Chapter 21: Cardiovascular System: Peripheral Circulation and Regulation

I. General Features of Blood Vessel Structure

A. General Pattern of Circulation

1. Ventricles pump blood into ______________________________
2. These arteries branch repeatedly to form ______________________________
3. The arteries undergo a gradual transition with decreased size:
   a. From ______________________________________________________
   b. To ________________________________________________________
4. Arteries are classified as:
   a. ______________________________
   b. ______________________________
   c. ______________________________
5. Blood flows from arterioles into ______________________________
6. Why does most material exchange occur across capillary walls?
   a. ___________________________________________________________
   b. ___________________________________________________________
   c. ___________________________________________________________
7. Blood flows from the capillaries into ______________________________
8. Compared to arteries the walls of veins are:
   a. ______________________________
   b. Contain ______________________________
   c. Fewer ______________________________
9. As veins project toward the heart they:
   a. Increase _________________________________________________
   b. Decrease _________________________________________________
   c. Walls _________________________________________________
10. Veins are classified as:
    a. ______________________________
    b. ______________________________
    c. ______________________________
B. Capillaries

1. What is the endothelium? ____________________________
   a. What is it continuous with? ____________________________
2. The capillary wall consists of ____________________________
3. Outside the basement membrane is ____________________________
4. Between the basement membrane and the endothelial cells are scattered cells called ____________________________
5. What is the average diameter of a capillary? ____________________________
6. How do red blood cells flow through capillaries? ____________________________
7. Types of Capillaries
   a. Classification is based on ________________ & ________________
   b. Continuous capillaries
      1. Have a diameter of approximately ____________________________
      2. Walls exhibit ____________________________ endothelial cells
      3. _________ permeable to ____________________________
   c. Fenestrated capillaries
      1. Endothelial cells have ____________________________
      2. What are the fenestrae? ____________________________
      3. Fenestral capillaries are ____________________________ permeable
   d. Sinusoidal capillaries
      1. ____________________________ diameter than the other two types
      2. Basement membrane is ____________________________
      3. Fenestrae are ____________________________ than fenestrated capillaries
      4. Occur where ____________________________ cross their walls
   e. Sinusoids are ____________________________
      1. Basement membrane is ____________________________ & often __________
      2. Their structure suggests that ____________________________
      3. What are closely associated with the sinusoid endothelium in the liver?
         ____________________________
   f. Venous sinuses are even ____________________________ than ____________________________
1. Occur primarily in ______________________________
2. Have ______________________________ endothelial cells

g. Substances cross the capillary walls by ______________________
   1. Through ______________________________
   2. Through ______________________________
   3. Between ______________________________
      a. Lipid-soluble substances readily ___________________________
      b. Larger water-soluble substances must ______________________
         or ___________________________________________________

h. Why are capillaries effective permeability barriers? ________________
   __________________________________________________________________

8. Capillary Network
   a. Blood is supplied to a capillary network by _______________________
   b. Blood is drained from a capillary network by _______________________
   c. What is an arterial capillary? ____________________________________
   d. What is a venous capillary? ______________________________________
   e. Blood flows from an arteriole through _____________________________
   f. A thoroughfare channel connects the ___________ to a _____________
      1. Blood flow through a thoroughfare channel is ___________________
   g. Capillaries branch from the ______________________________
      1. Blood flow in these branches is _________________________________
      2. Blood flow is regulated by ________________________________ which
         consist of ____________________ located at ___________________

C. Structure of Arteries and Veins
   1. General Features
      a. Consist of three layers, which are most apparent in the ______________
         and least apparent in ______________________
      b. Which layer is in direct contact with the blood? ________________
      c. What is the name of the outer layer? ______________________
d. Tunica Intima

1. This layer consists of:
   a. __________________________________________________
   b. __________________________________________________
   c. __________________________________________________
   d. __________________________________________________

2. What separates the tunica intima from the tunica media?
   __________________________________________

e. Tunica Media

1. Consists of:
   a. __________________________________________________
   b. Also contains variable amounts of:
      1. __________________________________________________
      2. __________________________________________________

