Unit 10 – Cardiovascular System

AP Biology 12

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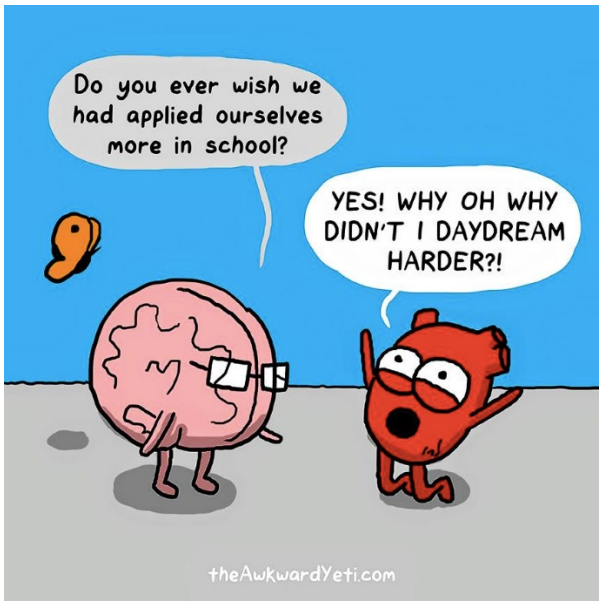
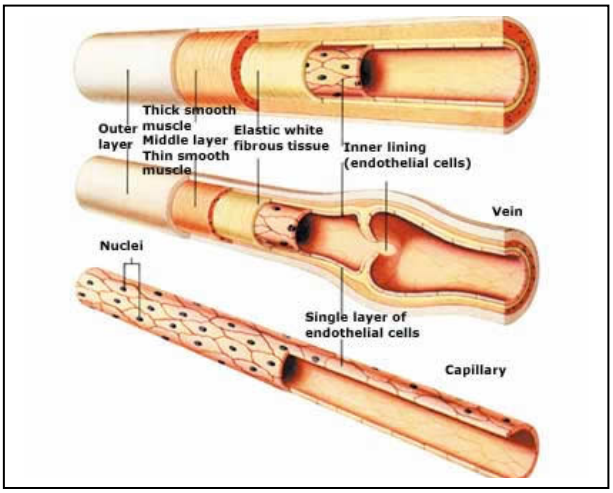
AT THE END OF THIS UNIT STUDENTS SHOULD BE ABLE TO…

1. List the three main types of blood vessels, their structural features, and their major functions.
2. Identify the type of blood vessel in which exchange takes place. Explain what is being "exchanged" and why.
3. List the major types of blood cells, and their functions.
4. Identify the major molecular and cellular events that result in a blood clot.
5. Define capillary exchange and describe the two major forces involved.
6. Identify the major components of the heart, including the four chambers and four valves.
7. Trace the path of blood through the heart and lungs.
8. Describe the intrinsic and extrinsic control of the heartbeat.
9. Describe the flow of blood from the heart through all major parts of the body.
10. Explain the factors that affect blood pressure in arteries, capillaries, and veins.
11. Describe the flow of blood in a fetus
12. Explain the role of the placenta
13. Describe the major categories of circulatory system disease that occur in Canada.
14. Define hypertension and describe its most common causes.
15. List three possible treatments for a blocked coronary artery.



10.1 – THE BLOOD VESSELS

- The circulatory system has 3 types of blood vessels:
  - Arteries, _____
    _____
  - Capillaries, _____
    _____
  - Veins, _____
    _____



The Arteries

- An arterial wall has 3 layers:
  - _____
  - _____– controls blood flow and pressure
  - _____
- The largest artery in the body is the aorta.
- Smaller arteries branch off from the aorta,
  _____
- Arterioles are _____.
  - When the muscle fibers in arteries and arterioles are contracted (constricted), the _____.
  - When they are relaxed (dilated),
    _____.
  - Whether they are constricted or dilated, this _____

