3.2 Organisation and the Vascular Structures

### Objectives

At the end of this sub section students should be able to:

| 3.2.2 Organisational complexity of the human - Human Circulatory & Lymphatic Systems | 1. Understand what is meant by the term Closed Circulation System in humans  
2. Describe the structure and organisation of the human Closed Circulation System, i.e. strong muscular heart, arteries, venules, capillaries, veins  
3. Identify the two circuits in the human system circulation system (1) pulmonary Circuit, (2) Systemic Circuit  
4. **Draw** and label the structure of the heart  
5. Mark the pathway of blood in a diagram of the heart and through the systemic and pulmonary circuits  
6. Explain the term Portal System and identify the Hepatic Portal Vein in a diagram  
7. Explain the role of muscles and valves in the heart and blood vessels  
8. Explain how the heart supplies blood to the heart wall through the Coronary arteries and Cardiac veins  
9. Understand and explain Pulse  
10. Understand and explain Blood Pressure  
11. Explain the effect of exercise on the circulation system  
12. Explain the effect of salt, fat and being overweight on the circulation system  
13. Give a simple explanation of the heart beat and how it is controlled (more detail in sec 3.2.4)  
14. Describe the structure of the Lymphatic System and describe three functions of the system  
15. State the four main parts in blood and give the function of each part (more detail for HL in sec 3.2.3)  
16. Name the four common blood groups and name the two rhesus blood types  

| 3.2.3.H Blood Cells extended study | 17. Describe the structure of red blood cells in detail  
18. Describe the structure of white blood cells  
19. Classification of white blood cells as Lymphocytes or monocytes  

| 3.2.4.H Heartbeat control | 20. Know the location of the Pacemaker (SA Node) (sinoatrial node)  
21. Know the location of the Pacemaker (AV Node) (atrioventricularl node)  
22. Understand that the heart has specialised Cardiac Muscle  
23. Explain the stages in the cardiac Cycle  
24. Understand the terms Systole and Diastole  
25. Explain how the AV and SA nodes function in relation to the heart cycle  

### Practical activity

**ME** - **Dissect and display and identify the dissected parts in a Sheep or Ox heart**  
**ME** - **Investigate the effect of exercise on pulse rate (or breathing rate)**
Composition of blood:

**Blood** (5-6 litres/8% body weight)

- **Plasma** (55% by volume)
  - Serum
  - Fibrinogen

- **Cells**
  - Red blood cells
  - White blood cells
    - Monocytes
    - Lymphocytes

- **Platelets**

**PLASMA** is a straw-coloured fluid, pH of about 7.4, containing:
- 90% water, 7% proteins and 3% dissolved substances:
  - Proteins e.g. antibodies, clotting proteins
  - Nutrients e.g. amino acids, glucose, vitamins and minerals
  - Gases e.g. oxygen and carbon dioxide
  - Wastes e.g. urea.

**Function:**
(a) **Transport** medium for **blood cells** and **dissolved substances**.
(b) **Transport heat** from organs such as liver. Helps to maintain a constant body temp.

**Serum** is plasma minus clotting proteins. It is sometimes used in injections to give someone resistance to disease (contains antibodies).

**RED BLOOD CELLS** (5 million per mm$^3$)
- Biconcave discs, 7-8μm in diameter, elastic membrane. Contain haemoglobin (red pigment), no mitochondria (can transport oxygen). Life span = about 4 months (no nuclei). Made in bone marrow of bone, such as ribs and sternum.

**Function:**
**Transport of oxygen** (haemoglobin + oxygen = oxyhaemoglobin) and 20% of the carbon dioxide.
(Dead red blood cells are broken down in the liver/spleen. The iron is stored in liver and recycled to make haemoglobin in bone marrow and the rest forms bile.)

