National 4/5 Biology
Unit 2 – Multicellular Organisms

Lesson 2 – **Hormonal control**

Learning Intentions

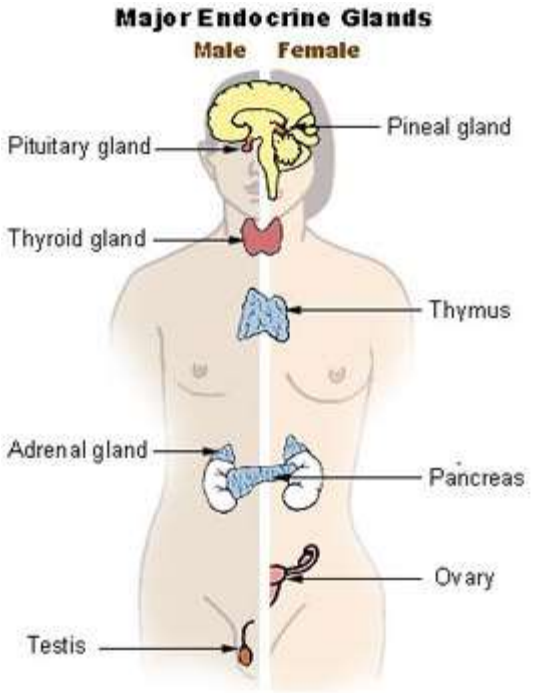
- To develop knowledge on hormones.

Success Criteria

- I know that hormones are released by Endocrine glands
- I know that hormones travel in the blood stream
- I know that target tissues have cells with hormone receptors that recognise specific hormones
- I know that only some tissues are affected by each hormone

Hormones

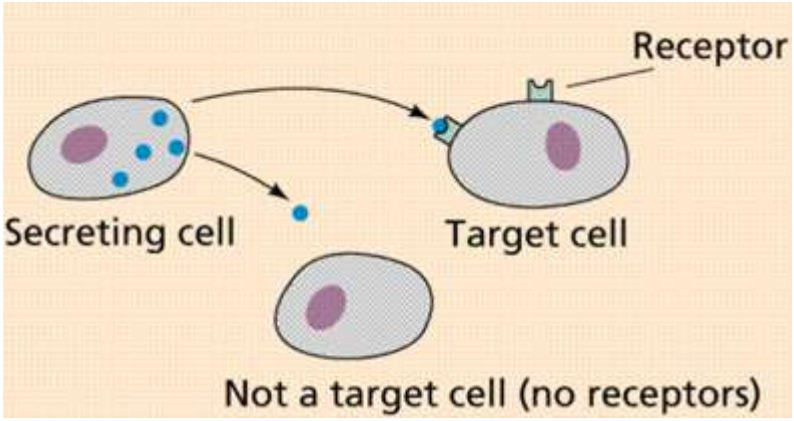
- Hormones are chemical messengers that travel around the body in the blood stream.
- Hormones are released from <u>endocrine glands.</u>



Hormones

- Hormones are recognised by cell receptors in specific tissues.
- Each hormone is only recognised by, and affects, specific tissues

Collect a copy of the diagram and stick it in your jotter



Activity

- Research the role of hormones (minimum 3) in the human body.
- You need to include the following information (in your own words so it is understandable)
  - The hormone name
  - Where it is made
  - Which tissue it affects
  - What it does

National 4/5 Biology
Unit 2 – Multicellular Organisms

Lesson 3– **Temperature**

Learning Intentions

- To extend knowledge on blood glucose regulation.

Success Criteria

- I can explain homeostasis in terms of maintaining body temperature.

- **The following slides are a recap from S3. Only short summary notes with the key points need to be written down.**

What is homeostasis?

The maintenance of the body's internal environment within certain tolerable limits…..

….despite changes in the body's external environment.

What is our normal body temperature?

- 37 degrees

Why do we need to maintain the body at this temperature?

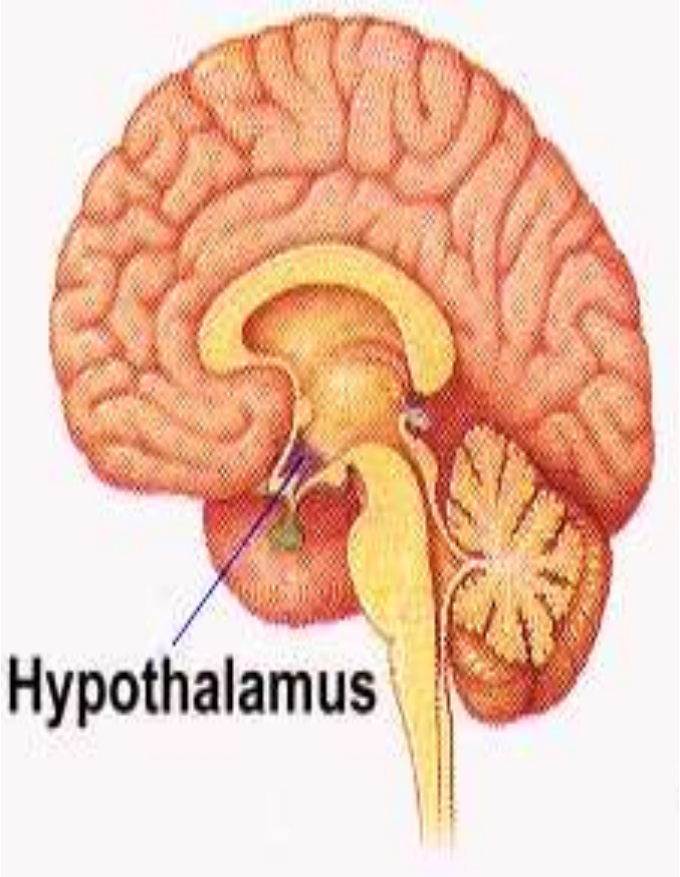
- Enzymes work best at 37 degrees

How is temperature regulated?

In a fridge…

…there is a thermostat

In the body…



The **hypothalamus** acts like a thermostat – detecting change in core body temperature through thermoreceptors in the skin.

Nerve impulses are sent to the effectors to create a response to the change in temperature.