2. Functionally the smooth muscle regulates ________________
   a. Vasoconstriction
      1. Is the result of muscle ____________________
      2. ____________________ the diameter of the vessel
      3. Results in ____________________ blood flow
   b. Vasodilation
      1. Is the result of muscle ____________________
      2. ____________________ the diameter of the vessel
      3. Results in ____________________ blood flow

3. What is the external elastic membrane? ________________________
   __________________________________________________________

f. Tunica Adventitia

1. Composed of ____________________________ that varies from:
   a. ____________________________ near the tunica media to
   b. ____________________________ that ___________________

g. The relative thickness of each layer varies with __________________
2. Large Elastic Arteries
   a. Have the ______________________________
   b. Are also called ______________________________
   c. Pressure is relatively ____________ and fluctuates between
      _____________________ & ___________________ values
   d. Have a greater amount of _________________________ and a smaller amount
      of ______________________________
   e. The elastic fibers are responsible for _____________________________

3. Muscular Arteries
   a. Are often called ______________________________
   b. Their walls are ____________________ compared to ________________
      1. This is due to _____________________________________________
   c. Frequently called ______________________________ because
      _____________________________________________________________
   d. Small muscular arteries are adapted for __________________________

4. Arterioles
   a. Transport blood from ____________________ to ___________________
   b. The smallest artery in which __________________________________
   c. What is their diameter range? _________________________________
   d. The arterioles are capable of _________________________________

5. Venules and Small Veins
   a. Venules have a diameter of ______________________________
   b. Structure is similar to ______________________________
   c. Venules have a few _______________________ outside the endothelium
   d. The vessels are called small veins when:
      1. Diameter ______________________________
      2. Smooth muscle ______________________________
      3. Have a tunica adventitia composed of __________________________
   e. Venules collect blood from ______________________ and pass it to
      ___________________ that pass it to ___________________________
6. Medium and Large Veins
   a. Medium veins collect blood from ____________________ and pass it to ____________________
   b. The large veins transport blood to ______________________________
   c. What layer is predominant in large veins? ______________________

7. Valves
   a. Valves are found in veins having a diameter larger than ______________
      1. ______________ toward the heart
      2. ______________ away from the heart
   b. Valves consist of:
      1. Folds ______________________________
      2. Form two _______ that are _______ & _______ like the ______________________________ of the heart
   c. The two folds _______________________________ so that ________________________________ the valves __________________

D. Vasa Vasorum
   1. Found in vessels larger than ______________ in diameter
   2. Penetrate from the ______________________ to form a capillary network in
      a. ______________________________
      b. ______________________________

E. Arteriovenous Anastomoses
   1. Allow blood to flow from ______________ to ______________ without passing ______________________________
   2. What is a glomus? ______________________________
      ______________________________
   3. Naturally occurring arteriovenous anastomoses function in ______________

F. Nerves
   1. The walls of most blood vessels are richly innervated by __________________
      a. __________ & __________ are innervated to the greatest extent
   2. Sympathetic stimulation causes ______________________________
3. Smooth muscle cells of blood vessels act as a ______________________
   a. This is due to frequent ______________________________
4. Stimulation of a few smooth muscle cells results in __________________
   ________________________________________________________

G. Aging of the Arteries
1. The most significant age related changes occur in the:
   a. _________________________________
   b. _________________________________
   c. _________________________________
2. What is arteriosclerosis? _________________________________
3. What is atherosclerosis? _________________________________
   a. The material is _________________________________
   b. Later it can be replaced with _________________________________
4. In arteriosclerosis:
   a. Tunica intima ______________________
   b. Tunica media ______________________ because of ______________________
   c. Fat ______________________ between the ______________________
      1. Produces a ______________________ that can bulge ______________
   d. In advanced arteriosclerosis ______________________ accumulate
5. Arteriosclerosis greatly increases ______________________

II. Pulmonary Circulation
A. The right ventricle pumps blood into the ______________________
B. This vessel divides into the ________ & ______________________________
   1. One to each ________
C. After gas exchange occurs:
   1. ________________________ exit each lung
   2. Enter the ________________________
III. Systemic Circulation: Arteries