**Anaemia** results from a lack of haemoglobin (or RBCs). The person lacks energy and can look pale. Causes are menstruation and lack of iron in diet. Iron-rich foods = red meat, liver, kidneys, chicken, eggs, sardines, nuts, prunes, apricots, bananas and green veg.
WHITE BLOOD CELLS  $\approx 8000/mm^3$
Larger flattened discs, nucleus, have no definite shape. Made in bone marrow.
Function: defence against disease.
Two types are:
- **Monocytes** - comprise 5% WBC. Size 15-20µm. Life span: 6-9 days.
  Function: They engulf foreign matter by phagocytosis. Some, called macrophages, can leave blood vessels and engulf damaged/dead cells as well as antigens in the tissues.
- **Lymphocytes** – comprise 25% of WBC. Size 8-10µm. Some mature and all are stored in the lymphatic system. Life span: 3months – 10 years.
  Function: Produce antibodies to fight disease.

**Leukaemia**
Is a form of cancer in which white blood cells are produced too rapidly and are immature. Cause is unknown but often linked to radiation exposure. They crowd out other blood cells and may cause anaemia, increased risk of infection and reduced ability to clot blood. Treatment is by drugs and radiation.

**PLATELETS** - $\approx 300,000/mm^3$ 2µm
Tiny fragments of cells. No definite shape and no nuclei. Made in bone marrow. Live for about a week.
Function:
Blood clotting.

<table>
<thead>
<tr>
<th></th>
<th>Red blood cells</th>
<th>White blood cells</th>
<th>Platelets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shape</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nucleus</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Function</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Site of production</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Number of types</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ratio of each type</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Blood clotting:**
When a blood vessel is cut:
1. The vessel narrows to reduce blood flow.
2. Platelets stick to the damaged cells to form a temporary clot.
3. A permanent clot is made when fibrin forms a mesh of strands at the site of the damaged cells.
   Blood cells are trapped in the mesh and later it hardens as a scab.
Blood clotting prevents further loss of blood and the entry of pathogenic micro-organisms.
In **haemophilia**, the platelets cannot make one of the clotting chemicals (usually factor VII) and so their blood will not clot easily if they cut themselves. They get regular injections of factor VII. Also their blood vessels are inclined to leak or burst under skin, leading to painful swelling, particularly in joints. **Thrombosis** – a blood clot forms inside a blood vessel and may block it e.g. stroke or heart attack.

**BLOOD GROUPS - ABO system:**
Two antigens, A and B, can be present on the surface of red blood cells.

<table>
<thead>
<tr>
<th>Blood group</th>
<th>O</th>
<th>A</th>
<th>B</th>
<th>AB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antigens</td>
<td>Neither</td>
<td>A</td>
<td>B</td>
<td>A and B</td>
</tr>
<tr>
<td>Antibodies (in plasma)</td>
<td>A and B</td>
<td>B</td>
<td>A</td>
<td>neither</td>
</tr>
<tr>
<td>Occurrence (Ireland)</td>
<td>55%</td>
<td>31%</td>
<td>11%</td>
<td>3%</td>
</tr>
</tbody>
</table>

The immune system will not produce antibodies against its own antigens but will produce antibodies against the other antigens. When blood transfusions are given it is important that the recipient’s blood matches that of the donor. If bloods are not the same clumping of donor’s RBCs occurs. This may block a blood vessel with fatal consequences. In addition, haemoglobin leaks from the agglutinated cells and may eventually cause kidney failure.

**Universal donor** = Blood group O (no antigens). Can be given to all other groups.

**Universal recipient** = Blood group AB (no antibodies)

**Rhesus factor:**
Rhesus\(^+\) or Rhesus\(^-\)
Grouping is determined by the presence or absence of a rhesus protein (first discovered in rhesus monkeys and then in humans). Rh\(^+\) people cannot make anti-D, the D antibody. Rh\(^-\) people are not born with anti-D but can make it if they are given Rh\(^+\) cells. In Ireland about 85 % are rhesus positive and 15% rhesus negative. Important in prenatal life. If the mother is Rh\(^-\) and the unborn child is Rh\(^+\) then some of the baby’s RBCs with D antigens may cross into the mother’s bloodstream at the end of pregnancy (placenta becomes ‘leaky’). The mother will recognise these D antigens as ‘foreign’ and produce antibodies against them. Usually there is no danger to the baby during the first pregnancy, though the mother is now sensitised to D antigen. These antibodies will destroy the baby’s red blood cells in subsequent Rh\(^+\) babies because antibodies pass into baby. This may cause the baby to be anaemic, brain damaged or stillborn. To prevent this happening the mother may be injected with Rh antibodies immediately after birth of first child. These will destroy the baby’s RBC before they cause a natural build-up of anti Rh antibodies in her blood.