How does the body maintain a constant temperature? - summary

Condition	Blood vessels	Shiver or sweat?	Skin hairs
Cold			
Warm			

How does the body maintain a constant temperature? - summary

Condition	Blood vessels	Shiver or sweat?	Skin hairs
Cold	Dilate	Shiver	Contract
Warm	Constrict	Sweat	Relax

National 4/5 Biology
Unit 2 – Multicellular Organisms

Lesson 4– **Blood glucose**

Learning Intentions

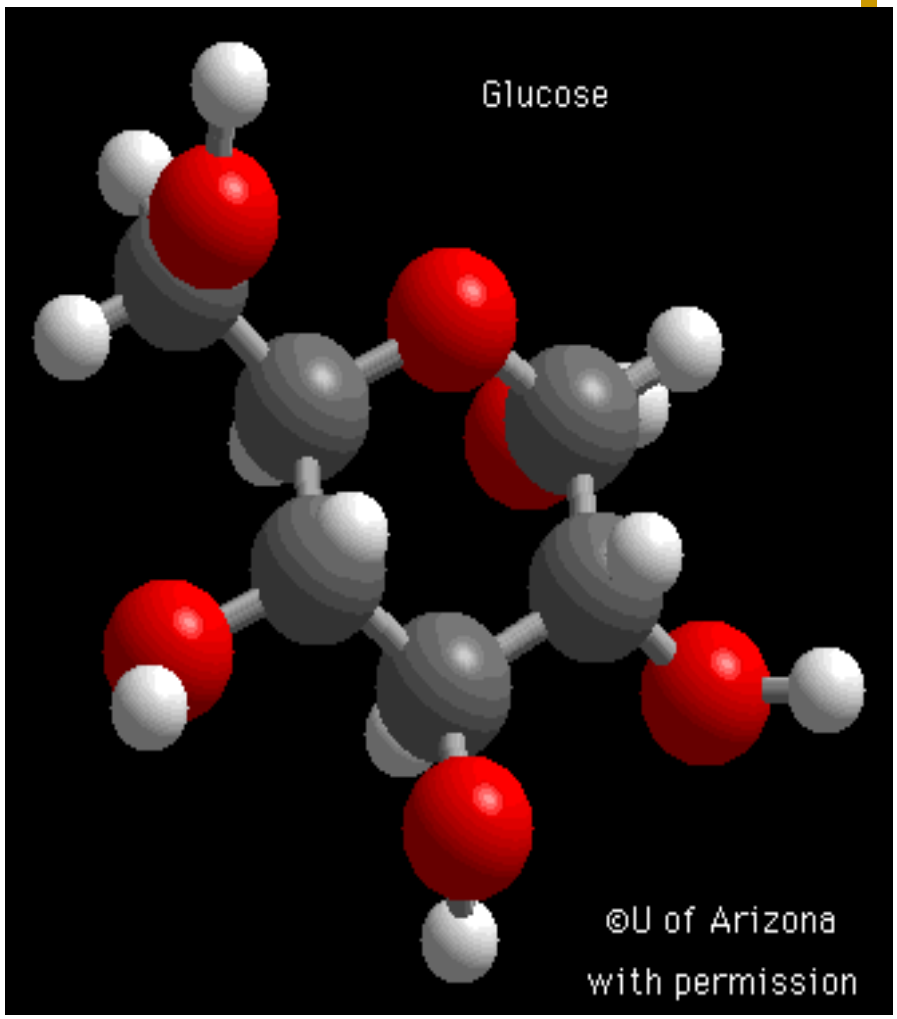
- To develop knowledge on blood glucose regulation.

Success Criteria

- I know how blood glucose levels are regulated or controlled
- I can describe the role of Insulin, Glucagon, Glycogen, the liver and pancreas in maintaining blood glucose levels.

Blood Glucose

All living cells must have an adequate supply of glucose in order to provide them with energy.



After eating something your blood glucose levels become very high.

It is unlikely that all of this glucose will be required by your body straight away.

The requirements are depending on how active you are……

Maintaining blood glucose

- Glucose concentrations in the blood must be kept within tolerable limits and involves the following:

- Monitoring centre – Islets of Langerhans receptor cells in Pancreas

- Control Centre – Pancreas

- Hormonal messages – Insulin or Glucagon

- Effector – Liver

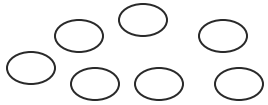
Insulin and glucagon

- Insulin causes the liver to take up glucose from the blood and convert it to a storage carbohydrate called glycogen and therefore reduces the levels of glucose in the blood.

- Glucagon causes the liver to convert the storage carbohydrate glycogen to glucose and therefore increases the levels of glucose in the blood

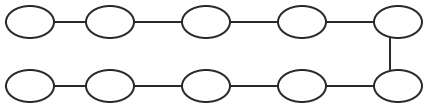
insulin

glucose



glucagon

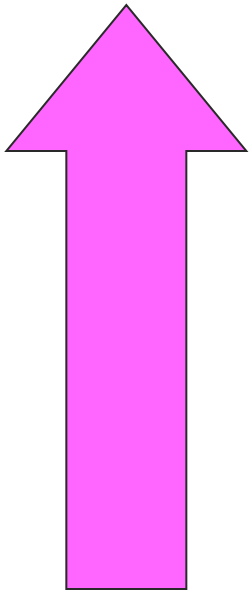
glycogen



Soluble so easily released into the blood

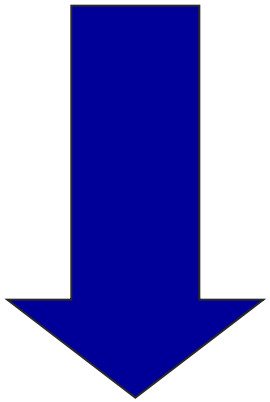
Insoluble so easily stored in liver cells

