# Chapter 32: Structure and Function of the Cardiovascular and Lymphatic Systems

## MULTIPLE CHOICE

1. Which statement does *not* accurately describe the pericardium?
   1. The pericardium is a double-walled membranous sac that encloses the heart.
   2. It is made up of connective tissue and a surface layer of squamous cells.
   3. The pericardium protects the heart against infection and inflammation from the lungs and pleural space.
   4. It contains pain and mechanoreceptors that can elicit reflex changes in blood pressure and heart rate.

ANS: B

The pericardium is made up of a surface layer of mesothelium over a thin layer of connective tissue. The remaining options accurately describe the pericardium.

PTS: 1 REF: Page 1085

1. Which cardiac chamber has the thinnest wall and why?
   1. The right and left atria; they are low-pressure chambers that serve as storage units and conduits for blood.
   2. The right and left atria; they are not directly involved in the preload, contractility, or afterload of the heart.
   3. The left ventricle; the mean pressure of blood coming into this ventricle is from the lung, which has a low pressure.
   4. The right ventricle; it pumps bNloUoRdSIiNntGoTtBh.eCOpuMlmonary capillaries, which have a lower pressure compared with the systemic circulation.

ANS: A

The two atria have the thinnest walls because they are low-pressure chambers that serve as storage units and conduits for blood that is emptied into the ventricles. This selection is the only option that correctly identifies which heart chambers have the thinnest walls and why that helps cardiac function.

PTS: 1 REF: Page 1086

1. Which chamber of the heart endures the highest pressures?
   1. Right atrium c. Left ventricle
   2. Left atrium d. Right ventricle

ANS: C

Pressure is greatest in the systemic circulation, driven by the left ventricle.

PTS: 1 REF: Page 1086

1. What is the process that ensures mitral and tricuspid valve closure after the ventricles are filled with blood?
   1. Chordae tendineae relax, which allows the valves to close.
   2. Increased pressure in the ventricles pushes the valves to close.
   3. Trabeculae carneae contract, which pulls the valves closed.
   4. Reduced pressure in the atria creates a negative pressure that pulls the valves closed.

ANS: B

During ventricular relaxation, the two atrioventricular valves open and blood flows from the higher pressure atria to the relaxed ventricles. With increasing ventricular pressure, these valves close and prevent backflow into the atria as the ventricles contract. This selection is the only option that correctly identifies the process that ensures closing of the mitral and tricuspid valves.

PTS: 1 REF: Page 1088

1. Regarding the heart’s valves, what is a function of the papillary muscles?
   1. The papillary muscles close the semilunar valve.
   2. These muscles prevent backward expulsion of the atrioventricular valve.
   3. They close the atrioventricular valve.
   4. The papillary muscles open the semilunar valve.

ANS: B

The papillary muscles are extensions of the myocardium that pull the cusps together and downward at the onset of ventricular contraction, thus preventing their backward expulsion into the atria. This selection is the only option that correctly describes the function of the papillary muscles.

PTS: 1 REF: Pages 1087-1088

1. During the cardiac cycle, why do the aortic and pulmonic valves close after the ventricles relax?
   1. Papillary muscles relax, which allows the valves to close.
   2. Chordae tendineae contract, which pulls the valves closed.
   3. Reduced pressure in the ventricles creates a negative pressure, which pulls the valves closed.
   4. Blood fills the cusps of the valves and causes the edges to merge, closing the valves.

ANS: D

When the ventricles relax, blood fills the cusps and causes their free edges to meet in the middle of the vessel, closing the valve and preventing any backflow. This selection is the only option that accurately explains why the aortic and pulmonic valves close after the ventricles contract.

PTS: 1 REF: Page 1088

1. Oxygenated blood flows through which vessel?
   1. Superior vena cava c. Pulmonary artery
   2. Pulmonary veins d. Coronary veins

ANS: B

Only the four pulmonary veins, two from the right lung and two from the left lung, carry oxygenated blood from the lungs to the left side of the heart.

PTS: 1 REF: Page 1088

1. The significance of the *atrial kick* is that it affects the contraction of the:
   1. Right atria, which is necessary to open the tricuspid valve.
   2. Right atria, which is necessary to increase the blood volume from the vena cava.
   3. Left atria, which increases the blood volume into the ventricle.
   4. Left atria, that is necessary to open the mitral valve.