**NEED FOR A CIRCULATORY SYSTEM**

**Internal transport** in small animals is by diffusion and active transport e.g. amoeba, jellyfish and flatworms whereas bigger and more complex animals e.g. humans need a vascular system.

**Open circulatory system – blood leaves the blood vessels.** Blood is pumped into open-ended vessels. The blood then passes into the body cavity where it bathes the cells. Later it goes back into the blood vessels and returns to the heart e.g. insect.

**Closed circulatory system** – blood is always enclosed in blood vessels. Tissue fluid bathes the cells and acts as a medium through which substances are exchanged between the blood and the cells e.g. earthworms and vertebrates. The closed circulatory systems are more efficient than open ones because:
- The blood can be pumped around the body faster and therefore exchange of food and oxygen is faster. This allows the animal to be more active.
- It allows the flow of blood to different organs to be increased or decreased.

**Human Circulatory System**
Double, closed circulatory system. Blood passes through heart twice for every complete circuit of body (‘figure of eight’). A **pulmonary system** carries blood to the lungs where it becomes oxygenated and carries it back to the heart. The **systemic system** carries this oxygenated blood to the body and brings deoxygenated blood back to the heart. Advantages of this double system over a single one are (i) it separates the oxygenated from deoxygenated blood and (ii) it ensures that the blood pressure is high enough to reach all parts of the body (iii) allows a rapid and efficient delivery of nutrients. A single-circulation system can only produce low blood pressure around most of the body. This restricts the activities of the animal e.g. earthworm and fish.

**Double circulation in humans:**

---

**Circulatory system:**
A **portal system** is a blood supply that flows from one organ directly to another organ without passing through the heart e.g. hepatic portal vein brings blood (rich in digested food but lacking in oxygen) from the intestine directly to the liver. Portal systems begin and end with capillaries.

**BLOOD VESSELS**

**Structure** of arteries, veins and capillaries

<table>
<thead>
<tr>
<th>Differences:</th>
<th>Artery</th>
<th>Vein</th>
<th>Capillary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structure</strong></td>
<td>Small lumen</td>
<td>Large lumen</td>
<td>Relatively large lumen although microscopic.</td>
</tr>
<tr>
<td></td>
<td>Wall has a thick layer of muscle and elastic fibres.</td>
<td>Wall has thin layer of muscle and elastic fibre.</td>
<td>1 cell thick (allow exchange* of materials between blood and cells)</td>
</tr>
<tr>
<td></td>
<td>No valves(necessary as blood under pressure)</td>
<td>Valves (prevent backflow)</td>
<td>None</td>
</tr>
<tr>
<td><strong>Function</strong></td>
<td>Transport blood <strong>away</strong> from heart.</td>
<td>Transport blood <strong>to</strong> heart.</td>
<td>Link arteries to veins</td>
</tr>
</tbody>
</table>
**Blood flow**

<table>
<thead>
<tr>
<th>Rapid flow under high pressure.</th>
<th>Slow flow under low pressure – assisted by squeezing action of nearby arteries and muscles.</th>
<th>Slow, pressure falling (allows time for exchange of substances to occur)</th>
</tr>
</thead>
</table>

*Exchange of materials facilitated by:*
1. Thin walls (rapid entry/exit of materials)
2. Large surface area/branching – in close contact with all body cells.
3. Narrow tubes – pressure increases, causing leakage of plasma.

**Blood flow in arteries is helped by:**
1. A thick muscle layer – this contracts and pushes blood on
2. Elastic fibres – can expand and recoil to push blood on. Collagen layer prevents over-expansion.