Increase in glucose concentration of blood

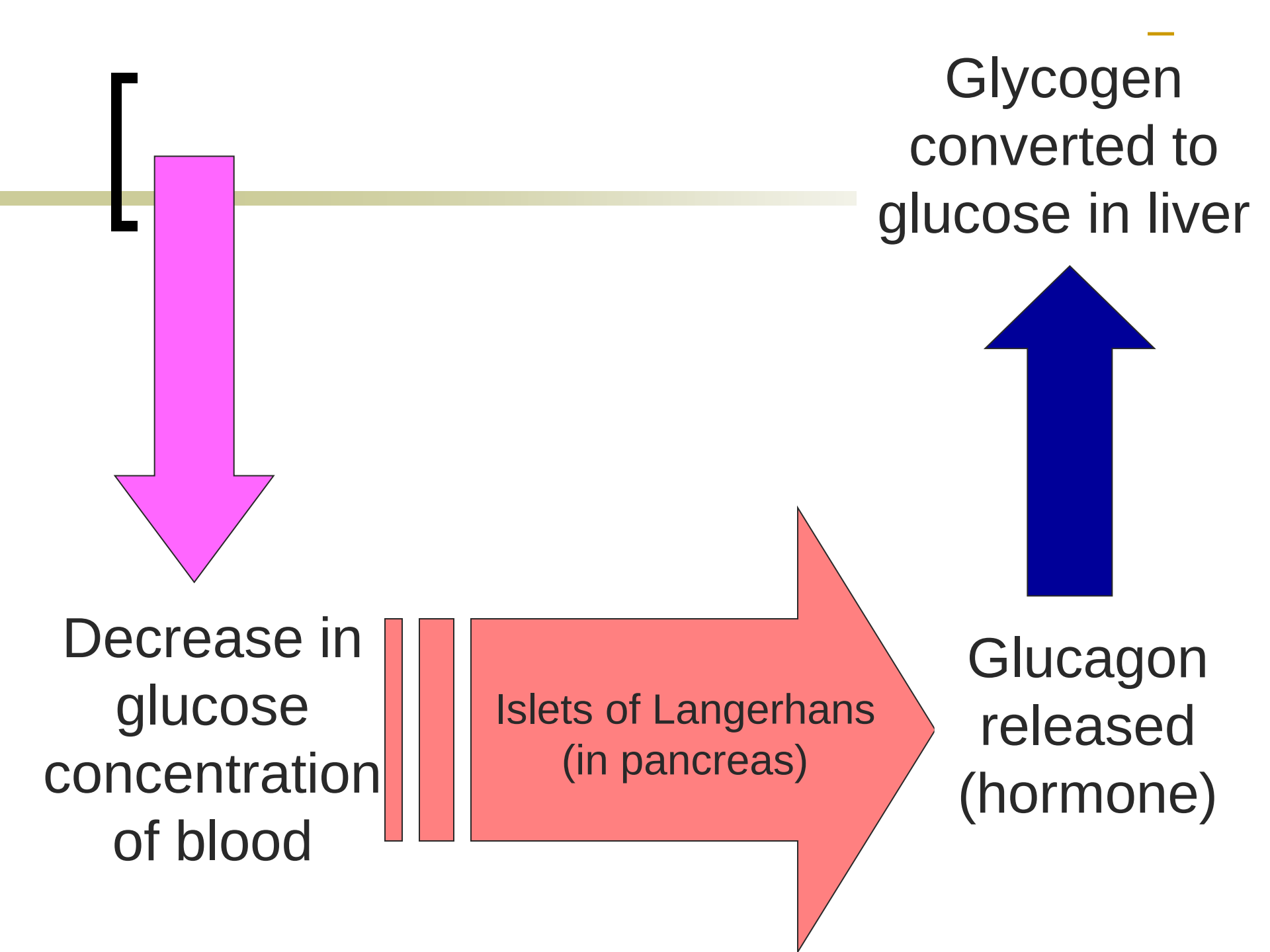


Islets of Langerhans (in pancreas)

Insulin released (hormone)



Glucose converted to glycogen, stored in liver.

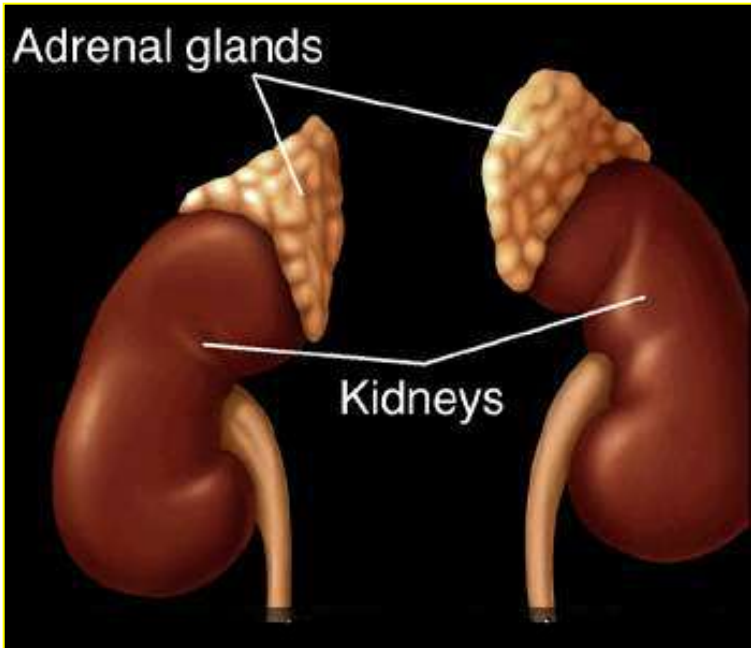

Glycogen converted to glucose in liver
Decrease in glucose concentration of blood
Islets of Langerhans (in pancreas)
Glucagon released (hormone)

Fight or Flight!!

- In emergency situations the body requires extra glucose to quickly provide energy.
- This allows us to respond with “fight or flight”.

The adrenal glands secrete adrenaline, which inhibits the release of insulin and promotes the breakdown of glycogen to glucose.

Once the crisis is over, adrenaline secretion is reduced.



- Receptor – islets of langerhans cells in pancreas
- Control centre – brain/adrenal gland
- Messenger – adrenaline
- Effector – liver

Activity – complete the table

Homeostatic mechanism	Receptors /location	Control centre	Messenger	Effector
Blood glucose (normal)				
Blood glucose (stress)				

Homeostasis summary

Homeostatic mechanism	Receptors/ location	Control centre	Messenger	Effector
Blood glucose (normal)	Islets of langerhans/ pancreas	Pancreas	Insulin Glucagon	Liver
Blood glucose (stress)	Islets of langerhans/ Pancreas	Adrenal gland	Adrenaline	Liver

Diabetes

- Diabetes is a communication pathway that has failed due to either

1) a fault in the release of insulin

2) a failure to respond to insulin

Activity

- Research on diabetes.
- Find out:

- The difference between type 1 and type 2 diabetes.
- The causes and treatments of both types.
- Refer to trends in Scottish health statistics during your research.

Additional lesson if time permits

- Exploring behavioural adaptations to ensure body conditions are maintained
- E.g. woodlice experiment