ANS: C

Left atrial contraction, the *atrial kick*, provides a significant increase of blood to the left ventricle.

PTS: 1 REF: Page 1088

1. Occlusion of the left anterior descending artery during a myocardial infarction would interrupt blood supply to which structures?
   1. Left and right ventricles and much of the interventricular septum
   2. Left atrium and the lateral wall of the left ventricle
   3. Upper right ventricle, right marginal branch, and right ventricle to the apex
   4. Posterior interventricular sulcus and the smaller branches of both ventricles

ANS: A

The left anterior descending artery (LAD), also called the *anterior interventricular artery*, delivers blood to portions of the left and right ventricles and much of the interventricular septum. This selection is the only option affected by the occlusion described.

PTS: 1 REF: Page 1090

1. Occlusion of the circumflex arteryNdUuRrSinINgGaTmB.yCoOcMardial infarction would interrupt blood supply to which area?
   1. Left and right ventricles and much of the interventricular septum
   2. Posterior interventricular sulcus and the smaller branches of both ventricles
   3. Upper right ventricle, right marginal branch, and right ventricle to the apex
   4. Left atrium and the lateral wall of the left ventricle

ANS: D

The circumflex artery supplies blood to the left atrium and the lateral wall of the left ventricle. The circumflex artery often branches to the posterior surfaces of the left atrium and left ventricle. This selection is the only option affected by the occlusion described.

PTS: 1 REF: Pages 1090-1091

1. The coronary ostia are located in the:
   1. Left ventricle c. Coronary sinus
   2. Aortic valve d. Aorta

ANS: D

Coronary arteries receive blood through openings in the aorta, called the *coronary ostia*.

PTS: 1 REF: Page 1090

1. The coronary sinus empties into which cardiac structure?
   1. Right atrium c. Superior vena cava
   2. Left atrium d. Aorta

ANS: A

The cardiac veins empty only into the right atrium through another ostium, the opening of a large vein called the *coronary sinus*.

PTS: 1 REF: Page 1090

1. What is the ratio of coronary capillaries to cardiac muscle cells?
   1. 1:1 (one capillary per one muscle cell)
   2. 1:2 (one capillary per two muscle cells)
   3. 1:4 (one capillary per four muscle cells)
   4. 1:10 (one capillary per ten muscle cells)

ANS: A

The heart has an extensive capillary network, with approximately 3300 capillaries per square millimeter (ca/mm2) or approximately one capillary per one muscle cell (muscle fiber).

PTS: 1 REF: Page 1092

1. During the cardiac cycle, which structure directly delivers action potential to the ventricular myocardium?
   1. Sinoatrial (SA) node c. Purkinje fibers
   2. Atrioventricular (AV) node d. Bundle branches

ANS: C

ENaUcRhSIcNaGrdTiBac.CaOcMtion potential travels from the SA node to the AV node to the bundle of His (AV bundle), throubgrahntchheebs,uannddlefina lly to the Purkinje fibers and the

ventricular myocardium, where the impulse is stopped. The refractory period of cells that have just been polarized prevents the impulse from reversing its path. The refractory period ensures that diastole (relaxation) will occur, thereby completing the cardiac cycle. This selection is the only option that accurately describes the structure that delivers the action potential directly to the myocardium.

PTS: 1 REF: Page 1124

1. What causes depolarization of a cardiac muscle cell to occur?
   1. Decrease in the permeability of the cell membrane to potassium
   2. Rapid movement of sodium into the cell
   3. Decrease in the movement of sodium out of the cell
   4. Rapid movement of calcium out of the cell

ANS: B

Phase 0 consists of depolarization, which lasts 1 to 2 milliseconds (ms) and represents rapid sodium entry into the cell. This selection is the only option that accurately describes the cause of cardiac muscle cell depolarization.

PTS: 1 REF: Page 1094

1. Which event occurs during phase 1 of the normal myocardial cell depolarization and repolarization?
   1. Repolarization when potassium moves out of the cells
   2. Repolarization when sodium rapidly enters into the cells
   3. Early repolarization when sodium slowly enters the cells
   4. Early repolarization when calcium slowly enters the cells

ANS: D

Phase 1 is early repolarization and the only time during which calcium slowly enters the cell.

PTS: 1 REF: Page 1094

1. Which phase of the normal myocardial cell depolarization and repolarization correlates with diastole?
   1. Phase 1 c. Phase 3
   2. Phase 2 d. Phase 4

ANS: D

Potassium is moved out of the cell during phase 3, with a return to resting membrane potential only in phase 4. The time between action potentials corresponds to diastole.

