

### 2.3.2 Virtual Learning system

The PhysioEX CD ROM is an easy to use laboratory simulation software and lab exercises that consist of 12 exercises containing a total of 63 physiology laboratory activities. It has been installed for facilitating virtual learning programs for the students and teachers from Botany, Zoology, Physics and chemistry departments. It can be used to supplement or act as a substitute for wet labs. PhysioEx allows students to repeat lab experiments as often as they like, perform experiments without harming live animals and conduct experiments that are difficult to perform in a wet laboratory because of time, cost or safety concerns. The PhysioEx 9.0 CD ROM is packed with the latest copy of the manual and is also available at [www.physioex.com](http://www.physioex.com).

The latest version has the following hallmarks.

- a) **Easy step-by-step instructions** so that everything the students need to do to complete the lab is located in one convenient place. Students can gather data, analyse results and check their understanding all on the screen.
- b) **Stop & Think Questions and Predict Questions** help students think about the connection between the activities and the physiological concepts they demonstrate.
- c) **Greater data variability in the results** reflects more realistically the results students would encounter in a wet lab experiment.
- d) **Pre-lab and Post- Lab Quizzes and short answer Review Sheets** are offered for every activity.
- e) **Students can save their Lab Report as a PDF**, which they can print and /or email to their instructor.
- f) **Seven Videos of Lab experiments** demonstrate the actual experiments simulated on-screen making it easy for the students to understand and visualize the context of the simulations.

#### List of experiments

Adobe Flash Player 11  
 File View Control Help

## PhysioEx™ 9.1

- Exercise 1: Cell Transport Mechanisms and Permeability
- Exercise 2: Skeletal Muscle Physiology
  - Overview
  - Activity 1: The Muscle Twitch and the Latent Period
  - Activity 2: The Effect of Stimulus Voltage on Skeletal Muscle Contraction
  - Activity 3: The Effect of Stimulus Frequency on Skeletal Muscle Contraction
  - Activity 4: Tetanus in Isolated Skeletal Muscle
  - Activity 5: Fatigue in Isolated Skeletal Muscle
  - Activity 6: The Skeletal Muscle Length-Tension Relationship
  - Activity 7: Isotonic Contractions and the Load-Velocity Relationship
- Exercise 3: Neurophysiology of Nerve Impulses
- Exercise 4: Endocrine System Physiology
- Exercise 5: Cardiovascular Dynamics
- Exercise 6: Cardiovascular Physiology
- Exercise 7: Respiratory System Mechanics
- Exercise 8: Chemical and Physical Processes of Digestion
- Exercise 9: Renal System Physiology
- Exercise 10: Acid-Base Balance
- Exercise 11: Blood Analysis
- Exercise 12: Serological Testing

**PEARSON** Copyright © 2013 Pearson Education. All rights reserved. Pearson Benjamin Cummings is an imprint of Pearson  
[Legal Notice](#) | [Privacy Policy](#) | [Permissions](#)

**Criterion V: Student Support and Progression**

Experiment 1: The Muscle Twitch and Latent Period(

Adobe Flash Player 11  
 File View Control Help

PEX Exercise 2: Skeletal Muscle Physiology > Activity 1: The Muscle Twitch and the Latent Period

Overview Objectives Introduction Pre-lab Quiz Experiment Post-lab Quiz Review Sheet Lab Report

**Objectives**

1. To understand the terms excitation-contraction coupling, electrical stimulus, muscle twitch, latent period, contraction phase, and relaxation phase.
2. To initiate muscle twitches with electrical stimuli of varying intensity.
3. To identify and measure the duration of the latent period.

1 of 1

CCleaner

**CCleaner Alert**

Cleaning can save 775 MB of disk space.

Click here to open CCleaner

Experiment 1: The Muscle Twitch and Latent Period

Adobe Flash Player 11  
 File View Control Help

PEX Exercise 2: Skeletal Muscle Physiology > Activity 1: The Muscle Twitch and the Latent Period

Overview Objectives Introduction Pre-lab Quiz Experiment Post-lab Quiz Review Sheet Lab Report

**Introduction**

A **motor unit** consists of a **motor neuron** and all of the **muscle fibers** it innervates. The motor neuron and a muscle fiber intersect at the **neuromuscular junction** (view [Figure 2.2](#)). Specifically, the neuromuscular junction is the location where the axon terminal of the neuron meets a specialized region of the muscle fiber's plasma membrane. This specialized region is called the **motor end plate**.