A. Aorta
1. The part of the aorta leaving the left ventricle is called __________________
   a. What 2 arteries branch off this part of the aorta? __________________ & __________________
2. The aorta then arches ________ & to the ________ as the ____________
   a. What three major branches originate here:
      1. ______________________________
      2. ______________________________
      3. ______________________________
3. The longest part of the aorta is called the ________________
   a. Which portion is the thoracic aorta? ______________________________
   b. Which portion is the abdominal aorta? ____________________________
4. At its termination the aorta divides into ______________________________

B. Coronary Arteries
1. Refer to Chapter 20.

C. Arteries to the Head and the Neck
1. What is the first branch off the aortic arch? ____________________________
   a. It branches at the level of the clavicle to form:
      1. ______________________________
         a. Transports blood to _________________________________
      2. ______________________________
         a. Transports blood to ______________________________
2. What is the second branch off the aortic arch? ________________________
   a. Transports blood to ______________________________________
3. What is the third branch off the aortic arch? ___________________________
   a. Transports blood to ______________________________________
4. Each common carotid artery divides into:
   a. ______________________________
   b. ______________________________
5. What is the carotid sinus? ______________________________________
a. Why is it important?______________________________________________

6. The external carotid arteries supply blood to __________________________

7. Blood Supply to the Brain
   a. Left and right vertebral arteries are branches of the _______________
      1. Enter the cranial cavity through the __________________________
      2. They join together to form the ______________________________
   b. The basilar artery:
      1. Gives off branches to the __________ & __________________
      2. Branches to form two _________________________________
         a. That supply blood to _________________________________
   c. The internal carotids enter the cranial cavity through _________________
      1. They terminate by forming ________________________________
         a. That supply blood to _________________________________
      2. Posterior branches are the ________________________________
         a. These connect to _________________________________
      3. Anterior branches are the ________________________________
         a. That supply blood to _________________________________
         b. These arteries are connected by ___________________________
         d. Forms a complete circle at the base of the brain around the pituitary called
            ________________________________ or __________________________

D. Arteries of the Upper Limb
   1. One continuous artery in the upper limb has three names based on location:
      a. Deep to the clavicle it is called ______________________________
      b. In the axilla it is called ______________________________
      c. Within the arm itself it is called ______________________________
   2. The brachial artery divides at the elbow to form:
      a. ____________________ on the ulna side of the forearm
      b. ____________________ on the radial side of the forearm
   3. In the palm of the hand:
      a. The ulnar artery forms ______________________________
b. The radial artery forms ______________________________

4. Extending from the two palmar arches are ______________________________
   a. That supply blood to ______________________________

E. Thoracic Aorta and Its Branches
1. Visceral branches supply blood to ______________________________
2. Parietal branches supply blood to ______________________________
   a. The walls of the thorax are supplied by ______________________________
   b. What supplies blood to the diaphragm? ______________________________

F. Abdominal Aorta and Its Branches
1. The three major unpaired visceral branches are:
   a. ______________________________
   b. ______________________________
   c. ______________________________
   1. Each has branches supplying ______________________________
2. Paired visceral branches supply the ________, ________, & ________

G. Arteries of the Pelvis
1. At the level of the fifth lumbar vertebrae the aorta divides into two ______________________________
2. Each of these divide into a:
   a. ______________________________ which supplies ______________________________
   b. ______________________________ which supplies ______________________________

H. Arteries of the Lower Limb
1. Based on location the external iliac artery becomes the:
   a. ______________________________ in the thigh which becomes the:
   b. ______________________________ behind the knee
   1. Below the knee it gives off a branch called ______________________________
   2. It continues down the back of the leg as the ______________________________
2. At the foot the anterior tibial artery becomes the ______________________________
3. The posterior tibial artery gives off branches called:
   a. __________ or ______________________________
   b. ______________________________
c. ______________________________

1. The plantar arteries give off ____________________ to the ________

IV. Systemic Circulation: Veins

A. Three Major Veins Return Blood to Right Atrium
   1. From the walls of the heart ______________________________
   2. From the head, neck, thorax, & upper limbs __________________________
   3. From the abdomen, pelvis, & lower limbs _____________________________