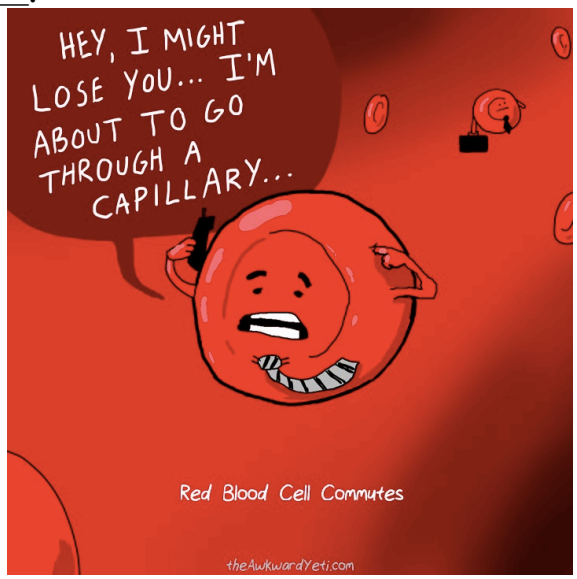
The Capillaries

- Capillaries join _____.
  - They are extremely narrow, and have thin walls made of only _____
    _____.
  - Although they are small they form vast networks called _____
    _____.
  - Capillaries play a very important role in homeostasis, because they facilitate _____.
  - _____into the fluid that surrounds cells. Some water leaves as well and is picked up by lymphatic vessels.
  - _____.
- Only certain capillary beds are open all the time.
- Most are _____
  _____.
  - For example, after eating, the capillary beds that serve the digestive system are mostly open, and those that
    _____.

- Each bed has anastomoses, shunts, that allow blood to go through, or _____

The Veins

- Veins and venules take blood from the _____.
  - First, the venules drain blood from the capillaries and _____.
  - The walls of veins and venules have the same three layers of arteries, but _____ _____.
- Veins often have valves, which _____ _____.
- Valves are found in the veins that carry blood _____.
  - Blood flow in the veins is primarily due to _____.
  - If the valves become damaged by disease or through normal wear and tear of aging, _____, causing them to enlarge (varicose veins).
- The largest veins are the _____ _____.



10.2 – BLOOD

- Blood is considered to be a _____.
- It has _____.
  - Blood transports _____.
- Blood helps regulate temperature by dispersing body heat, and regulate _____ _____.

  - It also helps protect the body against _____.
  - Clotting mechanisms protect the body against _____.
- Blood is separated into three components:
  - _____– the liquid portion of blood
  - _____–formed elements
  - _____ – formed elements

Plasma

- Plasma contains a variety of _____ dissolved or suspended in H2O.
- Plasma proteins assist in transporting _____.
  - For example: lipoproteins transport cholesterol.
- Other plasma proteins such as _____ _____.
  - Some even have immune functions such as _____ _____.

Red Blood Cells

- Red blood cells (erythrocytes), are _____ of the skull, ribs, vertebrae, and ends of the long bones.
  - Mature red blood cells do not have a nucleus, this shape helps them to move more easily through capillaries, as well as _____ _____.
  - RBC's carry _____ _____.
  - A hemoglobin molecule contains a heme group which contains the _____ _____.
- RBC's only live for 120 days, they are _____, and the iron is mostly salvaged.
- When the body does not contain enough hemoglobin, and individual suffers from anemia. There are 3 basic causes of anemia:
  - _____
  - _____
  - _____
- Whenever arterial blood carries a reduced amount of oxygen, the _____, which speeds the maturation of RBC's.

White Blood Cells

- White blood cells (leukocytes) fight infection and play a role in the _____.
  - They are larger than RBC's and _____.
- Based on structure: it is possible to divide WBC's into _____

_____.

- Granular leukocytes _____ are filled with _____, which help WBC's defend the body against microbes.
- Neutrophils are the most _____ _____
- Basophils _____, which can cause inflammation
- Eosinophils are thought to fight parasitic worms, although they are also _____.

■ Agranular leukocytes (monocytes and lymphocytes) typically have a _____.

- Monocytes are the largest of the WBC, and they differentiate into _____.
  - Dendritic cells are _____ _____: skin, nose, lungs, and intestines. Once they catch a microbe, they stimulate other WBC's to defend the body.
  - Macrophages play a similar role in the _____ _____.
- Lymphocytes are of two major types: _____.
  - B cells produced _____
  - T cells branch into another two types: helper T cells that _____, and cytotoxic T cells _____.