National 4/5 Biology
Unit 2 – Multicellular Organisms

Lesson 1 – **Transport in plants**

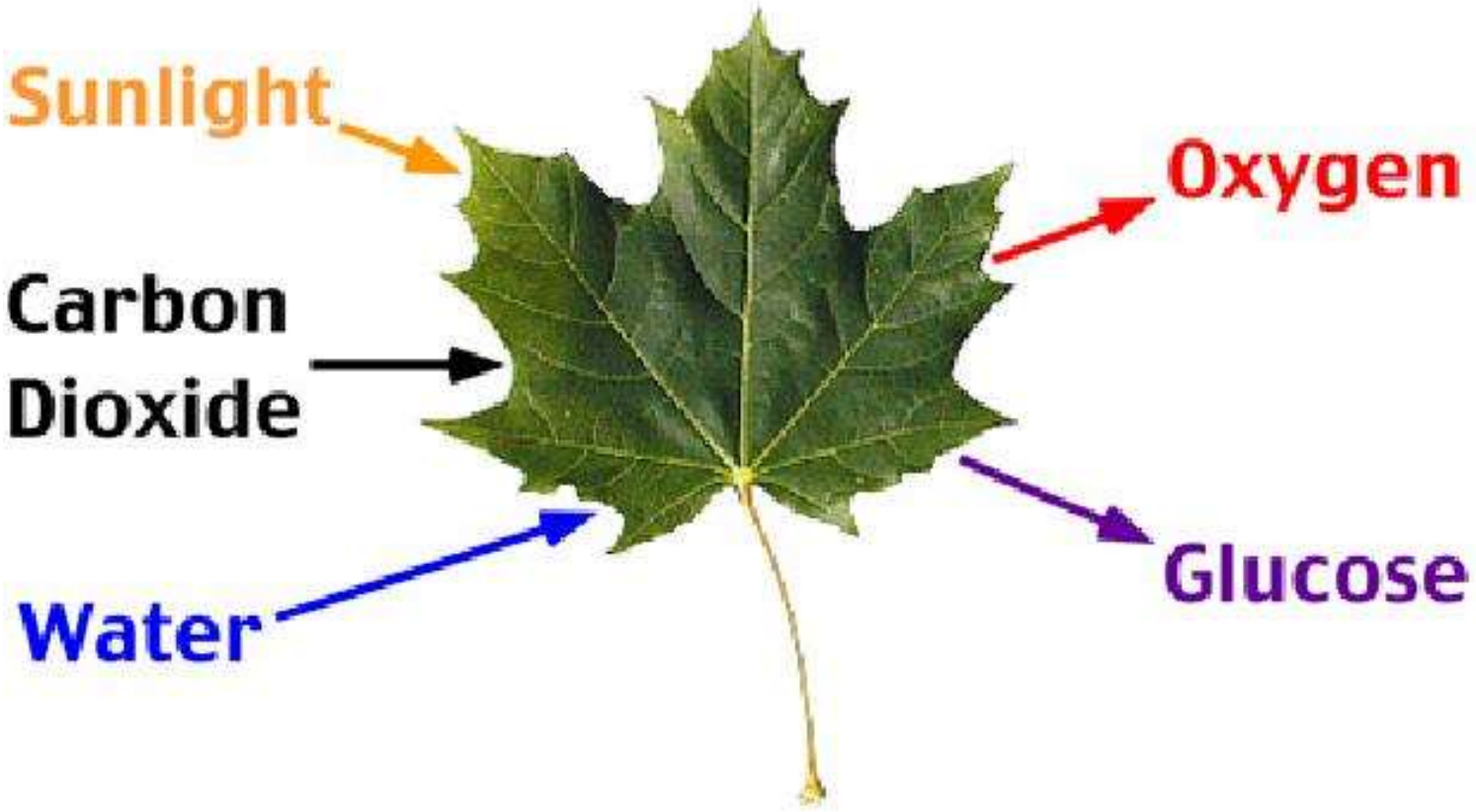
Learning Intentions

- To develop knowledge on plant transport systems.

Success Criteria

- I can state the structures and functions of leaf tissues and label them on a diagram.
- I can label a diagram showing the vascular bundles of a leaf.
- I know that xylem vessels transport water and minerals.
- I know that phloem vessels transport sugar.

Photosynthesis



Write this in equation form

Questions:

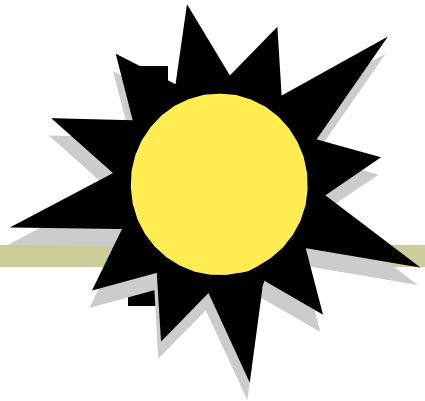
1. What is photosynthesis?

2. If your plant was kept in a closet and not exposed to any sunlight, what would happen to it? Why?

3. What does chlorophyll do to sunlight?

4. Could animals survive without plants? Could plants survive without animals? Why or why not?

5. True or False: Animals perform respiration to create energy, however because plants perform photosynthesis, they do not have to perform respiration.