**Relationship between blood vessels:**
Artery – arteriole – capillary – venule – vein

**Blood pressure** is the force exerted by the blood on the walls of the arteries due to the contracting of the heart. It depends on the volume of blood within the system and the space available within the blood vessels. Blood pressure is measured in an artery of the upper arm using a sphygmomanometer. An inflatable cuff is used to measure the pressure required to stop the blood flow at this point. Two pressures are measured: systolic and diastolic pressures of the ventricles (120/80 mm Hg – for a healthy adult). These values normally rise with age. If the lower of the two is above 95 the person is suffering from high blood pressure (hypertension). High blood pressure is often caused by blockages in arterioles or small arteries. The heart then has to pump harder and may lead to a stroke (lack of blood to the brain), heart attack and death.

**Pulse:**
A pulse is caused by the expansion and contraction of an artery as blood is forced through it. When the left ventricles contract, the pressure of the blood forced into the aorta causes the aorta to expand.
Feel pulse easily in neck or wrist.
Average adult pulse (heart) rate = 72 beats per min. Range: 60-100.

**Heart**
The heart is located in the thoracic cavity - between the lungs, slightly to the left, above the diaphragm and behind the sternum. It is surrounded by the pericardium. This double membrane is filled with fluid, which allows friction-free movement when the heart is beating.

**Internal structure of heart:**

(and blood flow)

Atrial walls are thinner than those of the ventricles because they only have to pump blood down into the ventricles. The left ventricle is much thicker than the right ventricle because it pumps blood to the entire body.

Valves are held in place by tendons (‘heart strings’), which are attached to the heart wall by projections called papillary muscles. Valves prevent backflow of blood.

Septum divides heart right and left. It separates oxygenated and deoxygenated blood. Cardiac muscle has its own coronary arteries and veins. Coronary arteries branch from aorta and coronary veins return blood to right atrium.

**Expt.: Dissection of a sheep’s heart**
CARDIAC CYCLE –
The sequence of events which take place during the completion of one heartbeat. Contraction of the heart is known as **systole** and relaxation of the heart (when the heart is filling with blood) is called **diastole**.

1. **Blood enters the heart.**
   The atria and ventricles are both relaxed (diastole). Blood enters the atria. All valves are closed.

2. **Blood is pumped from atria to ventricles.**
   Electrical impulses from the pacemaker cause the atria to contract (atrial systole). This pumps blood to the ventricles. The tricuspid and bicuspid valves open. The venae cavae and pulmonary veins close to stop blood entering the atria. The semi-lunar valves remain closed.

3. **Blood leaves the heart.**
   The atria relax and impulses from the AV node cause the ventricles to contract (ventricular systole). This forces blood out of the heart into the pulmonary artery and the aorta. The pressure forces open the semilunar valves and closes the cuspid valves (making the ‘lub’ sound). The ventricles now relax again. Closing of the semi-lunar valves prevents blood flowing back into the ventricles. This closure causes the ‘dub’ sound. The cycle now repeats itself – about 70 times per minute for an adult at rest.

Heart sounds are due to the closing of the valves – “lub dub” phonetically.
‘lub’ = low-pitched, quieter, long-lasting sound. ‘hub’ = higher-pitched, louder, shorter sound.

A heart murmur is any abnormal sound associated with the heart. It may indicate damage to one or more of the valves.

**Control of heartbeat.**
- Contraction of the heart is preceded by a wave of electrical excitation. It is triggered off by a special node of heart muscle: the sino-atrial node or **pacemaker**, located in the right atrium.
- When impulses through the nerves stimulate the pacemaker a wave of contraction spreads over the two atria. When the wave reaches the junction between the atria and ventricle, it excites AVN. The AV node then sends the electrical impulses down the septum. The impulse is passed out to the walls of the ventricles by thin fibres. The impulses from these fibres cause the ventricles to contract.
- If electrodes are placed on the heart they can measure the electrical activity of the heart. A record of this activity is called an ECG (electrocardiogram).

While heartbeat is usually controlled by the pacemaker, it can be altered by nervous stimulation from the brain or by hormones. Patients with heartbeat irregularities use artificial battery-powered pacemakers to regulate the heart beat. Factors that increase the rate of heartbeat include exercise, temperature, emotions and shock. Factors that decrease it are relaxation, sleep and alcohol.