■ If the number of WBC's increases or decreases beyond normal, _____.

- If neutrophil numbers decrease, this indicates a _____.
- An HIV infected person will have a very _____.
- Leukemia is characterized by _____.

Platelets and Blood Clotting

■ Platelets (thrombocytes) are fragments of certain large cells called _____.

- These formed elements are involved in the process of _____.

Blood Clotting

■ Platelets clump at the site of puncture and _____.

- Platelets then release prothrombin activator, which _____, Ca2+ is required for this.
- Thrombin acts as an enzyme that _____.
- Fibrin threads wind around platelets and _____.

- A fibrin clot is temporary, as soon as the blood vessel begins to repair, an enzyme called _____.

Clotting Diagram

Hemophilia

- Hemophilia is a group of inherited clotting disorders caused by a _____ _____.
  - Hemophilia A accounts for 90% of clotting disorders and is primarily seen in men because the _____.
  - The slightest bump can cause _____.
  - Bleeding into muscles can lead to _____.
  - Death can result from _____.
  - People with hemophilia require _____.

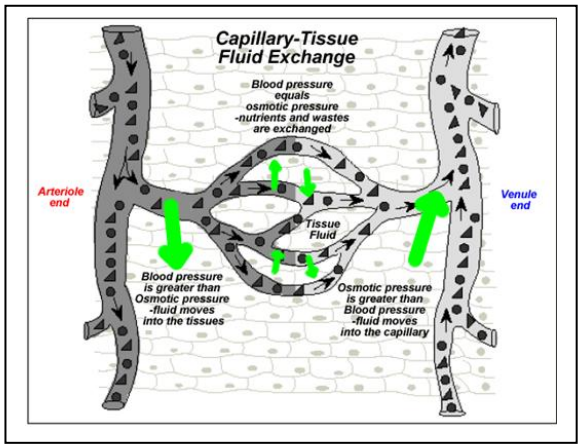
Bone Marrow Stem Cells

- A stem cell is a cell is a cell that is capable of dividing and producing new cells that go on to _____.
- Bone marrow stem cells have the ability to differentiate into:
  - _____
  - _____
  - _____
  - _____
  - _____
  - _____
- _____ could be used to treat conditions such as diabetes, heart disease and liver disease.
- The use of a persons own stem cells is ideal because they _____ _____.
- Some researchers also work with embryonic stem cells which can be collected from _____.

Capillary Exchange

- Two forces primarily control movement of fluid through the capillary wall:
  - _____. Here waster moves from the tissue into the blood
  - _____ tends to cause water to move in the opposite direction.

- At the arterial end of a capillary, blood pressure is higher than osmotic pressure, so _____.
- Midway along the capillary, blood and osmotic pressure are essentially equal, _____.
- Solutes can diffuse _____.
- _____.
- In the lungs, the movement of O2 and CO2 is reversed.
- Red blood cells and almost all plasma proteins _____.
- At the venous end of the capillary, blood pressure is less than osmotic pressure, so



_____.
- Excess fluid is collected by the _____ _____.
- Tissue fluid contained within lymphatic vessels is called _____.
- Lymph is returned to venous blood when _____ _____.