The events that occur at the neuromuscular junction lead to the **end-plate potential**. An action potential in a motor neuron triggers the release of acetylcholine from its terminal. Acetylcholine then diffuses onto the muscle fiber's plasma membrane (or **sarcolemma**) and binds to receptors in the motor end plate, initiating a change in ion permeability that results in a *graded depolarization* of the muscle plasma membrane (the end-plate potential). The end-plate potential triggers a series of events that results in the contraction of a muscle cell. This entire process is called **excitation-contraction coupling**.

You will be simulating excitation-contraction coupling in this and subsequent activities, but you will be using electrical pulses, rather than acetylcholine, to trigger action potentials. The pulses will be administered by an electrical stimulator that can be set for the precise voltage, frequency, and duration of shock desired. When applied to a muscle that has been surgically removed from an animal, a single electrical stimulus will result in a **muscle twitch**—the mechanical response to a single action potential. A muscle twitch has three phases: the latent period, the contraction phase, and the relaxation phase (view [Figure 2.3](#)).

1 of 2

**Criterion V: Student Support and Progression**

Experiment 1: The Muscle Twitch and Latent Period

Adobe Flash Player 11  
 File View Control Help

PEx Exercise 2: Skeletal Muscle Physiology > Activity 1: The Muscle Twitch and the Latent Period

Overview Objectives Introduction Pre-lab Quiz Experiment Post-lab Quiz Review Sheet Lab Report

**Pre-lab Quiz**

1. Skeletal muscles are connected to bones by

- a. joints.
- b. tendons.
- c. ligaments.
- d. motor axons.

Check Answer

1 of 5

Experiment 1: The Muscle Twitch and Latent Period

Adobe Flash Player 11  
 File View Control Help

PEx Exercise 2: Skeletal Muscle Physiology > Activity 1: The Muscle Twitch and the Latent Period

Overview Objectives Introduction Pre-lab Quiz Experiment Post-lab Quiz Review Sheet Lab Report

1. Note that the voltage on the stimulator is set to 0.0 volts. Click **Stimulate** to deliver an electrical stimulus to the muscle and observe the tracing that results.

Muscle Length (mm): 75

Stimulate

Voltage (V): 0.0

Force (g): 0.0

Active

Passive

Total

Measure

Time (msec)

Record Data

Clear Tracings

Force (g)

Time (msec)

Back Next

Undo Reset Submit

**Criterion V: Student Support and Progression**

**Experiment 1: The Muscle Twitch and Latent Period**

Adobe Flash Player 11

File View Control Help

**PEX** Exercise 2: Skeletal Muscle Physiology > Activity 1: The Muscle Twitch and the Latent Period

Overview Objectives Introduction Pre-lab Quiz Experiment Post-lab Quiz Review Sheet Lab Report

1. Note that the voltage on the stimulator is set to 0.0 volts. Click **Stimulate** to deliver an electrical stimulus to the muscle and observe the tracing that results.

Muscle Length (mm) 75

Stimulate Voltage (V) 0.0 Force (g) 0.0 Active 0.0 Passive 0.0 Total Measure Time (msec) ---

Record Data	Voltage	Length	Active Force	Passive Force	Total Force	Latent Period
	0.0	75	0.0	0.0	0.0	---

Back Next Undo Reset Submit

**Experiment 1: The Muscle Twitch and Latent Period**

Adobe Flash Player 11

File View Control Help

**PEX** Exercise 2: Skeletal Muscle Physiology > Activity 1: The Muscle Twitch and the Latent Period

Overview Objectives Introduction Pre-lab Quiz Experiment Post-lab Quiz Review Sheet Lab Report

2. The tracing on the oscilloscope indicates active muscle force. Note that no muscle force developed because the voltage was set to zero.