**Expt. To investigate the effect of exercise on the pulse rate of a human (or the effect of exercise on the breathing rate).**
Coronary heart disease
Due to atherosclerosis – hardening of blood vessels. This is caused by excess cholesterol forming fatty deposits under the inner lining of an artery. An atheroma (raised lump of fatty deposits) in the artery will raise a patient’s blood pressure and soon lead to the development of a blood clot. This clot will block the artery completely or break away and block some other smaller blood vessel. This is called thrombosis. This could lead to a stroke, if the blood supply to the brain is impaired.

Angina is the pain resulting from a blockage in one of the coronary arteries. This may lead to a heart attack.

Effects of smoking, diet and exercise on the circulatory system.

1. Smoking
   - Nicotine increases heart rate and blood pressure thus increasing the workload of the heart.
   - Carbon monoxide destroys the oxygen-carrying ability of red blood corpuscles. This results in lower energy production by the body.
   - Other chemicals in tobacco increase the likelihood of blood clots in blood vessels (thrombosis).

2. Exercise
   Exercise enlarges and strengthens the heart. It improves blood circulations and helps to reduce body weight. Aerobic exercises (high oxygen intake over a long period of time) are most beneficial e.g. walking, running, swimming, cycling.

3. Diet
   - Large amounts of saturated (animal) fat raises cholesterol levels and increases risk of heart disease. Cholesterol increases the risk of forming blockages in arteries, especially the coronary arteries and those leading to the brain. These blockages result in heart attacks and strokes. Less fat is also a good way of losing weight and thus reducing strain on the heart.
   - High salt intake raises blood pressure.
   - Obesity causes high blood pressure and heart attacks.

Treatments for heart disease:
   - No smoking and more exercise
   - Eat fewer animal fats
   - Coronary bypass surgery
Lymphatic system
A secondary transport system that returns excess tissue fluid to the blood circulatory system.

**Tissue fluid** - liquid that is forced out of the capillary arterioles (due to high blood pressure). Contains no RBC and no plasma proteins.

**Lymph** = tissue fluid with lymphocytes, protein and lipids.

The cells take up the nutrients and oxygen and excrete their waste (carbon dioxide, urea) into the tissue fluid. Most of the tissue (intercellular) fluid reenters the capillaries (venules) by osmosis. Approx. 1-2% is returned in separate vessels called lymphatics.

Valves ensure that the lymph flows in one direction only. Muscles squeeze the lymph through the tubes. The lymph capillaries, which unite to form two main vessels, right lymphatic duct (which drains upper right side of body) and the thoracic duct (which drains rest of body), which return the fluid to the blood in the subclavian veins.

**Lymph nodes** are swellings on the lymph nodes(collections of lymphocytes), found especially in groin and armpits. These store lymphocytes, which in turn produce antibodies, which help, neutralise m/o and they also filter out bacteria, which are then digested by phagocytes.

**Functions of lymphatic system (learn three):**

1. **Drainage**
   To collect excess tissue fluid from intercellular spaces and return it to the blood (keeping the volume of the blood constant).

2. **Defend against infection**
   - Filters out germs and then phagocytes engulf and destroy them.
   - Stores lymphocytes, which produce antibodies.

3. **Transport**
   To absorb and transport fatty acids and glycerol via lacteals from the small intestine to skin or other organs for storage.
   To transport hormones from endocrine glands into bloodstream.
4. To help hearing and balance by carrying vibrations in the inner ear.

<table>
<thead>
<tr>
<th>Lymphatic system</th>
<th>Blood system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open circulatory system</td>
<td>Closed c.s.</td>
</tr>
<tr>
<td>No pump</td>
<td>Heart</td>
</tr>
<tr>
<td>No RBCs and proteins</td>
<td>Has both</td>
</tr>
<tr>
<td>Colourless fluid</td>
<td>Red</td>
</tr>
<tr>
<td>Nodes</td>
<td>None</td>
</tr>
</tbody>
</table>

Oedema is the swelling of the body (usually lower legs and feet) due to too much tissue fluid. It may be due to a failing circulation system or an unusual blood composition (too much water and salt or too little protein) due to a kidney complaint.

Elephantiasis is due to eggs from a parasitic roundworm getting in by mosquito bites. The young worms grow and block the lymph vessels giving an elephantiasis appearance of limbs. Treatment is by removal of worm, drainage of fluid and surgical repair of damaged vessels if necessary.

