship between the electric current from the nerves and the response of the muscle or muscle group being innervated.
6. Students should be able to measure the EMG produced and corresponding muscle force.
7. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. understand and be able to record an EMG.
2. understand how nerves send electrical signals to muscles to cause a response.
3. be able to determine the relationship between antagonistic muscles during movement.
4. have gained understanding of the relationship between load and muscle activity.
5. have measured the EMG force difference between muscle groups without and without lifting a weight.
6. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
7. have used the functions available in the Analysis window to determine values necessary for this exercise.

Experiment HM-3: Oculomotor Muscle Activity

Learning Goals:

1. Students will successfully record electroculograms (EOGs) from the oculomotor muscle group of the eye.
2. Students will learn how the six oculomotor muscles control eye movement during saccades, pursuit, the vestibular ocular reflex (VOR), and vergence.

3. Students will perform tasks that will generate electrical activity in oculomotor muscles that are unique to each of four different types of eye movement (saccades, VOR, pursuit, and vergence).
4. Students will gain an understanding of the relationship between the electric current from the nerves and the response of the muscle or muscle group being innervated.
5. Students should be able to measure the EMG produced and corresponding muscle force.
6. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. understand and be able to record an EOG.
2. understand how nerves send electrical signals to muscles to cause a response.
3. be able to determine the relationship between saccades and reading; pursuit and following a moving target; VOR and head rotation; and vergence and focusing near to far.
4. have measured the EOG amplitude to determine the motion of the subject's eyes during various oculomotor activities.
5. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
6. have used the functions available in the Analysis window to determine values necessary for this exercise.

Experiment HM-4: Stimulus Response, Work, Summation, and Tetanus in Human Muscle

This exercise requires a stimulus isolator unit which allows students to electrically stimulate various muscles of the human body.

Learning Goals:

1. Students will learn how to apply a stimulus pulse to human muscle to elicit a muscular contraction.
2. Students will record finger twitches to be able to recognize contraction and relaxation times and twitch amplitudes.
3. Students will demonstrate the effect of increasing stimulus strength on the strength of a muscle contraction, the effect of increasing weight on twitch amplitude and work of a preloaded muscle, and the effect of increasing the frequency of stimulation on the contraction strength and muscle fatigue.
4. Students will gain an understanding of the relationship between the electric current from the nerves and the response of the muscle or muscle group being innervated.
5. Students should be able to measure the EMG produced and corresponding muscle force.
6. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. understand and be able to record a simple finger twitch.
2. understand how nerves send electrical signals to muscles to cause a response.
3. be able to determine the relationship between stimulus and muscle twitch amplitudes.
4. understand the concepts of muscle recruitment, fatigue, summation, and tetanus
5. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
6. have used the functions available in the Analysis window to determine values necessary for this exercise.

Human Spirometry Chapter

Experiment HS-1: Breathing Parameters at Rest and After Exercise

Learning Goals:

1. Students will be able to successfully record respiratory cycles.
2. Students should be able to measure respiration volumes including: tidal volume, reserve capacities, vital capacity, and be able to calculate overall lung volume.

3. Students will be able to determine the difference in lung volumes of a subject at rest, immediately after exercise, and up to a few minutes after exercise.
4. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded a recognizable respiratory cycle at rest.
2. have recorded recognizable respiratory cycles on an individual immediately after exercise and a few minutes after exercise.
3. be able to determine the respiratory volumes of an individual from the recorded data and understand the effects of exercise on lung volumes.
4. determine a subject's overall fitness and lung health after examining breathing rate recovery from exercise.
5. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
6. have used the functions available in the Analysis window to determine values necessary for this exercise.

Experiment HS-2: Breathing and Gravity

Learning Goals:

1. Students will be able to successfully record respiratory cycles.
2. Students should be able to measure respiration volumes including: tidal volume, reserve capacities, vital capacity, and be able to calculate overall lung volume.
3. Students will examine the effects of gravity on breathing by measuring the differences in lung volumes of a resting subject while he or she is sitting, standing, or lying down.
4. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded a recognizable respiratory cycle at rest.
2. have recorded recognizable respiratory cycles on an individual while he or she is sitting, standing and lying down.
3. be able to determine the respiratory volumes of an individual from the recorded data and understand the effects of gravity on lung volumes.
4. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
5. have used the functions available in the Analysis window to determine values necessary for this exercise.

