

Lesson Plan

The Heart and Heart Disease

Goals of the Lesson

Cognitive: Students will be able to identify the principal components of the heart and their functions. They will also gain an understanding of the circulatory, electrocardiac, and musculatory systems, and the pathophysiology of the heart. Finally, the students will be able to describe the cardiac cycle.

Psychomotor: Students will be able to trace the pathway of blood circulation through and around the heart as well as the pathway of electrical conduction. They will also be able to use their knowledge and skills to calculate cardiac output.

Affective: Students will gain an understanding of the actions taken as relayed through a case study as well as understand the normal heart sounds and identify variations in heart rates.

Learning Objectives (LO)

- LO-1 Describe the three tissue layers of the heart wall
- LO -2 Compare the functions of the right and left chambers of the heart
- LO -3 Name the valves at the entrance and exit of each ventricle and identify the function of each
- LO -4 Describe blood circulation through the myocardium
- LO -5 Describe the cardiac cycle
- LO -6 Identify and locate the components of the heart's conduction system
- LO -7 Identify common variations in heart rate
- LO -8 Explain the effects of the autonomic nervous system (ANS), hormones, and ions on cardiac output
- LO -9 Explain what produces each of the two normal heart sounds and identify the usual cause of a murmur
- LO -10 Describe five methods used to study the heart
- LO -11 Describe six types of heart disease
- LO -12 Identify risk factors for the development of coronary artery disease
- LO -13 Distinguish the difference between angina pectoris and myocardial infarction
- LO -14 Describe three approaches to the treatment of heart disease
- LO -15 Describe changes that may occur in the heart with age

Assessments

Module Quiz

Section 5 Exam

Final Exam

Estimated Time on Task

Learning Content	Pre-Test	Practice Activities	Quiz	TOTAL
171 min	10 min	62 min	10 min	4.2 hr

Learning Objective 1

Describe the three tissue layers of the heart wall.

Outline

- The heart
 - A hollow organ
 - Located between the lungs, slightly to left of midline
 - Mediastinum
- The tissue layers of the heart wall
 - Endocardium
 - Myocardium
 - Pericardium
 - Fibrous
 - Serous
 - Parietal
 - Visceral (epicardium)

Instructor's Notes

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

Heart models allow students to examine the layers of the heart. Sheep or calf hearts, available from butchers or from biological supply companies, provide an opportunity to study the heart structure. Students can examine the heart layers using microscope slides, histological images on the web, or histology textbooks

Materials

A heart model. Sheep or calf hearts and a scapel for dissection. Microscope slides, web images.

Learning Objective 2

Compare the functions of the right and left chambers of the heart.

Outline

- Four Chambers
 - Right Atrium
 - Left Atrium
 - Right Ventricle
 - Left Ventricle
- Septum
 - Interatrial Septum
 - Interventricular Septum

Instructor's Notes

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

Heart models allow students to examine the heart structure and the separate chambers as well as the septum. Sheep or calf hearts, available from butchers or from biological supply companies, provide an opportunity to study the heart structure.

Materials

A heart model, Sheep or calf hearts, a scalpel for dissection

Web Resources

[Anatomy of the Heart](#)

[Mayo Clinic Animation of Heart and Blood Circulation](#)

Learning Objective 3

Name the valves at the entrance and exit of each ventricle and identify the function of each.

Outline

- Entrance Valve
 - Right atrioventricular valve
 - tricuspid
 - Left atrioventricular valve
 - mitral
 - Attached by chordae tendineae
- Exit Valves
 - Semilunar
 - Pulmonary valve
 - Aortic valve

Instructor's Notes

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

In class discuss: Review the ways the function of a valve is analogous to a one-way swing door. Write on a board the structures through which blood passes, but scramble the order asking students to come to the board and draw lines between sequential structures.

Materials

White or Blackboard, chalk or white board markers.

Web Resources

[Mayo Clinic Animation of Heart and Blood Circulation](#)

[TED Animation: How the Heart Pumps Blood](#)

Learning Objective 4

Describe blood circulation through the myocardium.

Outline

- The myocardium requires its own blood supply
- Coronary circulation
 - Right coronary artery branches from aorta
 - Left coronary artery branches from aorta
- Coronary sinus empties into right atrium

Instructor's Notes

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

Injected preserved sheep hearts and heart models can be used to demonstrate the coronary circulation.

Materials

Sheep heart, dye, heart model.

Web Resources

[Mayo Clinic Animation of Heart and Blood Circulation](#)

Learning Objective 5

Describe the cardiac cycle.

Outline

Instructor's Notes

- Cardiac cycle – a single heartbeat, one complete sequence of:
 - Systole phase (contraction)
 - Diastole phase (relaxation)
 - Each cycle lasts an average of 0.08 seconds.

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

Group activity: Ask students to assemble a chart summarizing events during the three steps of the cardiac cycle.

Materials

Drawing materials, chart paper

Web Resources

[The Cardiac Cycle](#)

Learning Objective 6

Identify and locate the components of the heart's conduction system.

