# END-1312: CARDIOPULMONARY ANATOMY AND PHYSIOLOGY

## Cuyahoga Community College

### Viewing: END-1312 : Cardiopulmonary Anatomy and Physiology

**Board of Trustees:**
January 2023

**Academic Term:**
Fall 2023

**Subject Code**
END - Electroneurodiagnostic

**Course Number:**
1312

**Title:**
Cardiopulmonary Anatomy and Physiology

**Catalog Description:**
Anatomy and physiology of cardiovascular and pulmonary systems. Cardiovascular system anatomy and electrophysiology of the heart, electrocardiography (ECG) interpretation, blood flow characteristics and hemodynamics. Pulmonary system anatomy and physiology overview, principles of ventilatory control, diffusion, gas transport, and oxygenation.

**Credit Hour(s):**
3

**Lecture Hour(s):**
3

### Requisites

**Prerequisite and Corequisite**
BIO-2331 Anatomy and Physiology I, and departmental approval: admission to program.

### Outcomes

**Course Outcome(s):**
Apply basic knowledge of cardiovascular function while performing Electroencephalography (EEG) and Polysomnography (PSG) under supervision.

**Essential Learning Outcome Mapping:**
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**
a. Relate the anatomic structures of the cardiovascular system to their respective physiologic function.
b. Diagram and label the mechanical structures of the heart.
c. Compare the systemic and pulmonary vascular systems.
d. Compare and contrast factors that affect blood pressure and blood flow through the cardiovascular system.
e. Compare the relationship of preload, afterload and contractility on stroke volume and cardiac output.
f. Relate factors affecting cardiac output, systemic arterial pressure, Intracranial Pressure and perfusion.
g. Differentiate the results of sympathetic and parasympathetic innervation on the heart and blood vessels.

---

**Course Outcome(s):**
Apply basic knowledge of cardiac conduction while monitoring ECG during Electroencephalography (EEG) and Polysomnography (PSG) under supervision.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

a. Diagram and label the electrical structures of the heart.
b. Relate the phases of the action potential to the conduction of a normal heart beat.
c. Compare the effects of repolarization and depolarization of the heart chambers to the waveforms seen on the electrocardiogram (ECG).
d. Analyze ECG rhythm strips using 5-step method.
e. Calculate the heart rate given an ECG strip.
f. Compare normal and abnormal conduction (arrhythmias) to heart function.
g. Predict the physiologic events that are occurring given an electrocardiogram (normal or abnormal) to prevent emergencies.
h. Relate the terms depolarization and repolarization to the electrical and mechanical actions of the heart.

---

**Course Outcome(s):**

Apply basic knowledge of pulmonary function while performing Electroencephalography (EEG) in ICU setting, and diagnostic and therapeutic Polysomnography (PSG) under supervision.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

a. Relate the anatomic structure of the respiratory system to the respective physiologic function.
b. Associate principles of gas flow, resistance and compliance to the anatomical structures regulating the dynamic principles of ventilation.
c. Discuss the principles of gas diffusion and its limiting factors within the pulmonary circulation.
d. Differentiate the processes of ventilation, gas distribution, gas flow, diffusion and respiration and identify the structures that accommodate these functions.
e. Compare the stimulus of ventilation between the central and peripheral chemoreceptors.
f. Associate principles of gas flow, resistance and compliance to the anatomical structures regulating the principles of ventilation.
g. Evaluate the clinical changes seen with changes in lung compliance.
h. Classify clinical scenarios as presenting normal, shunting, deadspace relationships.
i. Categorize how changes in gas flow, volume, pressure, and/or resistance could alter work of breathing.
j. Illustrate the relationship of gas diffusion and gas transport to cellular respiration.
k. Differentiate the methods of gas transport for oxygen and carbon dioxide.
l. Categorize clinical factors that could shift the position of the oxygen and carbon dioxide dissociation curves.
m. Differentiate the gas volume of the lung to pulmonary circulation and the physical characteristics, which regulate ventilation to perfusion matching.
n. Examine concepts of ventilation-perfusion in a healthy lung, and in the presence of shunting and/or deadspace.
o. Distinguish normal and abnormal states of carbon dioxide elimination.
p. Discern effects of carbon dioxide on Intracranial Pressure.
q. Classify clinical scenarios of sleep disordered breathing conditions.