Photosynthesis

Carbon dioxide and water

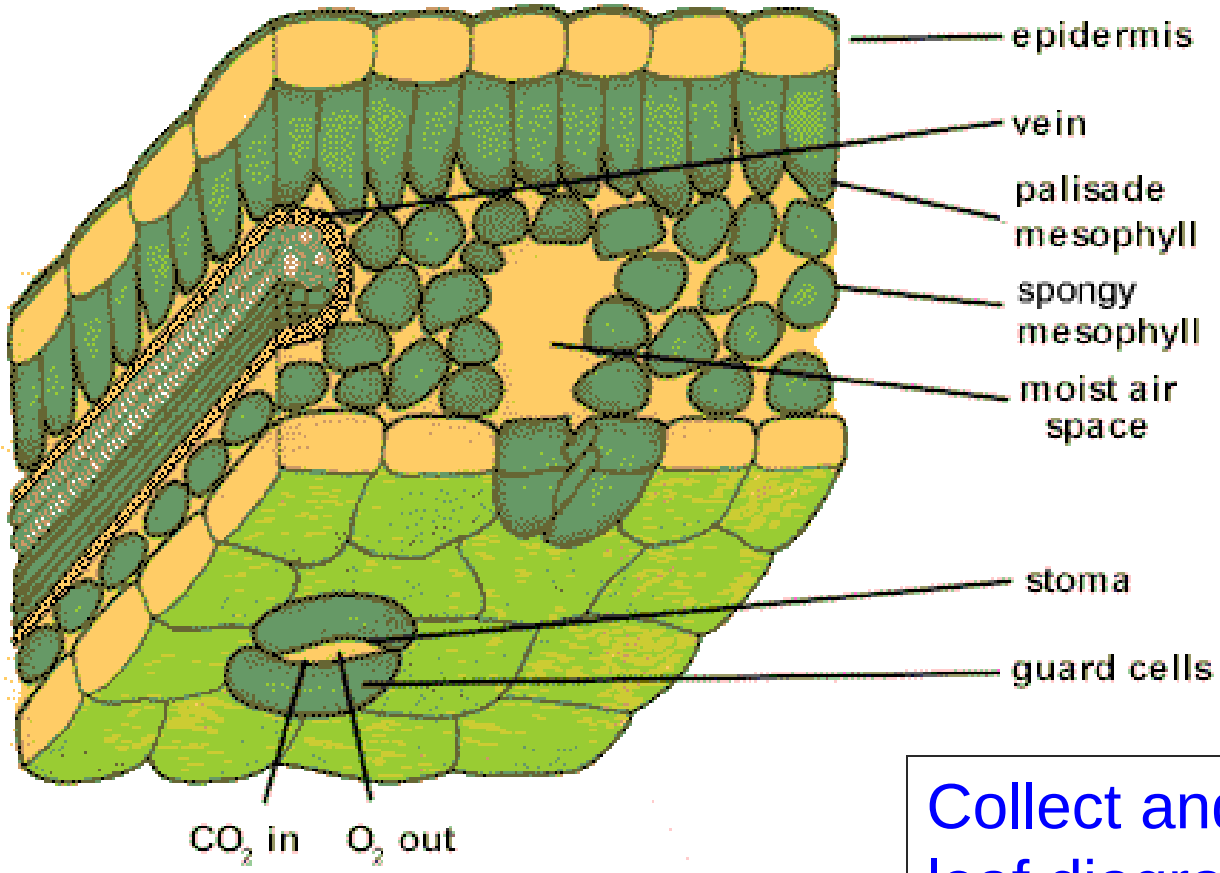
Glucose and oxygen

Energy for heat, movement, repair and growth

Respiration

Leaf structure

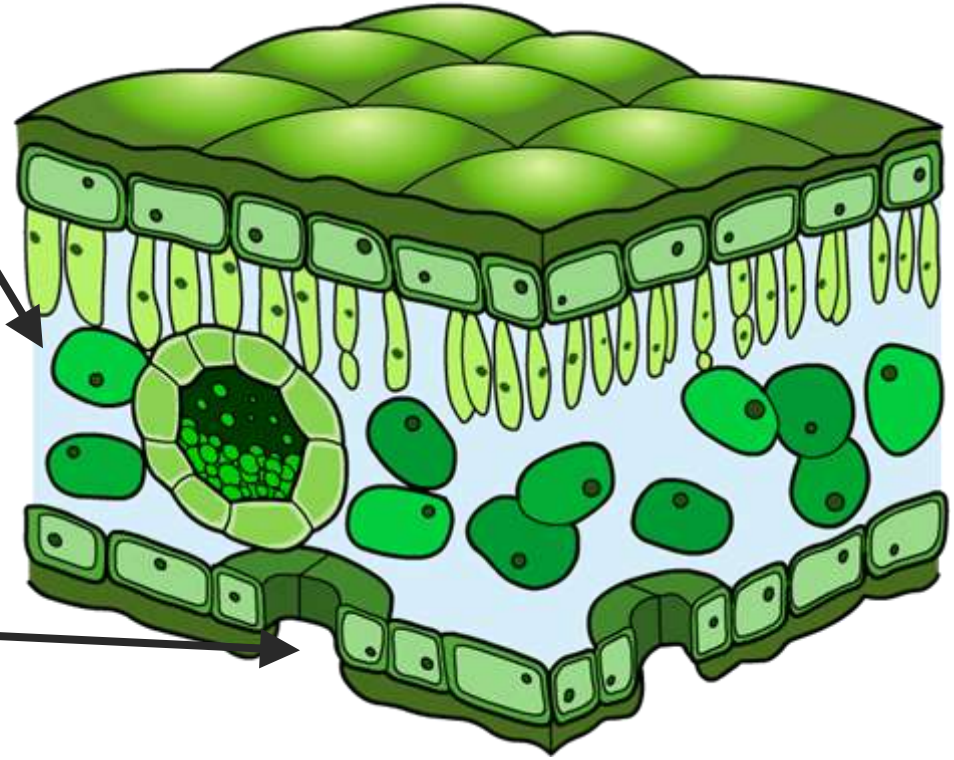
- The structure of a leaf is suited to its function.



Collect and label a leaf diagram

The diffusion of gases occurs in the leaves. They are adapted for this function in the following ways:

- Leaves are **thin**. This decreases the distance gases have to travel between the air and cells.
- There are **air spaces** between cells. This increases the speed of diffusion from the air to the cells inside the leaf.
- There are lots of **stomata (pores)** on the undersides of leaves. These let gases in and out.



Tissues of a leaf

- Upper Epidermis – consists of a waxy cuticle which prevents water evaporating from the leaf surface.

- Palisade mesophyll cells – many column shaped cells full of chloroplasts. This is the site of most photosynthesis.

- Spongy mesophyll cells – the cells here also have chloroplasts and photosynthesis may occur if light reaches this layer. There are many air spaces in this layer to allow gases into and out of the leaf.

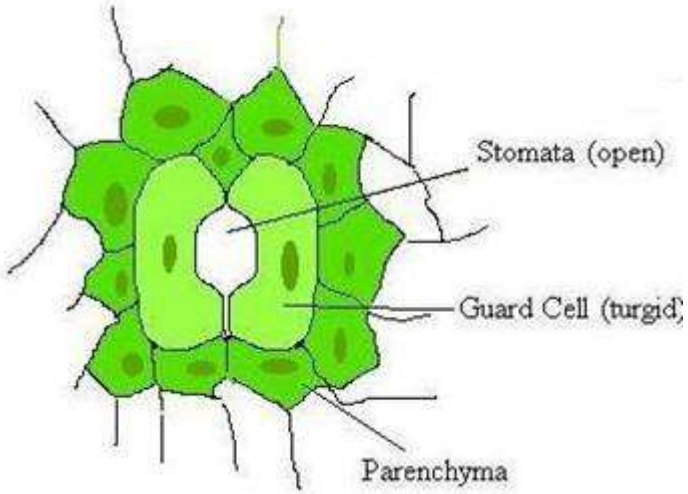
Tissues of a leaf

- Veins- these contain both xylem and phloem.

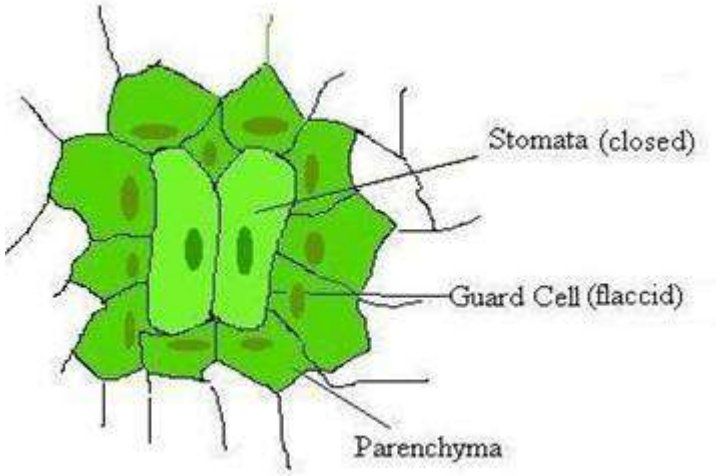
- Lower epidermis – Have same cells but also contain pores called stomata. Each stomata is surrounded by 2 guard cells which open and close the stomata.

Stomata

- Stomata are tiny pores found on the under surfaces of a leaf.
- They are involved in gas exchange.
- During the day, they open to allow carbon dioxide to enter for photosynthesis to take place and to allow exit of oxygen.
- During the night, the stomata are closed to conserve energy and photosynthesis cannot take place in the dark.



Open - Day



Closed - Night

Plant transport systems

- Plants need a transport system to get water and minerals from the soil up to the leaves for photosynthesis.
- Sugar from photosynthesis must be transported around the plant.
- The transport system consists of bundles of tubes running up and down the plant (vascular bundles).

Activity 1 - Demonstrating the site of water movement in a plant

- Cut a piece of celery and place it into a beaker of red dye until the next day.
- Observe what has happened.

Before

After

Why do multicellular organisms need a transport system ?