Outline

Instructor's Notes

- Electrical energy stimulates the heart muscle via nodes and specialized fibers.
 - Nodes
 - Sinoatrial (SA) node initiates the heartbeats
 - The atrioventricular (AV) node
 - Specialized fibers include
 - The atrioventricular bundle (bundle of His)
 - The Purkinje fibers (conduction myofibers)
 - Intercalated disks allow the rapid flow of impulses throughout the heart muscle.
 - The atria do not contract to drive blood into the ventricles—such filling occurs by volume load alone.

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

Group activity: Draw a picture of the heart on the blackboard or whiteboard and trace the conduction pathway.

Game: Divide the class into two groups, each with a leader visible to all students in the group. One group is the atria, and the leader the SA node; the other group is the ventricles, and the leader the AV node. Each group raises their arms (i.e., contracts) every time their leader raises his or her arms. In addition, the AV node raises his or her arms if the atria raise their arms (causing the ventricles to raise their arms). Ask students to practice this part of the demonstration, with only the SA node initiating arm raising. The students should observe separate atrial and ventricular contractions because the AV node will introduce a slight delay.

Materials

Blackboard or whiteboard and drawing materials

Web Resources

[Mayo Clinic- How to Interpret an ECG](#)

Learning Objective 7

Identify common variations in heart rate.

Outline

Instructor's Notes

- Common variations in heart rates
- Factors: autonomic nervous system, drugs, exercise, ions, breathing rates
- Terms
 - Bradycardia—slow, under 60 bpm
 - Tachycardia—fast, over 100 bpm
 - Sinus arrhythmia—variable, normal
 - Premature beat (extrasystole)—comes before expected heart beat

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

Use a heart rate monitor to study bradycardia and tachycardia in student volunteers.

Explore diving reflex by asking students to simulate cold water diving while wearing a heart rate monitor.

Materials

Heart rate monitor

Pan of very cold water; towels

Learning Objective 8

Explain the effects of the autonomic nervous system (ANS), hormones, and ions on cardiac output.

Outline

Instructor's Notes

- The autonomic nervous system (ANS) plays a major role in modifying heart rate.
 - Sympathetic
 - Increases heart rate
 - Parasympathetic
 - Decreases heart rate
- Hormones
 - Thyroid hormones increase the heart rate by increasing the number of epinephrine receptors
 - Some drugs lower heart rate by blocking the receptors
- Ions
 - Pathologic changes in blood concentrations of Na⁺, K⁺, and Ca²⁺ can also change heart rate
 - They alter the membrane potential of cardiac cells
 - Excessive potassium hyperpolarizes cardiac cells
 - Cardiac cells contract less often
 - Surgeons use this to stop heartbeat during surgeries

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

Group activity: Look up the mechanisms by which the sympathetic and parasympathetic nervous systems affect the heart using detailed physiology or cardiac physiology textbooks.

Give students simple quantitative problems to examine cardiac output, using the equation: cardiac output = heart rate × stroke volume. For example:

- A newborn baby has a cardiac output of about 0.5 L/minute, and a heart rate of 120 bpm. What is the baby's stroke volume?
- Unlike adults, babies do not significantly change their stroke volume. If the baby's cardiac output increases to 1 L, what happened to the heart rate?

Web Resources

[Cardiac Output and Stroke Factors](#)

Learning Objective 9

Explain what produces each of the two normal heart sounds and identify the usual cause of a murmur.

Outline

- “Lub”
 - Longer, lower-pitched
 - Occurs at start of ventricular systole
 - Mainly caused by closing of atrioventricular valves
 - Denoted as S1
- “Dup”
 - Shorter and sharper
 - Occurs at beginning of ventricular relaxation (diastole)
 - Caused by sudden closure of semilunar valves
 - Denoted as S2
- Murmur
 - Abnormal sound
 - Usually due to faulty action of valve
 - Organic—caused by structural change
 - Functional—normal sounds caused by heart working
 - Stenosis—narrowing of a valve opening affects heart sounds

Instructor’s Notes

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

Have students listen to heart sounds through a stethoscope.

Materials

Stethoscope

Web Resources

[Sound clips](#)

Learning Objective 10

Describe five methods used to study the heart.

Outline

Instructor's Notes

- Methods used to study the heart:
 - Stethoscope—used to hear heart sounds
 - Electrocardiograph (ECG or EKG) records of the electrical activity of the heart
 - Catheterization—uses catheter to take blood samples, measure blood pressure, inject fluorescent dye
 - Fluoroscope examines deep structures
 - Coronary angiography, coronary computed tomography angiography visualizes coronary arteries
- Echocardiography, also known as ultrasound cardiography (oscilloscope)—uses ultrasound waves to study structure and function of heart

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

Students can review EKG tracings on the Internet, searching under “EKG examples.”

Learning Objective 11

Describe six types of heart disease.