---

**Methods of Evaluation:**

a. Examinations
b. Quizzes
c. Assignments: EKG strip analysis
d. Participation in small group learning activities (EKG strip reading)
e. Class participation

**Course Content Outline:**

a. Cardiovascular system
   i. Anatomy and physiology
      1. Heart
      2. Oxygenation concepts
      3. System
      4. Vascular network/circulatory systems
      5. Cardiovascular coponents
      6. Blood flow through the heart chambers
      7. Cardiovascular control
   ii. Cardiovascular physiology and hemodynamics of cardiovascular system
      1. Interrelationships between flow, volume, resistance, and pressure
      2. Concept of perfusion
      3. Variables that determine/modify blood pressure
      4. Variables that determine/modify cardiac output
      5. Variables that determine/modify resistance to blood flow
      6. Clinical Measurements related to flow, volume, resistance, and pressure
      7. Cardiovascular pressures and volumes
      8. Intracranial pressure and perfusion
      9. Pulse as an indicator of cardiac function
   iii. Electrophysiology of the heart
      1. Types or cardiac cells and their characteristics
      2. Membrane potentials and action potential
      3. Electrical conduction system of the heart
      4. Sequence of electrical activity of the cardiac cycle
      5. Interrelationship of electrical system and mechanical action of heart
      6. Action potential related to conduction
   iv. Normal and abnormal electrocardiogram
      1. Normal and abnormal appearance of waveform components of electrocardiogram
      2. Corresponding electrical and mechanical actions of the heart
      3. Correct identification and measurement of waveform
   v. ECG rhythm analysis
      1. 5 step process
         a. Determine regularity of R waves
         b. Calculate heart rate
         c. Identify and examine P waves
         d. Measure PR interval
         e. Measure QRS complex
      2. Mechanisms of arrhythmias
      3. ECG rhythms related to cardiac pacemaker
         a. Sinus arrhythmias
         b. Atrial arrhythmias
         c. Junctional arrhythmias and atrioventricular blocks
         d. Ventricular arrhythmias and bundle branch block
      4. Identify potential emergency situations related to abnormal ECG rhythms and variants and their impact on cardiac output.
b. Pulmonary system
   i. Anatomy and physiology
      1. Upper and lower airways
      2. Respiratory exchange zone
      3. Lung divisions
      4. Thorax
   ii. Ventilation
      a. Normal ventilatory drive
      b. Abnormal ventilatory drive
      c. Ventilation mechanics
      d. Interrelationships between pressure, flow, volume, and resistance
      e. Pulmonary pressure changes that result in inspiration and expiration
      f. Normal and abnormal lung compliance

g. Alveolar ventilation and dead space
h. Ventilation patterns
    i. Pulmonary gases
        1. Normal movement of gases
        2. Oxygen
            a. Plasma oxygen
            b. Hemoglobin equilibrium curve
        3. Carbon Dioxide
            a. Hypercapnia vs. Hypocapnia
            b. Impact of $CO_2$ on cerebral vasculature
        4. Methods of gas transport for oxygen and carbon dioxide
        5. Oxygen and carbon dioxide dissociation curves
    ii. Ventilation-perfusion matching
        1. Perfusion-limited and diffusion limited gases
        2. Normal and abnormal ventilation-perfusion matching in the lung
        3. Pulmonary shunting and deadspace
    iii. Sleep and Sleep disorders
        1. Excessive daytime sleepiness
        2. Sleep apnea
            a. Obstructive sleep apnea
            b. Central sleep apnea

## Resources

Des Jardins, Terry. (2019) *Cardiopulmonary Anatomy and Physiology*, Boston, MA. Cengage.

Beachey, Will. (2018) *Respiratory Care Anatomy and Physiology*, St. Louis, MO. Elsevier.

Des Jardins, Terry. *Cardiopulmonary Anatomy and Physiology.* 6th ed. Clifton Park, NY: Thomson Delmar Learning, 2013.

Wilkins, Robert, James Stoller and Robert Kacmarek, eds. *Egan's Fundamentals of Respiratory Care.* 9th ed. St. Louis: Mosby, 2009.

Spriggs, William. *Essentials of Polysomnography.* St. Louis: Mosby, 2008.

Thaler, Malcolm. *The Only EKG Book You'll Ever Need*. 6th ed. Philadelphia: Lippincott Williams and Wilkins, 2009.

**Resources Other**

a. American Academy of Sleep Medicine http://www.aasmnet.org/
b. American Association of Sleep Technologists. http://www.aastweb.org/
c. Board of Registered Polysomnographic Technologists http://www.brpt.org/
d. National Sleep Foundation http://www.sleepfoundation.org/
e. *American Journal of Electroneurodiagnostic Technology (AJET)* by the ASET; 4 issues annually; which reflects most recent changes and updates in the field.

Top of page
Key: 5087