B. Veins Draining the Heart
   1. Refer to Chapter 20.

C. Veins of the Head and Neck
   1. External Jugular Veins
      a. More ____________________ of the two veins
      b. Drain blood from ______________________________
      c. Usually drain into ______________________________
   2. Internal Jugular Veins
      a. Drain blood from ______________________________
      b. Outside the cranial cavity they receive tributaries that drain ______________________________
      c. Join the subclavian veins to form the ______________________________

D. Veins of the Upper Limb
   1. Most of the blood from the upper limb drains through the:
      a. ______________________________
      b. ______________________________
      c. ______________________________
   2. The basilic vein becomes the ____________________ in the axilla
      a. This vein then becomes the ____________________ at the first rib
   3. The cephalic vein drains into the ______________________________
   4. Where is the median cubital vein? ______________________________
      a. Why is it important? ______________________________
5. Draining the forearm are:
   a. ______________________________ on the radial side of the forearm
   b. ______________________________ on the ulnar side of the forearm
   1. These veins drain into the ______________________________

E. Veins of the Thorax
1. The superior vena cava receives blood from three veins:
   a. Right ______________________________
   b. Left ______________________________
   c. ______________________________
2. Brachiocephalic veins receive blood from the anterior thoracic wall from:
   a. ______________________________
      1. They receive blood from ______________________________
3. The azygos vein receives blood from the posterior thoracic wall from:
   a. ______________________________ on the right
   b. _______ or ______________________________ on the left

F. Veins of the Abdomen and Pelvis
1. Blood from the posterior abdominal wall drains into ______________________________
   a. These empty into the superior vena cava via the:
      1. ____________________ on the right
      2. ____________________ on the left
2. The internal iliac veins drain the ______________________________
3. The external iliac veins drain the ______________________________
4. The internal iliac vein and external iliac vein join to form ______________________________ which join to form ______________________________
5. Hepatic Portal System
   a. What is a portal system? ______________________________
6. The hepatic portal vein is formed by the union of:
   a. ______________________________ draining ____________________
   b. ______________________________ draining ____________________
      1. ______________________________ draining ____________________
      2. ______________________________ draining ____________________
c. Also receives __________________________ before entering the liver

7. The hepatic portal vein empties blood into the liver sinusoids, which collect into __________________________, which empty into _________________

8. The hepatic veins also receive blood from:
   a. ____________________________ draining the __________________________

9. Hepatic veins empty into the __________________________

10. What happens to nutrients in the liver? __________________________

11. What happens to toxins in the liver? __________________________

G. Veins of the Lower Limb
   1. The deep veins of the leg are the:
      a. Anterior __________________
      b. Posterior __________________
         1. These veins unite just inferior to the knee forming ________________
   2. The popliteal vein becomes the ______________________ as it passes through the thigh and then become the ______________________________
   3. __________ or ____________________ empty into the posterior tibial veins
   4. The great saphenous vein:
      a. Originates ____________________________
      b. Ascends ____________________________
      c. Empties into __________________________
   5. The small saphenous vein:
      a. Begins ____________________________
      b. Ascends ____________________________
      c. Empties into __________________________

V. Dynamics of Blood Circulation
   A. Laminar and Turbulent Flow in Vessels
      1. What is laminar flow? ____________________________
         ____________________________
         a. Which layer moves slowest? ____________________________
         b. Which layer moves fastest? ____________________________
2. What causes turbulent flow? ______________________________________
   ______________________________________________________________

B. Blood Pressure
1. Define blood pressure: ___________________________________________
2. What is a mercury manometer? _________________________________
   a. Pressure of 100 mm Hg. means ________________________________
3. Why is the auscultatory method used to measure blood pressure? _______
   ______________________________________________________________
4. What is a sphygmomanometer? _________________________________
5. What are Korotkoff sounds? _________________________________
6. The process of measuring the blood pressure involves:
   a. Inflating blood pressure cuff until ______________________________
   b. Deflating cuff until the first Korotkoff sound is heard:
      1. Blood is flowing through the constricted area during _______________
      2. The pressure that this occurs at is recorded as ___________________
   c. Continuing to deflate cuff until no sound is heard:
      1. Continuous ____________________ has been reestablished
      2. The pressure that this occurs at is recorded as ___________________