Click **Record Data** to display your results in the grid.

Muscle Length (mm) 75

Stimulate Voltage (V) 3.0 Force (g) 1.04 Active 1.04 Passive 0.0 Total Measure Time (msec) ---

Record Data	Voltage	Length	Active Force	Passive Force	Total Force	Latent Period
	0.0	75	0.0	0.0	0.0	---
	3.0	75	1.04	0.0	1.04	---

Back Next Undo Reset Submit

**Criterion V: Student Support and Progression**

**Experiment 1: The Muscle Twitch and Latent Period**

Adobe Flash Player 11

File View Control Help

PEx Exercise 2: Skeletal Muscle Physiology > Activity 1: The Muscle Twitch and the Latent Period

Overview Objectives Introduction Pre-lab Quiz Experiment Post-lab Quiz Review Sheet Lab Report

1. Note that the voltage on the stimulator is set to 0.0 volts. Click **Stimulate** to deliver an electrical stimulus to the muscle and observe the tracing that results.

Muscle Length (mm) 75

Stimulate Voltage (V) 4.0 Force (g) 1.32 Active 0.0 Passive 1.32 Total Measure Time (msec)

Voltage	Length	Active Force	Passive Force	Total Force	Latent Period
0.0	75	0.0	0.0	0.0	----
3.0	75	1.04	0.0	1.04	----
4.0	75	1.32	0.0	1.32	----

Record Data

Undo Reset Submit

**Experiment 1: The Muscle Twitch and Latent Period**

Adobe Flash Player 11

File View Control Help

PEx Exercise 2: Skeletal Muscle Physiology > Activity 1: The Muscle Twitch and the Latent Period

Overview Objectives Introduction Pre-lab Quiz Experiment Post-lab Quiz Review Sheet Lab Report

1. Note that the voltage on the stimulator is set to 0.0 volts. Click **Stimulate** to deliver an electrical stimulus to the muscle and observe the tracing that results.

Muscle Length (mm) 75

Stimulate Voltage (V) 5.0 Force (g) 1.51 Active 0.0 Passive 1.51 Total Measure Time (msec)

Voltage	Length	Active Force	Passive Force	Total Force	Latent Period
0.0	75	0.0	0.0	0.0	----
3.0	75	1.04	0.0	1.04	----
4.0	75	1.32	0.0	1.32	----
5.0	75	1.51	0.0	1.51	----

Record Data

Undo Reset Submit

**Criterion V: Student Support and Progression**

Experiment 1: The Muscle Twitch and Latent Period

Adobe Flash Player 11

File View Control Help

PEx Exercise 2: Skeletal Muscle Physiology > Activity 1: The Muscle Twitch and the Latent Period

Overview Objectives Introduction Pre-lab Quiz Experiment Post-lab Quiz Review Sheet Lab Report

1. Note that the voltage on the stimulator is set to 0.0 volts. Click **Stimulate** to deliver an electrical stimulus to the muscle and observe the tracing that results.

Muscle Length (mm) 75

Stimulate Voltage (V) 6.0 Force (g) 1.65 Active 0.0 Passive 1.65 Total Measure Time (msec)

Voltage	Length	Active Force	Passive Force	Total Force	Latent Period
3.0	75	1.04	0.0	1.04	----
4.0	75	1.32	0.0	1.32	----
5.0	75	1.51	0.0	1.51	----
6.0	75	1.65	0.0	1.65	----

Record Data

Back Next

Undo Reset Submit

Experiment 1: The Muscle Twitch and Latent Period

Adobe Flash Player 11

File View Control Help

PEx Exercise 2: Skeletal Muscle Physiology > Activity 1: The Muscle Twitch and the Latent Period

Overview Objectives Introduction Pre-lab Quiz Experiment Post-lab Quiz Review Sheet Lab Report

1. Note that the voltage on the stimulator is set to 0.0 volts. Click **Stimulate** to deliver an electrical stimulus to the muscle and observe the tracing that results.