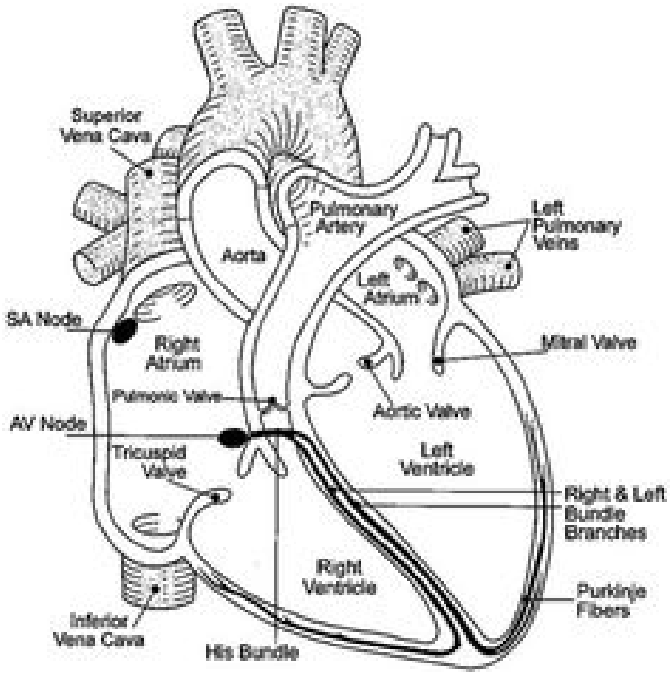
10.3 – THE HUMAN HEART

- The heart is a muscular organ about the size of a fist.
- It is located _____, and is tilted so the apex it to the body's left.
  - The major portion of the heart, myocardium, _____.
  - The heart lies in the pericardium, _____ _____.
- Internally, the septum _____.
- The heart has four chambers:
  - _____.
  - _____.
- Valves help _____.
  - Two lie between the atria and the ventricles called the _____ _____.
    - On the right is the _____, on the left is the _____.

- The other two valves lie between the ventricle and their attached vessels, the _____.
  - There is the _____.

Path of Blood through the Heart

- The superior and inferior vena cava carry _____ _____.
- The right atrium sends blood through the _____ _____.
- Right ventricle sends blood through the _____ _____, into the pulmonary trunk and through the _____.
- Four pulmonary veins, carrying _____ _____.
- The left atrium sends blood through the _____ _____.
- Left ventricle sends blood through the _____ _____.
- O2-poor blood _____.
- Blood must go through the lungs to pass from the _____ _____.
- The heart is a _____. The right ventricle sends blood to the lungs, and the _____.
- The left ventricle has a bigger job, _____.
- The volume of blood that the left ventricle pumps per minute is called _____.
- The pumping of the heart sends _____ _____.
- The pulse is a wave effect that passes down the walls of the _____ _____

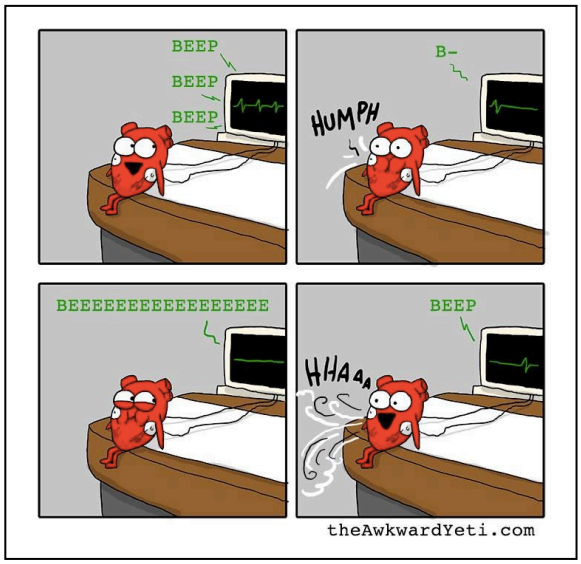


The Heartbeat

- Each heartbeat is called a _____.
- When the heart beats, first the _____, then the _____, then all the _____.
  - Systole is the _____.
  - Diastole is the _____.
- The heartbeat sounds like "lub-dub" through a stethoscope.
  - The "lub" sound comes from the _____.
  - The "dub" sound comes from the _____.

Intrinsic Control of Heartbeat

- The rhythmic contraction of the heart is due to the _____ _____
  - Nodal tissue has both _____ _____, and is located in two regions of the heart.



- _____ is in the upper back wall of the right atrium.
- _____ is located in the base of the right atrium near the septum.