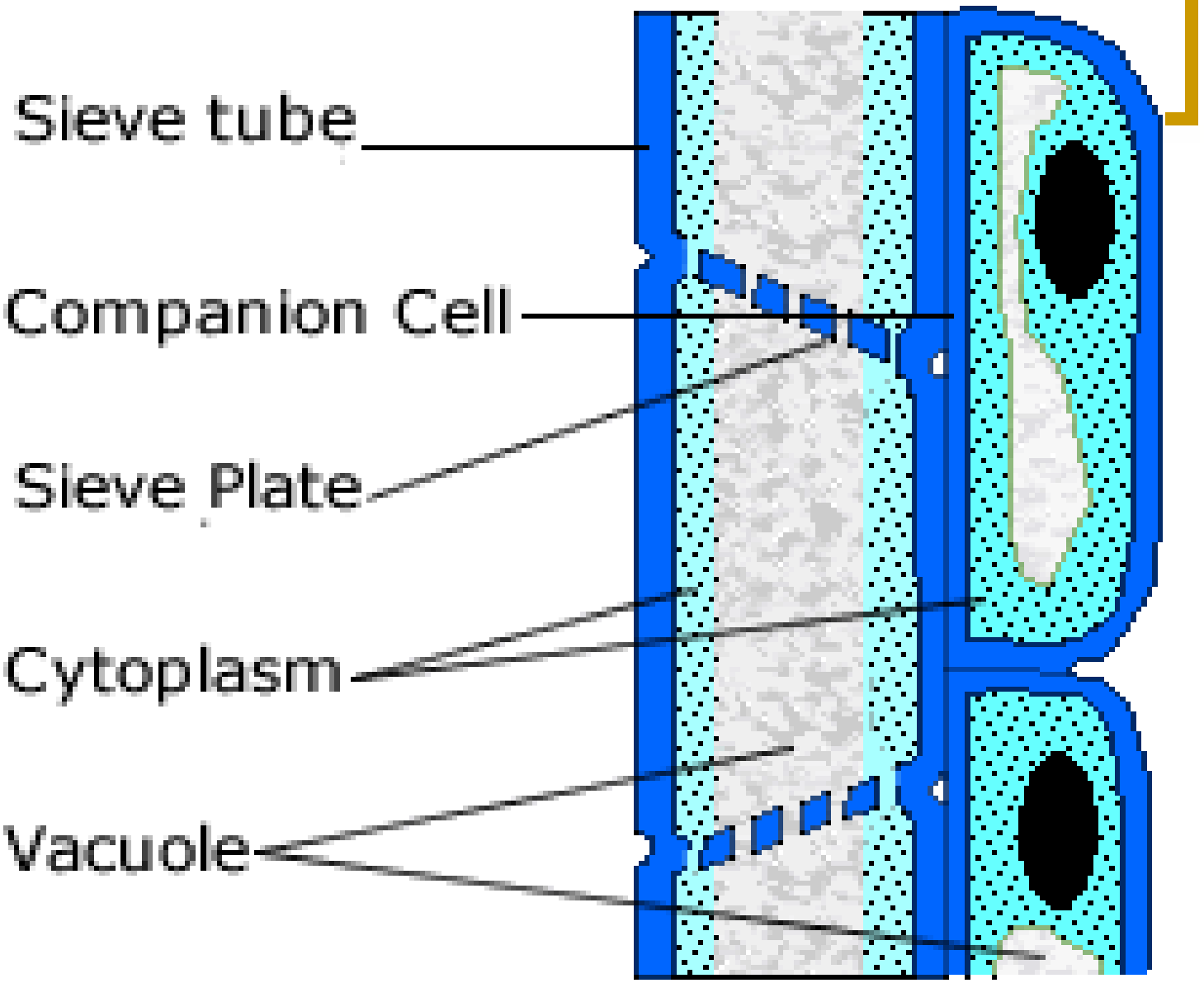
- The bigger an organism is, the lower its surface area to volume ratio.
- Substances needed by a large organism could not be supplied through its exposed external surface.
- Oxygen passing through an external surface would be rapidly used up before reaching the many layers of underlying cells.
- Similarly waste substances would not be excreted quickly enough. This problem has been solved, through evolution, by specially adapted tissues and organs.

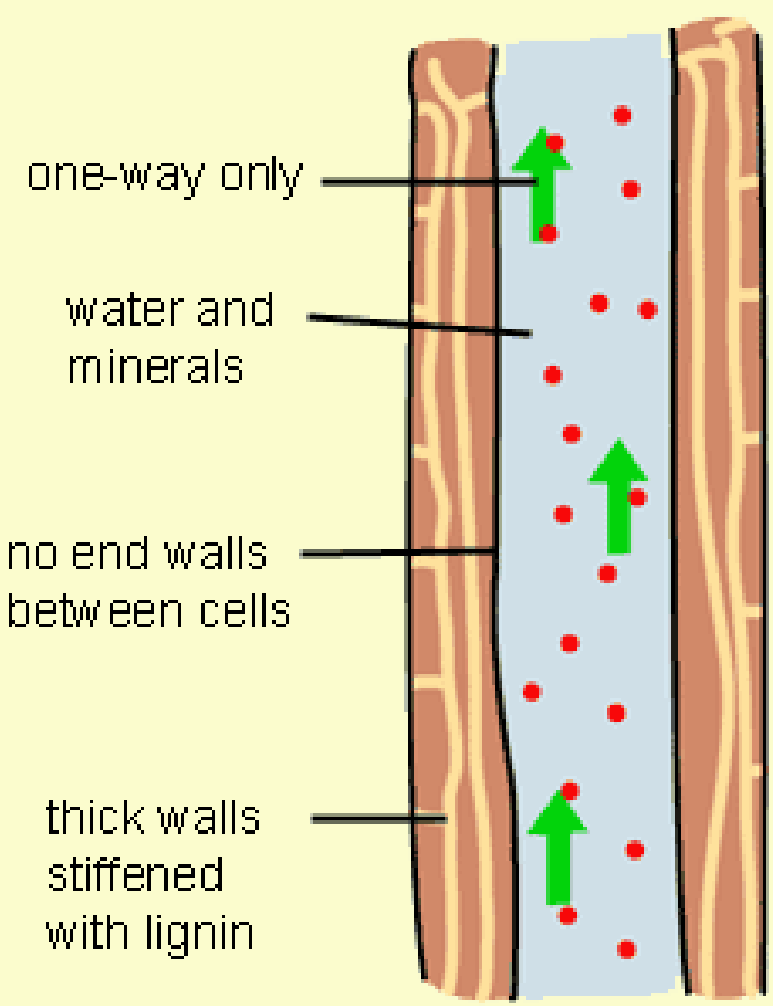
Xylem

- Carry water and minerals in the stem from the soil up to the leaves where the water is needed for photosynthesis.
- Xylem vessels are hollow dead tubes.
- Their walls are strengthened and thickened with lignin.
- The lignin helps support the plant and helps it to withstand the pressure changes as water moves through the plant.