Heart dissection

Apparatus:
Scalpel, forceps, seeker, dissecting board, heart, rubber tubing, plastic dropper, dissecting gloves.

1. Wash the heart with cold water. Drain and dry it with paper towels.
2. Place the heart on the dissecting board so that the front (ventral) side is facing up.
   The left side will feel much firmer than the right side. The front side is more rounded and the thick-walled arteries are on this side. Observe a coronary artery – in a groove that extends from the right side of the broad end of the heart diagonally downward.
3. Locate the four chambers of the heart
<table>
<thead>
<tr>
<th>Upper chamber on your right</th>
<th>Lower chamber on your right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper chamber on your left</td>
<td>Lower chamber on your left</td>
</tr>
</tbody>
</table>

4. Identify the four major blood vessels that enter and leave the heart. Use a seeker or your finger in order to identify them.
   (Very often the butcher will have removed most of the vessels):
   1
   2
The arteries are the white, thick-walled tubes. Place a ‘pencil’ into one of the arteries and squeeze the ventricles. If you can feel it it is the pulmonary artery and if not, it’s the aorta. The pulmonary artery lies in front of the aorta as you look at the ventral surface.

Insert a rubber tube attached to a tap, into part of the vena cava and gently turn on the tap. The water comes out through the _________.

Repeat this for the pulmonary vein. The water flows out of the _________.

(a straw can be used to put into the different vessels).

5. Locate the semilunar valve of the aorta. Look down the aorta and use a seeker to pull up the three flaps of the semi-lunar valve.

6. Draw a labelled sketch of the external structure of the heart.

Dissection

7. Using a scalpel carefully make a shallow cut in the left atrium and left ventricle as seen in diagram.

8. Using fingers push open heart at cut to examine internal structure. Rinse out any blood.

9. Observe different sizes of chambers. Note in table.

10. Locate the bicuspid valve. Note number of flaps it has in table.

11. Insert forceps under chorea tendinae and notice that they extend from valve to papillary muscles.

12. Repeat steps 6 - 8 for right side of heart.

13. Note, in table, the difference in thickness between the walls of the left and right ventricles.

14. Locate the tricuspid valve. Note number of flaps in table.

15. Find the septum, a thick muscular wall, which separates the right and left sides of the heart.

16. Using the scalpel cut open the aorta and observe the semi-lunar valve. Note the number of half-mooned shaped flaps in valve in table.

17. Find two small openings at base of aorta just above semi-lunar valve. These lead into the coronary arteries. Insert seeker into a coronary artery to trace its pathway.

18. Repeat steps 14-15 for pulmonary artery.

19. Observe the pericardium – a membrane attached very closely to heart (like cling film)

20. Flag label the parts identified and draw a labelled diagram of the internal structure of the heart.

21. Wash and sterilise dissecting instruments after use.

Leave one heart aside for dye/air injection.

Air may be pumped into a coronary artery, using a plastic dropper, to see it pulsate. Dye may be used to show the pathway of blood (front coronary artery shows dye better).

With another heart cut it like a loaf of bread. Note the difference in thickness of the ventricles.

Results:

<table>
<thead>
<tr>
<th>Chamber</th>
<th>Size – small/large</th>
<th>Wall – thin/thick</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left atrium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right atrium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left ventricle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right ventricle</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Valve type | Number of flaps
--- | ---
Bicuspid | 
Tricuspid | 
Semi-lunar | 

Conclusion/Comment

What is the function of the coronary artery? | Bicuspid
--- | ---
This vessel supplies blood with oxygen and nutrients to the heart itself.

How does the external appearance of the atria differ from that of the ventricles? Explain the difference. | The atria are smaller than the ventricles because don’t have to pump blood all around the body.

What is the difference in thickness between the right and left ventricles? Explain why this difference exists. | The left ventricle is thicker than the right because it pumps blood all around the body. The right ventricle pumps blood to lungs only.

How do the valves work at the base of the arteries? | They open to allow blood in and close to prevent the backflow of blood.

What is the function of the tendon cords on the bicuspid and tricuspid valves? | To open and close the valves.

What might happen if the coronary artery became blocked? | Angina - the muscles of the heart do not receive enough blood.