Muscle Length (mm) 75

Stimulate Voltage (V) 7.0 Force (g) 1.74 Active 0.0 Passive 1.74 Total Measure Time (msec)

Voltage	Length	Active Force	Passive Force	Total Force	Latent Period
4.0	75	1.32	0.0	1.32	----
5.0	75	1.51	0.0	1.51	----
6.0	75	1.65	0.0	1.65	----
7.0	75	1.74	0.0	1.74	----

Record Data

Back Next

Undo Reset Submit

**Criterion V: Student Support and Progression**

**Experiment 1: The Muscle Twitch and Latent Period**

Adobe Flash Player 11

File View Control Help

PEx Exercise 2: Skeletal Muscle Physiology > Activity 1: The Muscle Twitch and the Latent Period

Overview Objectives Introduction Pre-lab Quiz Experiment Post-lab Quiz Review Sheet Lab Report

1. Note that the voltage on the stimulator is set to 0.0 volts. Click **Stimulate** to deliver an electrical stimulus to the muscle and observe the tracing that results.

Muscle Length (mm) 75

Stimulate Voltage (V) 9.0 Force (g) 1.82 Active 0.0 Passive 1.82 Total Measure Time (msec)

Voltage	Length	Active Force	Passive Force	Total Force	Latent Period
6.0	75	1.65	0.0	1.65	----
7.0	75	1.74	0.0	1.74	----
8.0	75	1.81	0.0	1.81	----
9.0	75	1.82	0.0	1.82	----

Record Data

Back Next Undo Reset Submit

**Experiment 1: The Muscle Twitch and Latent Period**

Adobe Flash Player 11

File View Control Help

PEx Exercise 2: Skeletal Muscle Physiology > Activity 1: The Muscle Twitch and the Latent Period

Overview Objectives Introduction Pre-lab Quiz Experiment Post-lab Quiz Review Sheet Lab Report

1. Note that the voltage on the stimulator is set to 0.0 volts. Click **Stimulate** to deliver an electrical stimulus to the muscle and observe the tracing that results.


Muscle Length (mm) 75

Stimulate Voltage (V) 10.0 Force (g) 1.82 Active 0.0 Passive 1.82 Total Measure Time (msec)

Voltage	Length	Active Force	Passive Force	Total Force	Latent Period
7.0	75	1.74	0.0	1.74	----
8.0	75	1.81	0.0	1.81	----
9.0	75	1.82	0.0	1.82	----
10.0	75	1.82	0.0	1.82	----

Record Data

Back Next Undo Reset Submit



**REFERENCE BOOK SHOP**  
 I ST. FLOOR, G.S.S. SHOPPING COMPLEX, CONVENT ROAD,  
 Near Public Library, Cochin - 35, Email Id :- Rbsekm@gmail.com  
 Phone : ,,9447510078  
 TIN No. 32071739218

**INVOICE CREDIT**

*Zoology*

Invoice No. 1007  
 Invoice Date 21/12/2016  
 Order No.  
 Order Date / /

**Name & Address Of Purchasing Dealer :**  
 THE PRINCIPAL, S.H.COLLEGE,  
 THEVARA.


Sl. No.	Particulars	Cur.	Qty	Rate	Gross Amount	Dis. %	Discount Amount	Net Value	
1	ZAO :PHYSIOEX 9.1 : LABORATORY SIMULATIONS IN PHYSIOLOGY	D	1	48.00	3422.40	20.0	684.48	2737.92	
<b>Total :</b>					1	3422.40	684.48	2737.92	
								Round Off	-0.92
								Grand Total	2737.00

Rupees Two Thousand Seven Hundred Thirty Seven Only

**Dollar : 71.30      Pound : 88.90      Euro : 77.30**

**E&OE**  
 Certified that the rates at which the foreign currencies are converted in to Indian Rupees are as per the GOC in force as on the date of the invoices and if any excess found to be claimed later in the same will be adjusted in our subsequent bills or refunded by us. The prices charged in this bill are publisher's current price. Latest editions are supplied. Books supplied in this bill are not remainder titles.

For REFERENCE BOOK SHOP

  
 Authorised Signatory

*... that the same have been ...*

*... 85756 ...*

Date: \_\_\_\_\_ Librarian

Page No. : 1