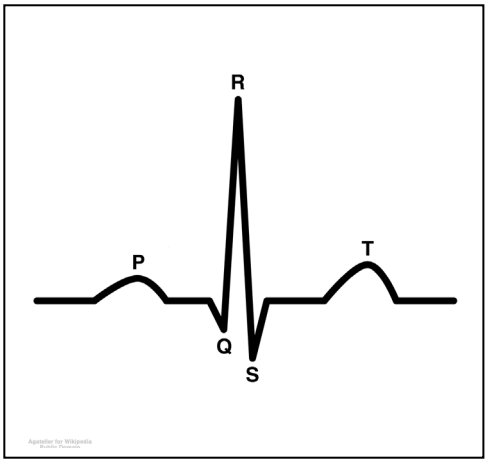
- The SA node initiates the heartbeat, and _____ _____.
  - The AV node delays the impulse for a fraction of a second to ensure the _____.
  - The AV node sends the impulse down the septum through the _____

Extrinsic Control of Heartbeat

- The body has an external way to control the heartbeat in the _____ _____.
- This is part of the _____ that divides further into two systems:
  - The parasympathetic division which _____.
  - The sympathetic division which _____.
- The hormones _____.

The Electrocardiogram

- An electrocardiogram (ECG) is a recording of the _____ _____.
- When the SA node triggers an impulse:
  - Atrial fibers produce the P wave – _____ _____.
  - The QRS complex signals that _____ _____.
  - The T wave indicates that the _____ _____.

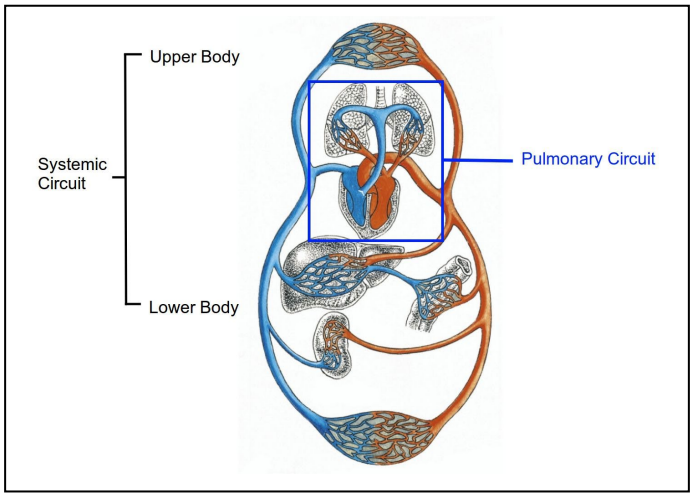


10.4 – THE VASCULAR PATHWAYS

- The circulatory system has two circuits:
  - The pulmonary circuit – _____.
  - The systemic circuit – _____.

The Pulmonary Circuit

- Blood from the body collects in the _____.
  - The right ventricle pumps de-O2 blood _____ _____.
  - Once O2 and CO2 have been exchanged at the pulmonary capillaries,



_____.

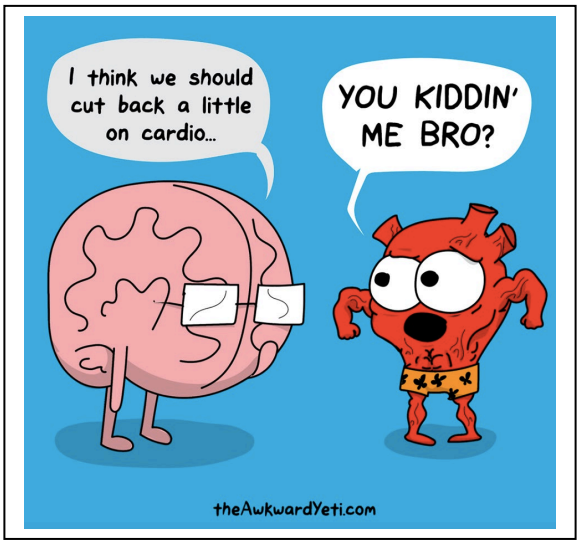
The Systemic Circuit

- The path of systemic blood _____ _____ _____.
- In most instances, the artery and the vein _____ _____.
- A portal system in blood circulation _____.
  - _____ is associated with the liver.
    - Capillaries in the villi of the small intestine, _____ _____.
    - This vein carries the blood _____.
    - The hepatic vein leaves the liver and _____.

Blood Pressure

- Systolic pressure results from blood being _____ _____.
- Diastolic pressure is the pressure in the _____ _____.