C. Blood Flow
1. Blood flow is usually reported in _______________________________
2. Blood flow in a vessel is proportional to ______________________________
   a. If the pressure at point 1 and point 2 are the same ___________________
   b. The greater the pressure difference ______________________________
   c. Flow always occurs from a _____________ to a ____________ pressure
3. What is resistance? _______________________________
   a. As resistance increases ______________________________
   b. As resistance decreases ______________________________
4. What is the mathematical formula for blood flow? ______________________

D. Poiseuille’s Law
1. What does Poiseuille’s Law express? _______________________________
2. Resistance to flow dramatically decreases when ______________________
a. Because flow is proportional to ____________________________

3. What effect does increased viscosity have on flow? __________________

4. What effect does increased vessel length have on flow? ________________

E. Viscosity

1. What does viscosity measure? _________________________________

2. As the viscosity of a liquid increases _____________________________

3. Compared to distilled water blood has a viscosity of __________________

4. What is the hematocrit? _______________________________________

5. How does hematocrit effect the viscosity of the blood? _______________

F. Critical Closing Pressure and Laplace's Law

1. What is critical closing pressure? _________________________________

2. Laplace's Law

   a. States that __________________________________________________

   b. Helps explain ________________________________________________

      1. As the pressure in a vessel decreases __________________________

      2. If the pressure decreases below the minimum requirement _________

      3. As the pressure in a vessel increases __________________________

   c. The formula is _______________________________________________

   d. As the diameter of a vessel increases _____________________________

      1. Why is this important in aneurysms? __________________________

G. Vascular Compliance

1. What is compliance? __________________________________________

2. The more easily a vessel wall stretches ___________________________

3. If the pressure increases a small amount:

   a. Vessels with a large compliance ________________________________

   b. Vessels with a small compliance ________________________________

4. Which human blood vessels have the greatest compliance? __________

   a. These vessels can act as __________________________ for blood
VI. Physiology of Systemic Circulation

A. Cross-Sectional Area of Blood Vessels
   1. Total cross-sectional area is the result of determining ____________________ multiplied by ____________________
   2. The aorta has a cross-sectional area of ____________________
   3. Although capillaries are minute there are millions of them so there total cross-sectional area is ____________________
   4. When cross-sectional area is small, blood flow is ____________________
   5. When cross-sectional area is large, blood flow is ____________________

B. Pressure and Resistance
   1. What causes the decrease in arterial pressure? ____________________

C. Pulse Pressure
   1. What is pulse pressure? ____________________
   2. What two major factors influence pulse pressure?
      a. ____________________
      b. ____________________
   3. How does a change in stroke volume effect pulse pressure? ______________

   4. As arteries age they become ____________________
      a. This results in _________ systolic pressure & __________ pulse pressure
   5. The pulse pressure caused by left ventricular ejection produces a ____________________
      a. This can be felt in peripheral arteries and used to determine __________
   6. Dampening of the pulse results in capillaries receiving blood at a steady ____________________

D. Capillary Exchange and Regulation of Interstitial Fluid Volume
   1. What is capillary exchange? ____________________
   2. The most important process for capillary exchange is ____________________
   3. Net filtration pressure (NFP) is ____________________
      a. Mathematically it is NFP = ____________________
4. Net hydrostatic pressure is the difference ____________________________
   a. Blood pressure results from ________________________________
   b. Interstitial fluid pressure is ________________________________
5. Net osmotic pressure is the difference ______________________________
   a. Blood colloid osmotic pressure is ______________________________
   b. Interstitial colloid osmotic pressure is __________________________
6. At the arterial end of capillaries fluid moves out of the capillary because
   __________________________________________________________________________
7. At the venous end of capillaries fluid moves into the capillary because
   __________________________________________________________________________
8. The volume of interstitial fluid is kept within a narrow range by:
   a. Exchange __________________________________________________
   b. Movement __________________________________________________

