Biology Notes

Unit 1

1.1 WHAT IS CARDIOVASCULAR DISEASE?

Cardiovascular disease: disease of the heart and circulation. The main forms are:

- Coronary heart disease
- Stroke

Diffusion:

"Movement of molecules or ions from a region of their high concentration to a region of low concentration by relatively slow, random movement of molecules."

- Unicellular creatures
- Distances are short
- Diffusion is fast enough to meet the organism's requirements

Mass transport system:

More complex multicellular organisms are too large for diffusion- it won't be fast enough. Substances are moved over long distances by mass flow (all particles in a liquid move in one direction through tubes due to difference in pressure). Animals have a circulatory system instead of diffusion.

Open circulatory system:

In insects, blood circulates in large open spaces.

- Simple heart pumps blood out into cari it is surrounding the organs
- Substances diffuse between the close and the cells
- When the heart in the bood is drawn back into it from the cavity
- Davn back in through small, all each in gs along its length

Closed circulatory system:

Generally large and active animals, including vertebrates, have a closed system where blood is enclosed in tubes (blood vessels).

- Higher blood pressure due to narrow channels instead of large cavities
- Blood travels faster
- More efficient at delivering blood

The blood leaves the heart under high pressure, flowing along arteries, arterioles then capillaries.

- Capillaries come into contact with most cells in the body
- Substance exchanged between blood and cells

It continues on to venules, veins and then back to the heart. Valves ensure blood flows in one direction.

Single circulatory system:

Closed circulatory systems have either single or double circulation. Example of fish:

illary bed of lungs where exchange occurs Pulmonary arter Pulmonary veins Aorta and branches Vena cava eft atrium Left ventricle Right atrium Right ventricle Systemic arterie Systemic veins Oxygen poor, CO₂ - rich blood Oxygen rich,
 CO₂ - poor blood apillary bed of all body gas exchange

Single-celled organisms

In a single-celled organism (such as Amoeba) the distance is so small that diffusion is rapid enough for the cell's needs



Π

cardial sinus

Gill

12



- Q 1.7 (a) (i) In atrial systole, the atrium contracts causing an increase in pressure in the atrium, forcing blood into the ventricular thus increasing the pressure in the ventricle; at the end of atrial systole the blood pressure starts to fall as the atrium relaxes;
 - (ii) In ventricular systole, the ventricles contract causing the pressure in the ventricles to rise, there is a pressure gradient between the ventricle and the atrium; as blood moves down this gradient it pushes against the atrioventricular valve causing it to close;
 - (iii) Blood moves from the high pressure in the ventricle to the low pressure in the aorta, opening the valve;
 - (iv) Blood entering the aorta from the ventricle causes the pressure in the aorta to rise;
 - (v) As the ventricles empty and relax the pressure in the ventricle falls below the pressure in the aorta, as blood moves down this pressure gradient it fills the flaps of the semilunar valve which closes;
 - (b) (i) open; (ii) closed;
 - (c) The shape of the graph would be the same as Figure 1.14 but with lower pressures, ranging from 0 to 30 mm Hg;
 - (d) One complete cardiac cycle lasts for 0.8 seconds; heart rate is calculated by dividing 60 seconds by the time taken for one cardiac cycle in seconds; 60/0.8 = 75 beats per minute;

Atherosclerosis High blood pressure in arteries can cause damage to the walls. Veir that is pressure so less change of damage.

	 Disease proces that ing to coronary heart areas tand strokes Fact deposits block an artery or that as their of being blocked by thrombosis (blood clot)
ł	- Blood supply can be blocked completely
ł	- Cells can be permanently damages
ł	 Coronary artery blockage = myocardial infarction
ł	 Arteries supplying the brain = stroke (damage/death of brain cells)
ł	 Narrowing leg arteries = tissue death = gangrene (decay)
	- Arteries can burst where blood builds up behind an artery that has been narrowed as a esult of atherosclerosis

What happens in atherosclerosis?