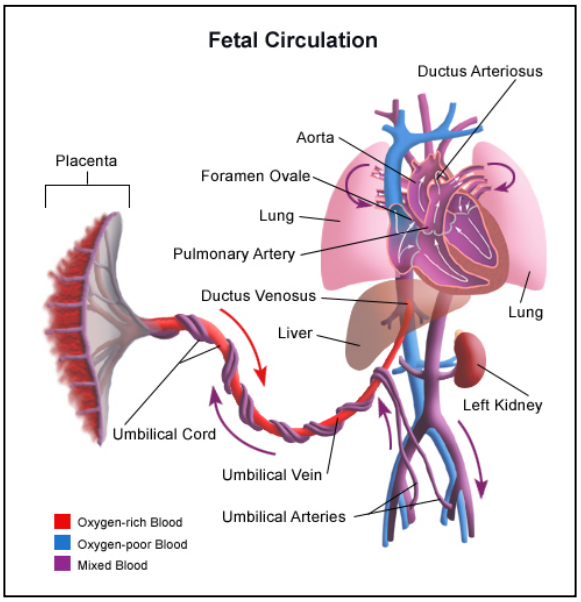
- As blood flows from the aorta into the arteries and arterioles, _____.
  - In the capillaries blood flow _____.
- Blood pressure can be measured with a _____ (a pressure cuff), that determines the _____ _____.
  - Blood pressure is expressed in mm of Hg.
  - Blood pressure consists of two numbers that _____.
    - A typical adult blood pressure is _____.
- Blood pressure in the veins is low, and



_____ _____.
  - When skeletal muscles near veins contract, _____ _____.
  - Valves in the veins prevent backflow of blood, therefore _____ _____.

10.5 – FETAL CIRCULATION

- The fetus has circulatory features that are _____.
  - These are necessary because the _____ _____
- Features in the heart include:
  - _____ – an opening between the two atriums so the blood entering the right atrium can be shunted to the left, _____.
  - _____ – a vessel that shunts blood that enters the right ventricle from the_____.
- Other features include:



- _____.
- The placenta facilitates exchange of gases and nutrients _____ _____.
- Umbilical veins carry blood rich in _____.
  - The umbilical vein enters the liver, and then joins the ductus venosus, _____.

- The most common cause of cardiac defects in a newborn is the _____ _____.
  - When a baby takes their first breath, blood enters the lungs, the return of this blood to the _____ _____.
  - In a small number of cases, this passageway does not close resulting _____.
    - This can be corrected by _____ _____.

Structure & Function of the Placenta

- Humans belong to the group of mammals called _____.
  - _____ between mother and baby.
  - The umbilical cord _____ - _____.
  - The umbilical cord is the _____.

10.8 – CIRCULATORY SYSTEM DISORDERS

- Cardiovascular diseases are the leading cause of _____ _____.
- Research efforts have resulted in _____ _____.

Atherosclerosis

- Atherosclerosis is an accumulation of soft masses of fatty materials, _____
  - Such deposits are called _____.
  - Plaque can cause _____ _____
  - When the clot is stationary it is called a thrombus, _____ _____.
  - Thromboembolism, is a clot that is carried in the blood stream, _____

Hypertension

- Normal blood pressure values vary among _____ _____.
  - Approximately 1 in 5 Canadian adults have hypertension, which is high blood pressure.
  - Hypertension often occurs _____.
  - Forcing blood through narrowing arteries over time creates _____ _____.
  - This condition can lead to a _____.

Heart Valve Disease

- Heart valve disorders can range from _____.
- In some cases, heart valves are malformed at birth, but more commonly they _____.
  - A narrowing of the aortic valve is the most common followed by a _____.
  - Sometimes the valves can be repaired, more commonly though they are _____.

Stroke, Heart Attack, and Aneurysm

- A stroke often results when an arteriole in the brain _____ _____.
  - The lack of O2 causes a _____ _____.
- _____, the individual may suffer from angina pectoris.

- Characterized by a _____.
- When a coronary artery is completely blocked, a _____ _____

■ _____, most often the abdominal aorta or the arteries leading to the brain.

- Atherosclerosis and high blood pressure _____ _____.