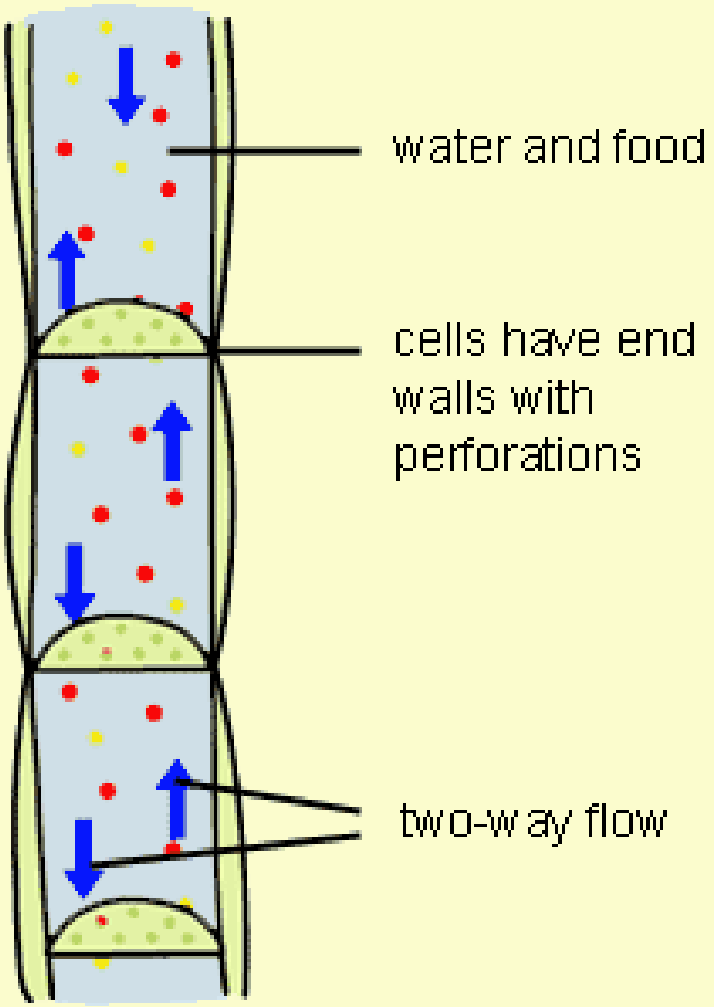
Phloem

- Phloem (sieve) tubes carry sugar (food) up and down the plant.
- Phloem cells are alive.
- They have (sieve) plates to let the sugar through.
- The companion cells at the side provide energy for the transport of the sugar.


Sieve tube
Companion Cell
Sieve Plate
Cytoplasm
Vacuole



xylem vessel



phloem vessel

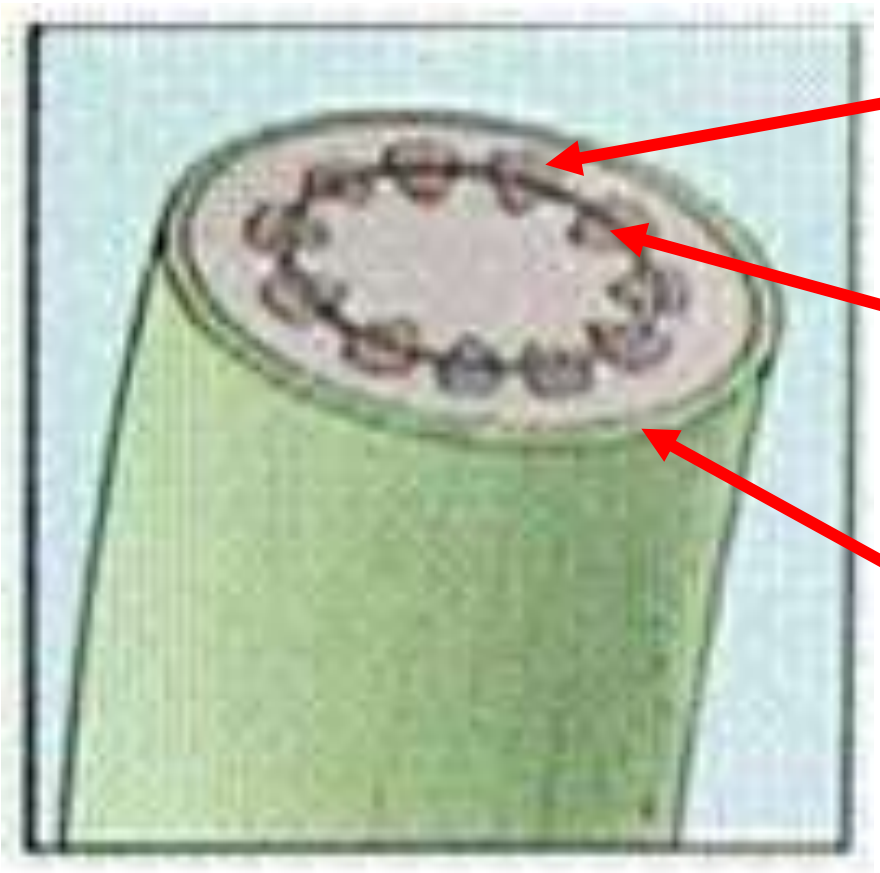
Collect a diagram of a xylem and phloem vessel

Vascular Bundles

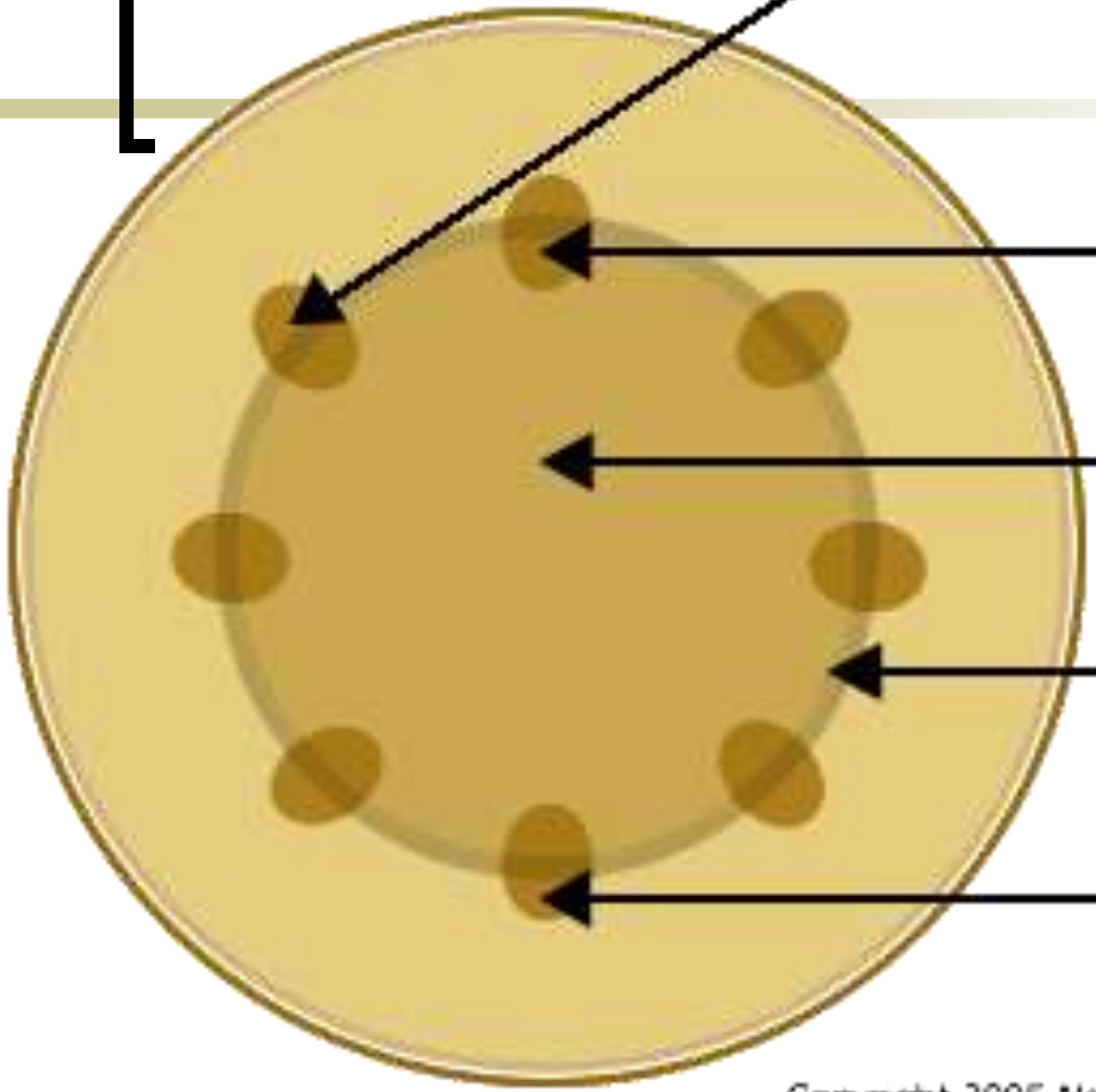
- In the plant xylem and phloem are grouped very close together. They are arranged in structures called vascular bundles.