PTS: 1 REF: Page 1094

1. In the normal electrocardiogram, what does the PR interval represent?
   1. Atrial depolarization
   2. Ventricular depolarization
   3. Atrial activation to onset of ventricular activity
   4. Electrical systole of the ventricles

ANS: C

The PR interval is a measure of time from the onset of atrial activation to the onset of ventricular activation; it normally ranges from 0.12 to 0.20 second. The PR interval represents the time necessary to travel from the sinus node through the atrium, the atrioventricular (AV) node, and the His–Purkinje system to activate ventricular myocardial cells. This selection is the only option that accurately describes the PR interval.

PTS: 1 REF: Page 1095

1. The cardiac electrical impulse normally begins spontaneously in the sinoatrial (SA) node because it:
   1. Has a superior location in the right atrium.
   2. Is the only area of the heart capable of spontaneous depolarization.
   3. Has rich sympathetic innervation via the vagus nerve.
   4. Depolarizes more rapidly than other automatic cells of the heart.

ANS: D

The electrical impulse normally begins in the SA node because its cells depolarize more rapidly than other automatic cells. This selection is the only option that accurately explains why cardiac electrical impulses normally begin spontaneously in the SA node.

PTS: 1 REF: Page 1095

1. What period follows depolarization of the myocardium and represents a period during which no new cardiac potential can be propagated?
   1. Refractory c. Threshold
   2. Hyperpolarization d. Sinoatrial (SA)

ANS: A

During the refractory period, no new cardiac action potential can be initiated by a stimulus. This selection is the only option that accurately identifies the period described in the question.

PTS: 1 REF: Page 1095

1. Which complex (wave) represents the sum of all ventricular muscle cell depolarizations?
   1. PRS c. QT interval
   2. QRS d. P

ANS: B

Only the QRS complex represents the sum of all ventricular muscle cell depolarizations.

PTS: 1 REF: Page 1095

1. What can shorten the conduction time of action potential through the atrioventricular (AV) node?
   1. Parasympathetic nervous system c. Vagal stimulation
   2. Catecholamines d. Sinoatrial node (SA)

ANS: B

CNUatReScIhNoGlaTmBi.CnOesMspeed the heart rate, shorten the conduction time through the AV node,

and increase the fibers. This selection is the only

option trhheytAhVmipcaitcyemofaker that can perform that function.

PTS: 1 REF: Page 1096

1. If the sinoatrial (SA) node fails, then at what rate (depolarizations per minute) can the atrioventricular (AV) node depolarize?
   1. 60 to 70 c. 30 to 40
   2. 40 to 60 d. 10 to 20

ANS: B

If the SA node is damaged, then the AV node will become the heart’s pacemaker at a rate of approximately 40 to 60 spontaneous depolarizations per minute.

PTS: 1 REF: Page 1095

1. What is the effect of epinephrine on 𝗉3 receptors on the heart?
   1. Decreases coronary blood flow.
   2. Supplements the effects of both 𝗉1 and 𝗉2 receptors.
   3. Increases the strength of myocardial contraction.
   4. Prevents overstimulation of the heart by the sympathetic nervous system.

ANS: D

𝗉3 receptors are found in the myocardium and coronary vessels. In the heart, stimulation of these receptors opposes the effects of 𝗉1- and 𝗉2-receptor stimulation and negative inotropic effect. Thus 𝗉3 receptors may provide a safety mechanism that decreases myocardial contractility to prevent overstimulation of the heart by the sympathetic nervous system. This selection is the only option that accurately describes the effect of epinephrine on 𝗉2 receptors on the heart.

PTS: 1 REF: Page 1097

1. Where in the heart are the receptors for neurotransmitters located?
   1. Semilunar and atrioventricular (AV) valves
   2. Endocardium and sinoatrial (SA) node
   3. Myocardium and coronary vessels
   4. Epicardium and AV node

ANS: C

Sympathetic neural stimulation of the myocardium and coronary vessels depends on the presence of adrenergic receptors, which specifically bind with neurotransmitters of the sympathetic nervous system. The 𝗉1 receptors are found mostly in the heart, specifically the conduction system (AV and SA nodes, Purkinje fibers) and the atrial and ventricular myocardium, whereas the 𝗉2 receptors are found in the heart and also on vascular smooth muscle. 𝗉3 receptors are also found in the myocardium and coronary vessels. This selection is the only option that accurately identifies the location of the receptors for neurotransmitters.