E. Functional Characteristics of Veins
1. What is venous tone? _____________________________________
2. Increased sympathetic stimulation causes:
   a. Increases ______________________ by ________________________________
   b. Increases __________ return and __________ causing ______________
3. Decreased sympathetic stimulation causes:
   a. Decreases _______________ allowing ______________________________
   b. Decreases _______________, _______________, and __________________
4. Contraction of skeletal muscle ________________________ the veins
   a. Forces blood ________________________________

F. Blood Pressure and the Effect of Gravity
1. What effect does standing have on pressure in the venules of the feet?
   ______________________________________________________________________
2. The major effect of prolonged standing without movement is ______________
VII. Control of Blood Flow in Tissues

A. Local Control of Blood Flow by the Tissues

1. In most tissues, blood flow is proportional to ______________________
   a. Increases in response to __________________ oxygen demand
   b. Increases in response to __________________ metabolic end products

2. Blood flow does serve other purposes:
   a. In the skin __________________________________________________
   b. In the kidney ________________________________________________
   c. In the liver __________________________________________________

3. Functional Characteristics of the Capillary Bed
   a. Innervation of the metarterioles and precapillary sphincters is _________
   b. Vasodilator Substances
      1. Produced as ____________________________________________
      2. Diffuse to _____________, _____________, & ______________
         a. Cause these structures to ____________________
      3. Vasodilator substances include: ______________________________
         ______________________________________________________
      4. How does lack of nutrients cause vasodilation? ______________
         ______________________________________________________
      5. What is vasomotion? ______________________________________

B. Nervous and Hormonal Regulation of Local Circulation

1. Nervous control of arterial blood pressure is important ______________
2. Blood pressure must be adequate to move blood through capillaries:
   a. While ______________________________
   b. During ______________________________
   c. In response ______________________________

3. Nervous regulation shunts blood ______________________________

4. Which part of the autonomic nervous system is most important in controlling blood flow? ______________________________

5. Where is the vasomotor center? ______________________________

6. Peripheral blood vessels are partially constricted at all times due to:
   a. This condition of the vessels is referred to as ____________________

7. Vasoconstriction results from ______________________________

8. Vasodilation results from ______________________________

9. What areas of the brain can effect the vasomotor center? ____________________
   ____________________

10. Norepinephrine binds to ____________ receptors and causes ____________

11. Epinephrine binds to ____________ receptors and causes ____________

VIII. Regulation of Mean Arterial Pressure

A. Mean Arterial Pressure (MAP)
   1. MAP is slightly less than ______________________________
   2. What is peripheral resistance? ______________________________
   3. MAP is proportional to ____________________ times __________________
   4. Mathematically MAP is represented as ______________________________
      a. Increasing any of these factors ____________________ blood pressure
      b. Decreasing any of these factors ____________________ blood pressure

B. Short-Term Regulation of Blood Pressure
   1. Baroreceptor Reflexes
      a. Important in regulating blood pressure on ____________________
      1. Detect even ____________________
2. Respond 

b. What are baroreceptors sensitive to? 

1. Where are they located? 

   

c. The carotid sinus reflex is activated by 

d. The aortic arch reflex is activated by 

e. Normal blood pressure the arterial wall so that 

f. In response to a sudden increase in blood pressure:

1. Frequency of action potentials 

2. Action potentials influence the & centers of the 

3. The vasomotor center responds by:
   a. 
   b. Which causes peripheral vessels to 

4. The cardioregulatory center responds by:
   a. 
   b. Heart rate & blood pressure 

g. In response to a sudden decrease in blood pressure:

1. Frequency of action potentials 

2. Action potentials influence the & centers of the 

3. The vasomotor center responds by:
   a. 
   b. Which causes peripheral vessels to 

4. The cardioregulatory center responds by:
   a. and
   b. Is accompanied by 
   c. Heart rate & stroke volume 

5. Blood pressure 

h. How long does it take for the baroreceptors to adapt to any new sustained blood pressure? ________________