Experiment HS-3: Factors that Affect Breathing Patterns

Learning Goals:

1. Students will be able to successfully record respiratory cycles.
2. Students should be able to measure respiration volumes including: tidal volume, reserve capacities, vital capacity, and be able to calculate overall lung volume.
3. Students will examine how factors, like concentrating on the completion of a task or sitting up quickly, influence breathing.
4. Students will record and measure lung volumes during these tasks and answer questions based on the data collected.
5. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded a recognizable respiratory cycle at rest.
2. have recorded recognizable respiratory cycles on an individual while performing different tasks like concentrating on the completion of a problem or sitting up quickly.

3. be able to determine the respiratory volumes of an individual from the recorded data and understand the effects of these tasks on lung volumes.
4. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
5. have used the functions available in the Analysis window to determine values necessary for this exercise.

Experiment HS-4: Lung Volumes and Heart Rate

Learning Goals:

1. Students will be able to successfully record respiratory cycles and pulse waves.
2. Students should be able to measure tidal volume and be able to calculate both breathing and heart rate.
3. Students will determine the heart rate and respiratory sinus arrhythmia (RSA) prominence of a subject breathing at rest.
4. You will also determine the effect of apnea, different inhalation volumes, and the movement of the muscles involved in breathing on heart rate.
5. Students will record and measure lung volumes during these tasks and answer questions based on the data collected.
6. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded recognizable respiratory cycles and pulse waves.
2. be able to measure tidal volume amplitudes, and calculate breathing and heart rate.
3. be able to determine the effects of apnea, use of different muscle groups and inhalation volumes on heart rate.
4. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
5. have used the functions available in the Analysis window to determine values necessary for this exercise.

Human Psychophysiology Chapter

Experiment HP-1: The Electroencephalogram (EEG)

Learning Goals:

1. Students will learn to collect electroencephalogram (EEG) signals from the left and right cerebral hemispheres.
2. Students will learn to recognize common EEG artifacts caused by movements such as eye blinks, facial muscle contractions, and head movement.
3. Students should be able to recognize and analyze Alpha and Beta EEG patterns associated with closed and open eye conditions;
4. Students will observe the Alpha block.
5. Students will test an experimental hypothesis about relative levels of Alpha and Beta EEG waves in each hemisphere in two psychological states.
6. Students will test an experimental hypothesis about personality and EEG.
7. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded recognizable EEG traces for Alpha and Beta waves on both the right and left cerebral hemispheres.
2. be able to recognize common EEG artifacts.
3. be able to determine the effects of eye conditions (open or closed) and Alpha block on an EEG recording.

4. have tested a hypothesis and reached a conclusion about psychological states and brain hemisphere dominance.
5. have taken personality profile test and explored a hypothesis about EEG and personality.
6. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
7. have used the functions available in the Analysis window to determine values necessary for this exercise.

Experiment HP-2: The Galvanic Skin Response (GSR) and Emotion

Learning Goals:

1. Students will learn to measure the tonic level of skin conductance, the frequency of spontaneous conductance responses, and the habituation of the skin conductance response.
2. Students will observe and measure the galvanic skin response (GSR) as an orienting response to being asked neutral content questions.
3. Students will observe and measure the GSR in response to questions with emotional content.
4. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded GSR traces.
2. be able to recognize changes in the GSR as a response to neutral content or emotional content questions.
3. be able to determine and understand the effects of these questions on an individual's GSR.
4. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
5. have used the functions available in the Analysis window to determine values necessary for this exercise.

Experiment HP-3: The Galvanic Skin Response, Deception, Cognitive Complexity, and Vigilance

Learning Goals:

1. Students will learn to measure the tonic level of skin conductance, the frequency of spontaneous conductance responses, and the habituation of the skin conductance response.
2. Students will observe and measure the galvanic skin response (GSR) as an orienting response to being asked neutral content questions.
3. Students will test an experimental hypothesis about deliberate deception, *guilty knowledge*, and the amplitude of the GSR.
4. Students will test an experimental hypothesis about cognitive complexity and the latency of the GSR.
5. Students will test an experimental hypothesis about personality, vigilance, and the lability of skin conductance levels.
6. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have recorded GSR traces.
2. be able to recognize changes in the GSR as a response to neutral content questions and habituation.

3. come to a conclusion after testing the hypothesis on deliberate deception and guilty knowledge. This will allow students to gain an understanding of the nature of Polygraph Tests.
4. come to a conclusion with regard to the hypotheses about cognitive complexity, personality and vigilance; and how these play a role in the GSR of individuals.
5. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
6. have used the functions available in the Analysis window to determine values necessary for this exercise.