PTS: 1 REF: Page 1097

1. What enables electrical impulses to travel in a continuous cell-to-cell fashion in myocardial cells?
   1. Sarcolemma sclerotic plaques c. Trabeculae carneae
   2. Intercalated disks d. Bachmann bundles

ANS: B

Only intercalated disks, thickened portions of the sarcolemma, enable electrical impulses to spread quickly in a continuous cell-to-cell (syncytial) fashion.

PTS: 1 REF: Page 1097

1. Within a physiologic range, what does an increase in left ventricular end-diastolic volume (preload) result in?
   1. Increase in force of contraction c. Increase in afterload
   2. Decrease in refractory time d. Decrease in repolarization

ANS: A

This concept is expressed in the Frank-Starling law; the cardiac muscle, like other muscles, increases its strength of contraction when it is stretched. This selection is the only option that accurately describes the result of an increase in preload.

PTS: 1 REF: Pages 1101-1102

1. As stated in the Frank-Starling law, a direct relationship exists between the of the blood in the heart at the end of diastole and the of contraction during the next systole.
   1. Pressure; force c. Viscosity; force
   2. Volume; strength d. Viscosity; strength

ANS: B

As stated in the Frank-Starling law, the volume of blood in the heart at the end of diastole (the length of its muscle fibers) is directly related to the force (strength) of contraction during the next systole. This selection is the only option that accurately describes the relationship associated with the Frank-Starling law.

PTS: 1 REF: Pages 1101-1102

1. Pressure in the left ventricle must exceed pressure in which structure before the left ventricle can eject blood?
   1. Superior vena cava c. Inferior vena cava
   2. Aorta d. Pulmonary veins

ANS: B

Pressure in the ventricle must exceed aortic pressure before blood can be pumped out during systole. The aorta is the only structure in which pressure must be less than the amount of blood in the left ventricle for ejection to occur.

PTS: 1 REF: Page 1103

1. Continuous increases in left ventricular filing pressures result in which disorder?
   1. Mitral regurgitation c.Pulmonary edema
   2. Mitral stenosis d. Jugular vein distention

ANS: C

Pressure changes are important because increased left ventricular filling pressures back up into the pulmonary circulation, where they force plasma out through vessel walls, causing fluid to accumulate in lung tissues (pulmonary edema). This selection is the only option that accurately identifies the disorder described in the question.

PTS: 1 REF: Page 1103

1. When the volume of blood in the ventricle at the end of diastole increases, the force of the myocardial contraction during the next systole will also increase, which is an example of which law or theory about the heart?
   1. Laplace’s law c. Cross-bridge theory
   2. Poiseuille law d. Frank-Starling law

ANS: D

This concept is expressed only in the Frank-Starling law; the cardiac muscle, like other muscles, increases its strength of contraction when it is stretched.

PTS: 1 REF: Page 1101

1. The resting heart rate in a healthy person is primarily under the control of which nervous system?
   1. Sympathetic c. Somatic
   2. Parasympathetic d. Spinal

ANS: B

The resting heart rate in healthy individuals is primarily under the control of parasympathetic stimulation. This selection is the only option that accurately identifies the nervous system responsible for the healthy resting heart.

PTS: 1 REF: Page 1106

1. The Bainbridge reflex is thought to be initiated by sensory neurons in which cardiac location?
   1. Atria c. Sinoatrial (SA) node
   2. Aorta d. Ventricles

ANS: A

The Bainbridge reflex causes changes in the heart rate after intravenous infusions of blood or other fluid. The changes in heart rate are thought to be caused by a reflex mediated by volume receptors found only in the atria that are innervated by the vagus nerve.