The coronary veins return blood from heart muscle directly into the…….. | Right atrium

In the foetus the lungs does not oxygenate the blood. What does? | The placenta

What do we mean by ‘a hole in the heart’? |
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the foetus blood is diverted away from the lungs by ……</td>
<td>A hole between the right and left atrium that fails to close after the infant is born.</td>
</tr>
<tr>
<td>How many chambers in a mammal heart?</td>
<td>A short vessel between the pulmonary artery and aorta and the hole between the two atria.</td>
</tr>
<tr>
<td>Which side of the heart pumps oxygenated blood?</td>
<td>Four</td>
</tr>
<tr>
<td>What do we mean by a two-circuit circulatory system?</td>
<td>Left</td>
</tr>
<tr>
<td>What is the moderator band in a sheep’s heart?</td>
<td>One is the pulmonary system (going to and from lungs) and the second is a systemic system (to and from rest of the body)</td>
</tr>
<tr>
<td>What is the function of the moderator band?</td>
<td>A muscular band, formed from the papillary muscles, that runs from the anterior papillary muscle to the interventricular septum.</td>
</tr>
<tr>
<td>If water is run into part of the vena cava through which vessel does it come out?</td>
<td>To prevent over stretching of the right ventricle muscle.</td>
</tr>
<tr>
<td>How many flaps do the semi-lunar valves have?</td>
<td>Pulmonary artery</td>
</tr>
<tr>
<td>The heart and blood vessels are part of this system.</td>
<td>Three</td>
</tr>
<tr>
<td>Name the blood vessel that carries blood to the body.</td>
<td>Circulatory</td>
</tr>
<tr>
<td>This vessel carries oxygenated blood from the lungs.</td>
<td>Aorta</td>
</tr>
<tr>
<td>The heart is made of this type of muscle.</td>
<td>Pulmonary vein</td>
</tr>
<tr>
<td>Structures that hold the valves in place.</td>
<td>Cardiac</td>
</tr>
<tr>
<td>A chamber that receives blood from the lungs.</td>
<td>Tendons</td>
</tr>
<tr>
<td>Which valve has 2 flaps?</td>
<td>Left atrium</td>
</tr>
</tbody>
</table>
What is the function of the coronary artery?

How does the external appearance of the atria differ from that of the ventricles? Explain the difference.

What is the difference in thickness between the right and left ventricles? Explain why this difference exists.

How do the valves work at the base of the arteries?

What is the function of the tendon cords on the bicuspid and tricuspid valves?

What might happen if the coronary artery became blocked?

Coronary veins return blood from heart muscle directly into……...

In the foetus the lungs do not oxygenate the blood. What do we mean by ‘a hole in the heart’?

Foetus blood is diverted away from the lungs by……
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many chambers in a mammal heart?</td>
<td>4</td>
</tr>
<tr>
<td>Which side of the heart pumps oxygenated blood?</td>
<td>Right</td>
</tr>
<tr>
<td>What do we mean by a two-circuit circulatory system?</td>
<td></td>
</tr>
<tr>
<td>What is the moderator band in a sheep’s heart?</td>
<td></td>
</tr>
<tr>
<td>What is the function of the moderator band?</td>
<td></td>
</tr>
<tr>
<td>Water is run into part of the vena cava through which does it come out?</td>
<td></td>
</tr>
<tr>
<td>How many flaps do the semi-lunar valves have?</td>
<td>2</td>
</tr>
<tr>
<td>The heart and blood vessels are part of this system.</td>
<td></td>
</tr>
<tr>
<td>The blood vessel that carries blood to the body.</td>
<td>Aorta</td>
</tr>
<tr>
<td>Vessel carries oxygenated blood from the lungs.</td>
<td></td>
</tr>
<tr>
<td>Heart is made of this type of muscle.</td>
<td>Smooth</td>
</tr>
<tr>
<td>Structures that hold the valves in place.</td>
<td></td>
</tr>
<tr>
<td>Chamber that receives blood from the lungs.</td>
<td></td>
</tr>
<tr>
<td>What valve has 2 flaps?</td>
<td></td>
</tr>
</tbody>
</table>