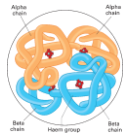
science

biology

A-Level Biology Mass Transport

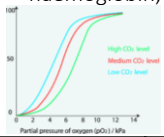
Haemoglobin

- Red blood cells transport oxygen using the protein haemoglobin
- Haemoglobin is made up of four polypeptide chains, each containing a prosthetic haem group. Each haem group binds one oxygen molecule.



oxygen + haemoglobin ⇌ (ASSOCIATION / DISSOCIATION) oxyhaemoglobin

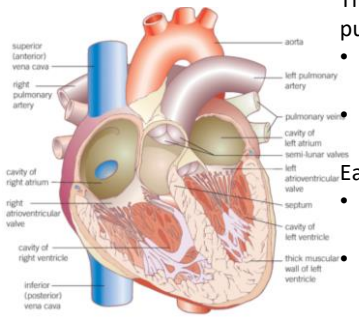
- Binding of the first O_2 molecule causes a conformational change in the haemoglobin, making the haem groups more accessible to oxygen.



- **Bohr affect** - haemoglobin's oxygen binding affinity is inversely related to the concentration of carbon dioxide, causing the oxygen dissociation curve to shift.

Region of the body	Oxygen concentration	Carbon dioxide concentration	Affinity of Haemoglobin for oxygen	Result
Gas exchange surface	High	Low	High	Oxygen is associated
Respiring tissues	Low	High	Low	Oxygen is dissociated

The Structure of the Heart



The human heart has two separate pumps lying side by side.

- The pump on the left deals with oxygenated blood from the lungs
- The one of the right deals with deoxygenated blood from the body.

Each pump has two chambers

- The atrium is thin walled and elastic and stretches as it collects blood
- The ventricle has a thicker muscular wall as it has to contract strongly to pump blood some distance.

Vessels connecting the heart to the lungs are called pulmonary vessels. The vessels connected to the 4 chambers are as follows:

- **The aorta** is connected to the left ventricles and carries oxygenated blood to all parts of the body except the lungs.
- **The vena cava** is connected to the right atrium and brings deoxygenated blood back from the tissues of the body (except the lungs)
- **The pulmonary artery** is connected to the right ventricle and carries deoxygenated blood to the lungs when oxygen is replenished.
- **The pulmonary vein** is connected to the left atrium and brings oxygenated blood back from the lungs.

Supplying the heart muscle with oxygen

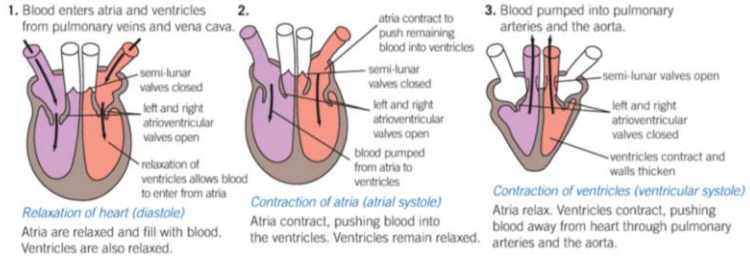
- The coronary arteries supply the heart with oxygen.
- Blockage of these arteries for example by a blood clot can lead to myocardial infarction, or heart attack.

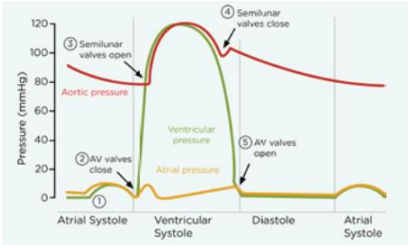
Supplying the hear muscle with oxygen contd.

- This is because the heart muscle is deprived of oxygen.
- The muscle cells in the region are unable to respire (aerobically) and so die.

The Cardiac Cycle

- The sequence of events that occur within one full beat of the heart.
- There are two phases contraction (systole) and relaxation (diastole)
- Cardiac output = heart rate x stroke volume.



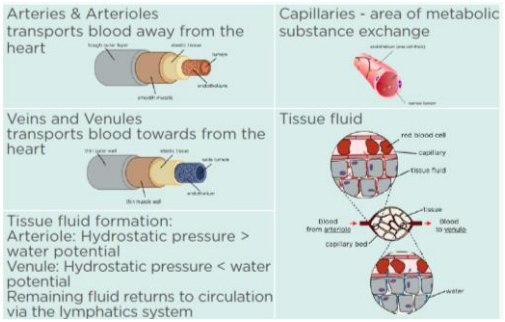


Valves in the control of blood flow

Valves open when the difference in blood pressure either side of them favors the movement of blood in the required direction. Examples of valves include:

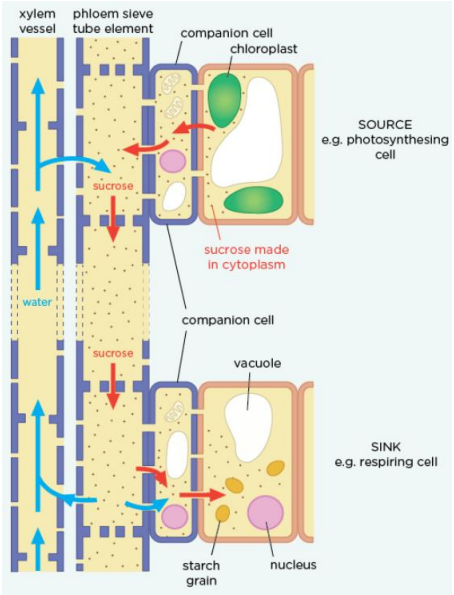
- **Atrioventricular valves between the left/ right atrium and ventricles**. Prevent the backflow of blood when contraction of the ventricles means that ventricular pressure exceed atrial pressure.
- **Semi-lunar valves in the aorta and pulmonary artery.** Prevent the backflow of blood into the ventricles when the pressure in theses vessels exceeds that in the ventricles.
- **Pocket valves in the veins**. These ensure that blood flows back towards the heart rather than away from it.

Circulatory system



Mass Transport in Plants

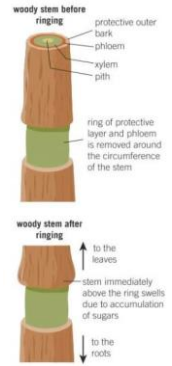
- The xylem transports water & mineral ions up the plant against gravity
- Water evaporates from the leaves creating tension (transpiration), and the cohesive nature of water moves the whole column of water up the xylem (cohesion-tension theory)
- The rate of transpiration is affected by: light, temperature, humidity & wind.
- The phloem transports assimilates from sources to sinks via translocation



- Sucrose is actively transported into the companion cells and moves via diffusion into the sieve tube followed by water.
- Assimilates move from area of high to low pressure (mass flow).
- At the sink the solutes are removed, water leaving by osmosis.

Investigating transport in plants

- To track the movement of sugars through the phloem, scientists' radioactive isotopes are used in tracer experiments with radioactive isotopes.
- Ringing - removal of the bark and phloem, theoretically prevents translocation to the sinks below the ring.



chaseterrace academy