PTS: 1 REF: Page 1106

1. After the baroreceptor reflex is stimulated, the resulting impulse is transmitted from the carotid artery by which sequence of events?
   1. Vagus nerve to the medulla to increase parasympathetic activity and to decrease sympathetic activity
   2. Glossopharyngeal cranial nerve through the vagus nerve to the medulla to increase sympathetic activity and to deNcrUeRasSeINpGaTraBs.yCmOMpathetic activity
   3. Glossopharyngeal cranial nerve through the vagus nerve to the medulla to increase parasympathetic activity and to decrease sympathetic activity
   4. Glossopharyngeal cranial nerve through the vagus nerve to the hypothalamus to increase parasympathetic activity and to decrease sympathetic activity

ANS: C

Neural impulses are transmitted over the glossopharyngeal nerve (ninth cranial nerve) from the carotid artery and through the vagus nerve from the aorta to the cardiovascular control centers in the medulla. These centers initiate an increase in parasympathetic activity and a decrease in sympathetic activity, causing blood vessels to dilate and the heart rate to decrease. This selection is the only option that accurately describes the correct sequence of events asked for in the question.

PTS: 1 REF: Page 1106

1. Reflex control of total cardiac output and total peripheral resistance is controlled by what mechanism?
   1. Parasympathetic stimulation of the heart, arterioles, and veins
   2. Sympathetic stimulation of the heart, arterioles, and veins
   3. Autonomic control of the heart only
   4. Somatic control of the heart, arterioles, and veins

ANS: B

Reflex control of total cardiac output and peripheral resistance includes (1) sympathetic stimulation of the heart, arterioles, and veins; and (2) parasympathetic stimulation of the heart only. Neither autonomic nor somatic controls are involved in this process.

PTS: 1 REF: Pages 1114-1115

1. What is the most important negative inotropic agent?
   1. Norepinephrine c. Acetylcholine
   2. Epinephrine d. Dopamine

ANS: C

Chemicals affecting contractility are called *inotropic agents.* The most important negative inotropic agent is acetylcholine released from the vagus nerve. The most important positive inotropic agents produced by the body are norepinephrine released from the sympathetic nerves that supply the heart and epinephrine released by the adrenal cortex. Other positive inotropes include thyroid hormone and dopamine. Many medications have positive or negative inotropic properties that can have profound effects on cardiac function. This selection is the only option that accurately identifies the regulation that is involved in the described process.

PTS: 1 REF: Page 1103

1. The right lymphatic duct drains into which structure?
   1. Right subclavian artery c. Right subclavian vein
   2. Right atrium d. Superior vena cava

ANS: C

The right lymphatic duct drains lyNmUpRhSoINnGlyTBin.CtoOtMhe right subclavian vein.

PTS: 1 REF: Page 1118

1. Where is the major cardiovascular center in the central nervous system?
   1. Frontal lobe c. Brainstem
   2. Thalamus d. Hypothalamus

ANS: C

The major cardiovascular control center is in the brainstem in the medulla with secondary areas in the hypothalamus, the cerebral cortex, the thalamus, and the complex networks of exciting or inhibiting interneurons (connecting neurons) throughout the brain. This selection is the only option that accurately identifies the cardiovascular control center.

PTS: 1 REF: Page 1104

1. What is an expected change in the cardiovascular system that occurs with aging? a. Arterial stiffening
   1. Decreased left ventricular wall tension
   2. Decreased aortic wall thickness
   3. Arteriosclerosis

ANS: A

Arterial stiffening occurs with aging even in the absence of clinical hypertension. Aging is not responsible for the other conditions.

PTS: 1 REF: Page 1123

1. What is the major determinant of the resistance that blood encounters as it flows through the systemic circulation?
   1. Volume of blood in the systemic circulation
   2. Muscle layer of the metarterioles
   3. Muscle layer of the arterioles
   4. Force of ventricular contraction

ANS: C

Of the options available, only the thick, smooth muscle layer of the arterioles is a major determinant of the resistance blood encounters as it flows through the systemic circulation.

PTS: 1 REF: Page 1108

1. Which function of the cardiovascular system is often affected by ischemia?
   1. Cardiac output (CO) c. Heart rate (HR)
   2. Stroke volume (SV) d. Cardiac index (CI)

ANS: C

Common causes of an abnormal heart rate include ischemia, electrolyte imbalance, and drug toxicity. The other options are related to vascular resistance changes.

PTS: 1 REF: Page 1120 | Table 31-4

1. What physical sign is the result of turbulent blood flow through a vessel?
   1. Increased blood pressure durinNgUpReSrIiNoGdsTBo.fCsOtrMess
   2. Bounding pulse felt on palpation
   3. Cyanosis observed on excretion
   4. Murmur heard on auscultation

ANS: D

Where flow is obstructed, the vessel turns or blood flows over rough surfaces. The flow becomes *turbulent* with whorls or eddy currents that produce noise, causing a murmur to be heard on auscultation, such as occurs during blood pressure measurement with a sphygomanometer. This selection is the only option that accurately identifies the physical sign of turbulent vascular blood flow.