2. Adrenal Medullary Mechanism
   a. The mechanism is activated when ________________

   1. Examples are:
      a. Large ______________________________
      b. Sudden ______________________________
      c. Other ______________________________

   b. The adrenal medullary mechanism results from stimulation ________________

   1. The adrenal medulla releases ________________ & smaller amounts of ________________ causing:
      a. Increased ____________________
      b. Increased ____________________
      c. ____________________ in blood vessels to skin and viscera
      d. Epinephrine can ____________________

   c. The mechanism is ________________ & ________________

3. Chemoreceptor Reflexes
   a. Where are the carotid bodies? ______________________________
   b. Where are the aortic bodies? ______________________________
   c. When oxygen availability decreases in the chemoreceptor cells:
      1. Frequency ______________________________
      2. Stimulates ______________________________
      3. Resulting in ______________________________
      4. Normally don't respond ______________________________
   d. The chemoreceptor cells are also stimulated by:
      1. Increased ______________________________
      2. Increased ______________________________
   e. Increased vasomotor tone:
      1. Increases ______________________________
2. Increases blood flow through tissues in which ____________________

4. Central Nervous System Ischemic Response
   a. What is the central nervous system ischemic response? ____________________
      __________________________________________________________
   b. Reduced blood flow to the medulla results in:
      1. Reduced ______________________________
      2. Increased ______________________________
      3. Reduced ______________________________
         a. This strongly stimulates the ______________________________
         b. Which causes ____________________
         c. Systemic blood pressure ______________________________
         d. Increases ______________________________
   c. If severe ischemia lasts longer than a few minutes ___________________
      1. Vasomotor center becomes inactive & _________________________
   d. Prolonged ischemia of the medulla oblongata leads to ________________
      __________________________________________________________

C. Long-Term Regulation of Blood Pressure
   1. Renin-Angiotensin-Aldosterone Mechanism
      a. This mechanism helps regulate ______________________________
      b. Can also influence ________________________________________
      c. The kidneys release an enzyme called _________________________
      d. What structure releases renin? ______________________________
      e. Where is angiotensinogen synthesized? _________________________
      f. What does renin do to angiotensinogen? _________________________
      g. The fragment is called ______________________________
      h. What enzyme is found in the lungs? ___________________________
         1. This enzyme converts ______________________________ to
            ______________________________ or _____________________
      i. Angiotensin II causes vasoconstriction in _________ & ____________
         1. Increasing __________________ & __________________________
j. Angiotensin II also stimulates the adrenal cortex to release ____________

k. Aldosterone acts on the kidneys to:
   1. Increase ______________________________
   2. Increase ______________________________
   3. If ADH is present increase ______________________________
      a. This conserves water to ______________________________

l. Angiotensin II also increases the _________, _________, & _________

m. Renin secretion is stimulated by ______________________________

n. Renin secretion decreases in response to ______________

2. Vasopressin (ADH) Mechanism
   a. Baroreceptors detect decreases in blood pressure and stimulate release ______________________________ from ______________________
   
   b. ADH acts directly on blood vessels to cause __________________
   
   c. ADH also acts on the kidneys to decrease _________________________
      1. This helps to maintain ______________________________
   
   d. ADH is also released in response to ___________ in solute concentration

3. Atrial Natriuretic Mechanism
   a. Where does atrial natriuretic hormone come from? ________________
   
   b. What causes its release? ______________________________________
   
   c. Functionally atrial natriuretic hormone:
      1. Acts on the kidneys to:
         a. Increase ______________________________
         b. ________________ loss in the urine
            1. Causes the blood volume to ________________ which
               ______________________________ venous return
      2. Also ________________ arteries and veins
         a. Results in a decrease in ______________________________
      3. Both effects cause a ______________________________

4. Fluid Shift Mechanism
   a. The fluid shift mechanism occurs in response to ________________
b. As blood pressure increases ____________________________________
   1. Helps prevent development of ______________________________

c. As blood pressure falls ________________________________________
   1. Resists __________________________________________________

d. Blood pressure is ___________ because interstitial _____________

5. Stress-Relaxation Response
   a. When blood volume suddenly declines:
      1. Blood pressure ______________________________
      2. Causing ______________________________
      3. In response the smooth muscle cells ____________ reducing the
         ______________________ & resisting __________________________

   b. When blood volume increases rapidly:
      1. Blood pressure ______________________________
      2. In response smooth muscle cells ______________________________
      3. Resulting in ______________________________