Experiment HP-4: Skin Temperature, Stress, Calming, and Embarrassment

Learning Goals:

1. Students will learn to measure and record skin temperature.
2. Students will observe and measure the changes in skin temperature during a mild psychosocial stressor, a mental arithmetic test.
3. Students will measure the effect of calming mental imagery in a biofeedback paradigm on skin temperature.
4. Students will test an experimental hypothesis about embarrassability and, blushing and gender.
5. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have successfully calibrated the temperature probe and recorded skin temperature traces.
2. be able to recognize changes in skin temperature as a result of a mild stressor and when using calming mental imagery.
3. come to a conclusion with regard to the about gender and embarrassability, using changes in skin temperature as the correlating factor.
4. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
5. have used the functions available in the Analysis window to determine values necessary for this exercise.

Experiment HP-5: Heart Rate, Blood Pressure, and Vagal Tone

Learning Goals:

1. Students will learn to measure and record heart rate and blood pressure as a baseline measurement.
2. Students will collect data and analyze heart rate and blood pressure changes during a stressful task and during a reaction time test.
3. Students will test a hypothesis that persons with high perceived shyness and behavioral inhibition have lower Vagal tone than persons with low perceived shyness.
4. Students will learn how these measurements coordinate with heart rate and breathing.
5. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have successfully calibrated the blood pressure cuff (sphygmomanometer) and recorded blood pressure and pulse.
2. be able to recognize changes from baseline measurements in blood pressure and pulse rate during a stressful task and a reaction time test.
3. come to a conclusion with regard to these changes.
4. come to a conclusion about shyness and the relationship with heart rate and breathing, and how this corresponds to vagal tone.

5. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
6. have used the functions available in the Analysis window to determine values necessary for this exercise.

Experiment HP-6: Cynicism/Hostility and the "Hot Reactor"

Learning Goals:

1. Students will participate anonymously in a personality assessment for the cynicism/hostility personality trait.
2. Students will learn to measure and record heart rate and blood pressure as a baseline measurement.
3. Students will collect and analyze heart rate and blood pressure during a social issues debate and during a recovery to baseline period.
4. Students will test hypotheses about personality and changes in heart rate and/or blood pressure that may have occurred during the debate.
5. Students will learn how these measurements coordinate with being a “hot reactor”.
6. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have taken a personality profile test specifically designed to gauge hostile reactions to certain questions.
2. have successfully calibrated the blood pressure cuff (sphygmomanometer) and recorded blood pressure and pulse.
3. learn about current social issues, proper debate procedures and presenting in front of their peers.
4. be able to recognize changes from baseline measurements in blood pressure and pulse rate during a debate on social issues.
5. come to a conclusion about personality with regard to these changes.
6. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
7. have used the functions available in the Analysis window to determine values necessary for this exercise.

Cellular Metabolism Chapter

Experiment CM-1: Oxygen Consumption and Size

Learning Goals:

1. Students will learn to accurately weigh small organisms.
2. Students will learn to calibrate the dissolved oxygen sensor and measure the rate of oxygen consumption over time of different sized organisms.
3. Students will collect and analyze oxygen consumption curves to determine how oxygen consumption is related to the size of an organism.
4. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. have accurately measured the weight of small animals.
2. have successfully calibrated the dissolved oxygen sensor and recorded the oxygen consumption over time of various sized organisms.
3. after analyzing the data collected, be able to relate oxygen consumption to size.
4. come to a conclusion about any trends shown by this experiment.
5. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

6. have used the functions available in the Analysis window to determine values necessary for this exercise.

Experiment CM-2: Mitochondrial Metabolism

Learning Goals:

1. Students will examine one step in the process of the Kreb's Cycle of Cellular Respiration, the oxidation of succinic acid to fumaric acid.
2. Students will use a spectrophotometer to observe changes in the color of dye-labeled mouse liver extract in order to examine rate of reaction.
3. Students will perform three (3) separate experiments: one without cyanide, one in the presence of cyanide, and one using a competitive inhibitor to respiration.
4. Students will collect data, and use linear regression analysis to find the line of best fit for each set of reactions.
5. Students will make a histogram to compare the rate of reaction of color change of the three experiments.

Outcomes: Students who have successfully completed this exercise will:

1. understand the process of Cellular Respiration at the mitochondrial level.
2. be able to successfully use a spectrophotometer to measure color changes over time.
3. understand the concept of competitive inhibition.
4. be able to explain what cyanide does to the rate of a cellular respiration reaction.
5. analyze data and design a histogram for data comparison.
6. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.
7. have used the functions available in the Analysis window to determine values necessary for this exercise.