PTS: 1 REF: Page 1113

1. What is the major effect of a calcium channel blocker such as verapamil on cardiac contractions?
   1. Increases the rate of cardiac contractions.
   2. Decreases the strength of cardiac contractions.
   3. Stabilizes the rhythm of cardiac contractions.
   4. Stabilizes the vasodilation during cardiac contractions.

ANS: B

The L-type, or long-lasting, channels are the predominant type of calcium channels and are the channels blocked by calcium channel–blocking drugs (verapamil, nifedipine, diltiazem). The major effect of these medications is to decrease the strength of cardiac contraction. This selection is the only option that accurately identifies the effect of a calcium channel blocker on the cardiac contractions.

PTS: 1 REF: Page 1099

1. An early diastole peak caused by filling of the atrium from peripheral veins is identified by which intracardiac pressure?
   1. A wave c. C wave
   2. V wave d. X descent

ANS: B

The V wave is an early diastolic peak caused by the filling of the atrium from the peripheral veins. This event is not identified by any of the other options.

PTS: 1 REF: Page 1089

1. Which intracardiac pressure is generated by the atrial contraction?
   1. A wave c. Y descent
   2. C wave d. X descent

ANS: A

Atrial pressure curves are made up of only the A wave, which is generated by atrial contraction.

PTS: 1 REF: Page 1089

1. Which intracardiac pressure is produced because of the descent of the tricuspid valve ring and by the ejection of blood from both ventricles?
   1. V wave c. Y descent
   2. C wave d. X descent

ANS: D

The X descent follows an A wave and is produced because of the descent of the tricuspid valve ring and by the ejection of blood from both ventricles.

PTS: 1 REF: Page 1089

## MULTIPLE RESPONSE

*47.* Which statements are *true* concerning the method in which substances pass between capillaries and the interstitial fluid? *(Select all that apply.)* a. Substances pass through junctions between endothelial cells.

1. Substances pass through pores or oval windows (fenestrations).
2. Substances pass between vesicles by active transport across the endothelial cell membrane.
3. Substances pass across the endothelial cell membrane by osmosis.
4. Substances pass through endothelial cell membranes by diffusion.

ANS: A, B, C, E

Substances pass between the capillary lumen and the interstitial fluid in several ways: (1) through junctions between endothelial cells, (2) through fenestrations in endothelial cells,

(3) in vesicles moved by active transport across the endothelial cell membrane, or (4) by diffusion through the endothelial cell membrane.

PTS: 1 REF: Page 1108

## MATCHING

*Match the description with the corresponding terms.*

1. Relationship among blood flow, pressure, and resistance
2. Increased heart rate from increased volume

1. Relationship of wall tension, intraventricular pressure, internal radius, and wall thickness
2. Cycles of attachment, movement, and dissociation of thin filaments during the attachments of actin to myosin
3. Length-tension relationship of cardiac muscle
4. Poiseuille law
5. Cross-bridge theory
6. Frank-Starling law
7. Laplace’s law
8. Bainbridge reflex

1. ANS: A PTS: 1 REF: Pages 1111-1112

MSC: Poiseuille law for resistance to fluid flow through a tube takes into account the length of the tube, the viscosity of the fluid, and thNeUraRdSiIuNsGoTf Bth.Ce OtuMbe's lumen.

1. ANS: D PTS: 1 REF: Page 1099

MSC: With the attachment of actin to myosin at the cross-bridge, the myosin head molecule undergoes a position change, exerting traction on the rest of the myosin bridge, causing the thin filaments to slide past the thick filaments. During contraction, each cross-bridge undergoes cycles of attachment, movement, and dissociation from the thin filaments.

1. ANS: E PTS: 1 REF: Page 1101

MSC: The Frank-Starling law states that the cardiac muscle, like other muscles, increases its strength of contraction when it is stretched.

1. ANS: C PTS: 1 REF: Pages 1102-1103

MSC: In Laplace's law, wall tension is directly related to the product of intraventricular pressure and internal radius and inversely to the wall thickness.

1. ANS: B PTS: 1 REF: Page 1106

MSC: The Bainbridge reflex causes changes in the heart rate after intravenous infusions of blood or other fluid.