Outline	Instructor's Notes
<ul style="list-style-type: none"> • Anatomical classifications of heart disease <ul style="list-style-type: none"> • Endocarditis: inflammation of the endocardium on valves and valvular disease • Myocarditis: inflammation of heart muscle • Pericarditis: inflammation of serous membrane on heart surface and lining of pericardial sac • Classification based on causative factors <ul style="list-style-type: none"> • Congenital heart disease <ul style="list-style-type: none"> • Result of defects in fetal development, e.g., atrial septal defect, patent ductus arteriosus • Ventricular septal defect—most common congenital heart disease, hole in the septum • Coarctation of the aorta—narrowing of aortic arch • Tetralogy of Fallot—combination of four defects leading to relative lack of oxygen. Cyanosis, or “blue babies” • Rheumatic heart disease <ul style="list-style-type: none"> • Rheumatic fever • Caused by antibodies formed to fight toxins that also attack heart valves 	<ul style="list-style-type: none"> • Classification based on causative factors (continued) <ul style="list-style-type: none"> • Heart valves inflamed, thickened • Blood flow impeded, leading to pulmonary congestion • Coronary artery disease <ul style="list-style-type: none"> • Atherosclerosis • Degenerative <ul style="list-style-type: none"> • Buildup of plaque deposited over time in the lining of vessels, usually arteries • Thickening and hardening, loss of elasticity, narrows vessel • Ischemia • Myocardial infarction (MI)—medical term for heart attack <ul style="list-style-type: none"> • Coronary thrombosis • Sudden occlusion of coronary vessel, complete stop of blood flow • Angina pectoris <ul style="list-style-type: none"> • Inadequate flow to heart muscle • Abnormalities of heart rhythm <ul style="list-style-type: none"> • Arrhythmia • Flutter • Fibrillation • Heart block

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

Ask students to do short presentations on the different categories of heart disease. Students can discuss the causes, symptoms, and treatments for each.

Web Resources

[Heart Valve Disease](#)

Learning Objective 12

Identify risk factors for the development of coronary artery disease.

Outline

- Factors that cannot be modified:
 - Age; risk increases with age
 - Gender
 - Heredity; family history places one at higher risk
- Body type; fat deposited in abdomen
- Risk factors that can be modified:
 - Smoking, tobacco use
 - Physical inactivity
 - Overweight
 - Saturated fats and trans fats in diet
 - High blood pressure
 - Diabetes
 - Sleep apnea
- Markers for heart disease risk
 - C-reactive protein (CRP)
 - Homocysteine
- Lipoproteins

Instructor's Notes

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

Students can reflect on themselves, their family members, or acquaintances and discuss what areas of their life could be changed that could influence their health. Discuss areas that cannot be changed.

Students can research various fats online or by visiting a grocery store to see which ones are healthy and which are not.

Web Resources

[Strategies to Prevent Heart Disease](#)

Learning Objective 13

Distinguish the difference between angina pectoris and myocardial infarction.

Outline

- Angina pectoris
 - Moderate ischemia
 - Discomfort in the heart, left arm, or shoulder
 - Relieved with rest or medications (nitroglycerin)
- Myocardial infarction
 - Heart Attack
 - Coronary thrombosis
 - Complete obstruction
 - Tissue undergoes necrosis
 - Cannot convey electrical signals or generate force in contracting

Instructor's Notes

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

Simulate the narrowing of a vessel by using a short water hose. Begin to bend it slowly as water passes through and observe the change in pressure as the water is unable to get through. Have students compare the simulation to angina and a myocardial infarction.

Materials

Water hose

Learning Objective 14

Describe three approaches to the treatment of heart disease.

Outline

Instructor's Notes

- Medical and surgical approaches to heart disease:
 - Medications
 - Statins
 - Anticoagulants, e.g., aspirin, warfarin
 - Digitalis
 - Nitroglycerin
 - Beta-adrenergic blocking agents
 - Antiarrhythmic agents
 - Slow calcium-channel blockers
 - Devices
 - Artificial pacemaker for correction of arrhythmias
 - Implanted cardioverter-defibrillator; shocks hearts back to normal rhythm
 - Surgery
 - Coronary artery bypass graft (CABG)
 - Angioplasty
 - Coronary atherectomy
 - Cardiac ablation
 - Valve replacement
 - Surgical transplantation of heart or heart and lungs
 - Artificial heart
- Ventricular assist devices (VADs)

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

Students can look up various medications used for the treatment of heart disease and have a discussion on the pros and cons.

Materials

Drug handbook (or online drug site)

Learning Objective 15

Describe changes that may occur in the heart with age.

Outline

Instructor's Notes

- Factors that influence how the heart ages
 - Heredity
 - Environmental factors
 - Diseases
 - Habits
 - Exercise
 - Tobacco use
 - Diet
- Less flexibility in valves
 - Murmur
- Decrease cardiac output
- Abnormal rhythms
- Interference in the conduction system

Resources and Activities

Resources

PPT slides, Pre-test, Practice Activities, Module Quiz, Section Exam, Final Exam

Activities

Students can investigate the effects of exercise and types of activities both high and low intensity that may offset the damaging effects of age on heart function.