- 1. Artery endothelium (cells separating blood from muscle wall) becomes damaged due to high blood pressure putting extra strain on the cells or toxins from cigarettes in blood
- 2. Inflammatory response is triggered. White blood cells move into the artery wall, accumulating chemicals from the blood (e.g. cholesterol). This builds up atheroma, a fatty deposit.
- 3. Calcium salts and fibrous tissue build up, resulting in plaque on the inner wall (hard material). The artery loses some of its elasticity- hardens.
- Plaque causes the lumen of the artery to become narrower, making it harder to pump blood around the 4. body (rise in blood pressure.
- 5. Positive feedback builds up- plaque leads to raised blood pressure, which causes further plaques to form, damaging endothelial tissue...

- Accounted for 90% of the risk
- Same for men and women in almost every geographic region and racial/ethnic group

Features of a good study

- 1. <u>Clear aim</u>
- Clear stated hypothesis
- Design of the study must produce reliable and valid results

2. <u>Representative sample</u>

- Selected from the wider population that conclusions will be applied to
- Differences between people asked to take part in a study and those actually responding should also be considered before generalising findings
- Proportion of people who drop out of a study should be minimised (e specially in long studies e.g. cohort)
- People who drop out often share common features

3. <u>Valid and reliable results</u>

Valid results: if measurements provide information on what the study was set out to measure

- Invalid results may be collected where participants are told to recall information (memory failure or lying)

Reliable results: the method is repeatable and reproducible.

- Similar results obtained when repeated with same equipment, procedure and corritions over a short timescale
- Similar results obtained when used at different times, or by difference per pre-
- Variables that can affect outcome have to be controlled, the relief of the one investigated

Disease diagnosis must be clearly refined to other doctory can record and measure symptoms in the same way.

- 4. <u>Sample size</u> Page
- Large enough to produce results that can't have occurred by chance
- Large samples = more accurate estimates for the wider population

5. <u>Controlling variables</u>

- Potential effects of all variables that could be correlated with the disease should be considered
- Matching case and control groups on variables known to correlate with the disease will ensure that only the factor under investigation is influencing the outcome

Risk factors of CVD

- High blood pressure
- Obesity
- Blood cholesterol
- Dietary factors
- Smoking
- Inactivity
- Genetic inheritance

Blood pressure

Risk of CVD is higher for men than women but in both sexes, the risk of CVD increases with age. It may be due to arteries losing elasticity and becoming more easily damaged due to ageing.

- Age may increase risk associated with other factors

Hypertension= high blood pressure, increasing the likelihood of atherosclerosis occurring



Blood pressure is the measure of hydrostatic force of the blood against the walls of a blood vessel

- Higher in arteries and capillaries than veins

Systolic pressure:

- Pressure is highest (ventricles contracted- blood flows into arteries)
- Pressure is taken when the blood first starts to spurt through the artery that was closed

Diastolic pressure:

- Pressure at its lowest in the artery when the ventricles are relaxed
- Pressure taken when no sound

Sphygmomanometer measures blood pressure.

- Cuff wraps around upper arm
- Manometer measures pressure

Cuff inflated- blood flow through the artery in the upper arm is stopped, Cuff released- blood starts to flow through the artery.

The flow of blood can be heard using a stethoscope positioned on that artery.

Its measured in millimetres of mercur- mmHg (number of millimetres the ressure will raise a column of mecury).

What determines your blood pressure?

Peripheral resistance: contact between blood and walls of blood yest encluses miction, impeding the flow of blood. Arteriols and capillaries have all eater surafce area than arteries, resisiting flow more- sows blood down (lower pressure) classification control blood vescels manual softe pressure and keeps blood flowing.

tP.



Increasing distance from left ventricle

Tissue fluid and oedema

Oedema is a sign of high blood pressure- fluid building up in tissues and causing swelling.

May be associated with kidney/liver disease or restricted body movement





If smooth artery muscles contraact, the vessel contricts, making the lumen narrower and increasing resistance (blood pressure increases).

If the smooth muscle relaxes, the lumen is dilated and so peripheral resistance is reduces, blood pressure falling.

Factors that cause arteries/arterioles to ontrict:

- Loss of elasticity with age
- Release of hormones (adrenaline)
- High salt diet



Edema (swelling) of the ankles and feet