Animal Nerve Chapter

Experiment AN-1: Membrane Potentials

Learning Goals:

1. Students will dissect a crayfish tail to expose the fast extensor muscles.
2. Students will assemble the equipment to record membrane potentials.
3. Students will understand the Na+/K+ pump and how it works to keep membranes polarized for contraction.
4. Students will test the hypothesis that all fibers within a single muscle are the same and therefore have the same membrane potentials.
5. Students will also test the hypothesis that membrane potentials are dependent upon the concentration gradient of different ions.
6. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. be able to successfully expose the muscles of the crayfish tail and be able to distinguish between the different muscle types.
2. have a better understanding of microelectrode recording from muscle fibers and the equipment used to perform such recordings.
3. gain an understanding of the Na+/K+ pump and how it relates to membrane potentials.
4. record membrane potentials from the different crayfish tail muscles to test a hypothesis and reach a scientific conclusion.
5. test various saline solutions to determine if the concentration of K+ ions has any effect on muscle membrane potentials.
6. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

7. have used the functions available in the Analysis window to determine values necessary for this exercise.

Experiment AN-2: Compound Action Potentials

Learning Goals:

1. Students will dissect a frog leg to extract the sciatic nerve.
2. Students will assemble the equipment needed to be able to stimulate the nerve and record compound action potentials from nerves.
3. Students will understand the different types of fibers that make up the large sciatic nerve.
4. Students will test different hypothesis with regard to nerve function:
    i. Compound action potential: observing the one or more populations of different fiber types.
    ii. Stimulus-response/axon recruitment: observing how the nerve response changes with increased stimulus voltage.
    iii. Conduction velocity: measuring the speed at which action potentials propagate down the axons.
    iv. Effects of temperature: observing how cooling affects the nerve conduction velocity.
    v. Bidirectionality: determining whether axons conduct in both directions.
    vi. Refractoriness: observing how stimulus frequency affects the amplitude of compound action potentials
    vii. Strength-Duration: observing how the amplitude of a stimulus required to stimulate axons is related to the duration of the stimulus.
5. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. be able to successfully excise the sciatic nerve of a frog and be able to understand the different fiber types within the nerve.
2. have a better understanding of electrical stimulation of nerve fibers and the equipment used to perform such stimulation.
3. gain an understanding of compound action potentials and how they relate to nerve function.
4. record compound action potentials from the sciatic nerve to test a variety of hypotheses and reach scientific conclusions.
5. have used the functions available in the Analysis window to determine values necessary for this exercise.
6. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

Experiment AN-3: Neuromuscular Studies

Learning Goals:

1. Students will dissect a frog leg to extract the sciatic nerve and the muscles of the lower limb (either the gastrocnemius or tibialis anterior).
2. Students will assemble the equipment needed to be able to stimulate the nerve and muscles, and record compound action potentials from both.
3. Students will understand the correlation between nerve stimulus and muscle responses.
4. Students will test synaptic delay between nerve and muscle compound action potentials.
5. Students will test different drugs with regard to nerve and muscle function:
    i. eserine.
    ii. curare.
    iii. atropine.
    iv. high acetylcholine concentration.
    v. nicotine.

vi. dantrolene.
vii. high magnesium concentration.
viii. high calcium concentration.

6. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. be able to successfully excise the sciatic nerve and muscles of a frog's leg.
2. have a better understanding of electrical stimulation of nerve fibers and the equipment used to perform such stimulation.
3. gain an understanding of both nerve and muscle compound action potentials and how they relate to each other.
4. record compound action potentials from the sciatic nerve and lower limb muscles to test a variety of hypotheses and reach scientific conclusions.
5. have used the functions available in the Analysis window to determine values necessary for this exercise.
6. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

Animal Muscle Chapter

Experiment AM-1: Skeletal Muscle, Weight and Work

Learning Goals:

1. Students will dissect a frog leg to extract the gastrocnemius muscle of the lower limb.
2. Students will assemble the equipment needed to be able to stimulate the muscle and record muscle twitch.
3. Students will understand the correlation between the stimulus, the muscle twitch amplitude, and the effect of weight on muscle contractions.
4. Students will test afterloading, supporting the weight before contraction; and preloading, hanging the weight on the muscle without support before the contraction.
5. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. be able to successfully excise the gastrocnemius muscle of a frog's leg.
2. have a better understanding of electrical stimulation of the muscle and the equipment used to perform such stimulation.
3. gain an understanding of muscle stimulation and contraction (twitch) and how they relate to each other.
4. record muscle twitches from the gastrocnemius, test a variety of hypotheses and reach scientific conclusions
5. have used the functions available in the Analysis window to determine values necessary for this exercise.
6. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

Experiment AM-2: Skeletal Muscle, Summation and Tetanus

Learning Goals:

1. Students will dissect a frog leg to extract the gastrocnemius muscle of the lower limb.
2. Students will assemble the equipment needed to be able to stimulate the muscle and record muscle twitch.
3. Students will understand the correlation between the stimulus, muscle twitch, and the strength of the stimulation on muscle contraction.
4. Students will test summation and tetanus by repeatedly stimulating the muscle.

5. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. be able to successfully excise the gastrocnemius muscle of a frog's leg.
2. have a better understanding of electrical stimulation of the muscle and the equipment used to perform such stimulation.
3. gain an understanding of muscle stimulation and contraction (twitch) and how they relate to each other.
4. successfully record muscle twitches from the gastrocnemius and correlate the reactions to stimulation to summation and tetanus.
5. have used the functions available in the Analysis window to determine values necessary for this exercise.
6. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

Experiment AM-3: Heart Muscle

Learning Goals:

1. Students will dissect a frog to expose the heart.
2. Students will assemble the equipment needed to be able to stimulate the heart and will record cardiac contractions.
3. Students will understand the correlation between exogenous stimulus and heart muscle response.
4. Students will gather data corresponding to normal heart rhythms.
5. Students will test different parameters with regard to cardiac muscle function:
    i. cold temperature.
    ii. epinephrine.
    iii. atropine.
    iv. isolation of the ventricle.
6. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. be able to successfully isolate the frog heart.
2. have a better understanding of electrical stimulation of the heart muscle and the equipment used to perform such stimulation.
3. gain an understanding of normal cardiac muscle contraction.
4. stimulate and record cardiac muscle contractions to test a variety of hypotheses and reach scientific conclusions.
5. have used the functions available in the Analysis window to determine values necessary for this exercise.
6. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

Experiment AM-4: Uterine Motility

Learning Goals:

1. Students will dissect a female rat to excise the uterus to be able to examine smooth muscle contractions.
2. Students will assemble the equipment needed to be able to record smooth muscle contractions.
3. Students will gather data corresponding to normal rhythmic smooth muscle contractions.
4. Students will test different parameters with regard to uterine muscle function:
    i. methergine.
    ii. acetylcholine.
    iii. atropine.

iv. epinephrine.
v. stretch and tension.

5. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. be able to successfully isolate the rat uterus.
2. gain an understanding of rhythmic smooth muscle contractions.
3. activate and record uterine muscle contractions to test a variety of hypotheses and reach scientific conclusions.
4. have used the functions available in the Analysis window to determine values necessary for this exercise.
5. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

Experiment AM-5: Intestinal Motility

Learning Goals:

1. Students will dissect a rat to excise the lower small intestine.
2. Students will gather data corresponding to normal rhythmic smooth muscle contractions.
3. Students will test different parameters with regard to intestinal function:
   i. stretch.
   ii. acetylcholine.
   iii. curare.
   iv. atropine.
   v. epinephrine.
   vi. serotonin.
   vii. changes in pH.
   viii. changes in calcium levels.
   ix. cyanide.
4. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. be able to successfully isolate the rat small intestines.
2. gain an understanding of rhythmic smooth muscle contractions.
3. activate and record intestinal muscle contractions to test a variety of hypotheses and reach scientific conclusions.
4. have used the functions available in the Analysis window to determine values necessary for this exercise.
5. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.

Fluid Balance Chapter

Experiment FB-1: Osmoregulation

Learning Goals:

1. Students will weigh and observe polychaete worms in different marine salinity dilutions.
2. Students will understand the correlation between saline concentration and osmoregulation in marine organisms.
3. Students will determine the iso- hypo- and hyper- tonic environments based on the loss or gain of weight due to osmosis over time.
4. Students will continue to be successful at using the LabScribe software to move cursors, analyze data, record data to the Journal, and add functions to the Analysis window.

Outcomes: Students who have successfully completed this exercise will:

1. be able to accurately weigh living polychaete worms to determine weight changes due to osmosis.
2. have a better understanding of osmoregulation and survival of marine organisms.
3. understand the processes of osmosis and diffusion as they relate to living organisms.
4. graph the weight changes of the worms in different salinity concentrations over time to be able to visually understand the concepts.
5. have used the functions available in the Analysis window to determine values necessary for this exercise.
6. feel comfortable transferring data to the Journal and interpreting that data to answer questions about their recordings.