- The positioning of these vascular bundles in roots and stems is different.

Stem – Cross section



Young Stem



vascular bundle

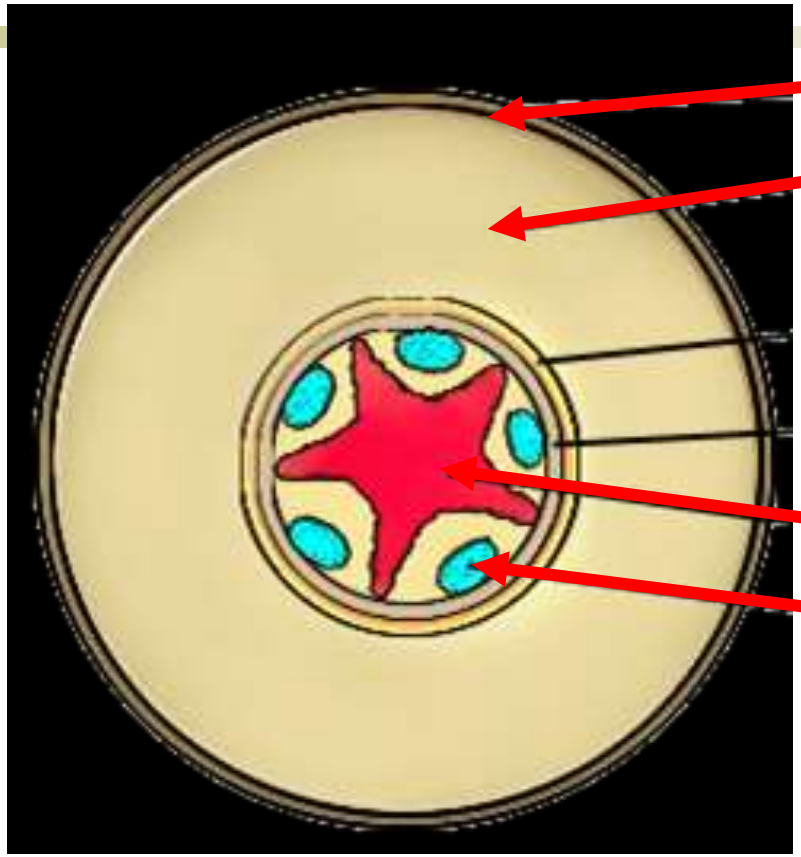
primary xylem

pith

cambium

primary phloem

Root – Cross Section



National 4/5 Biology
Unit 2 – Multicellular Organisms

Lesson 2 – **Transpiration**

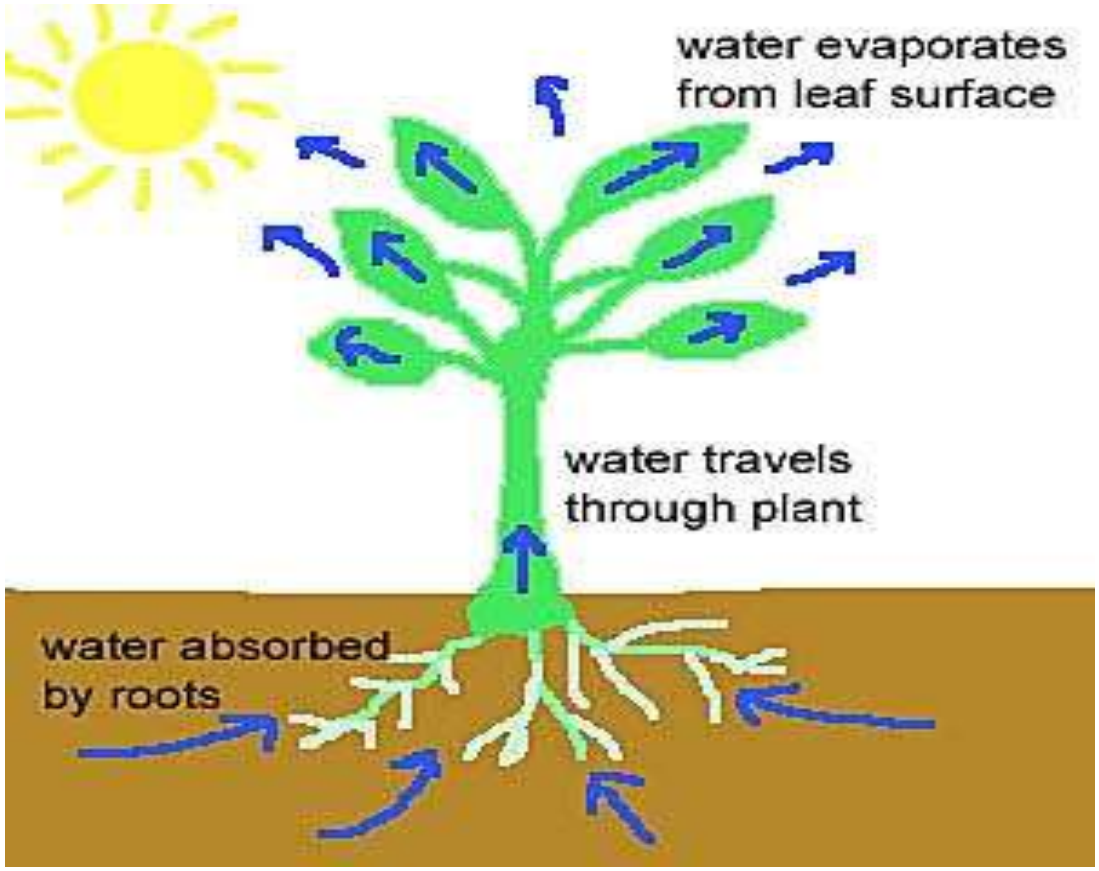
Learning Intentions

- To develop knowledge on transpiration.

Success Criteria

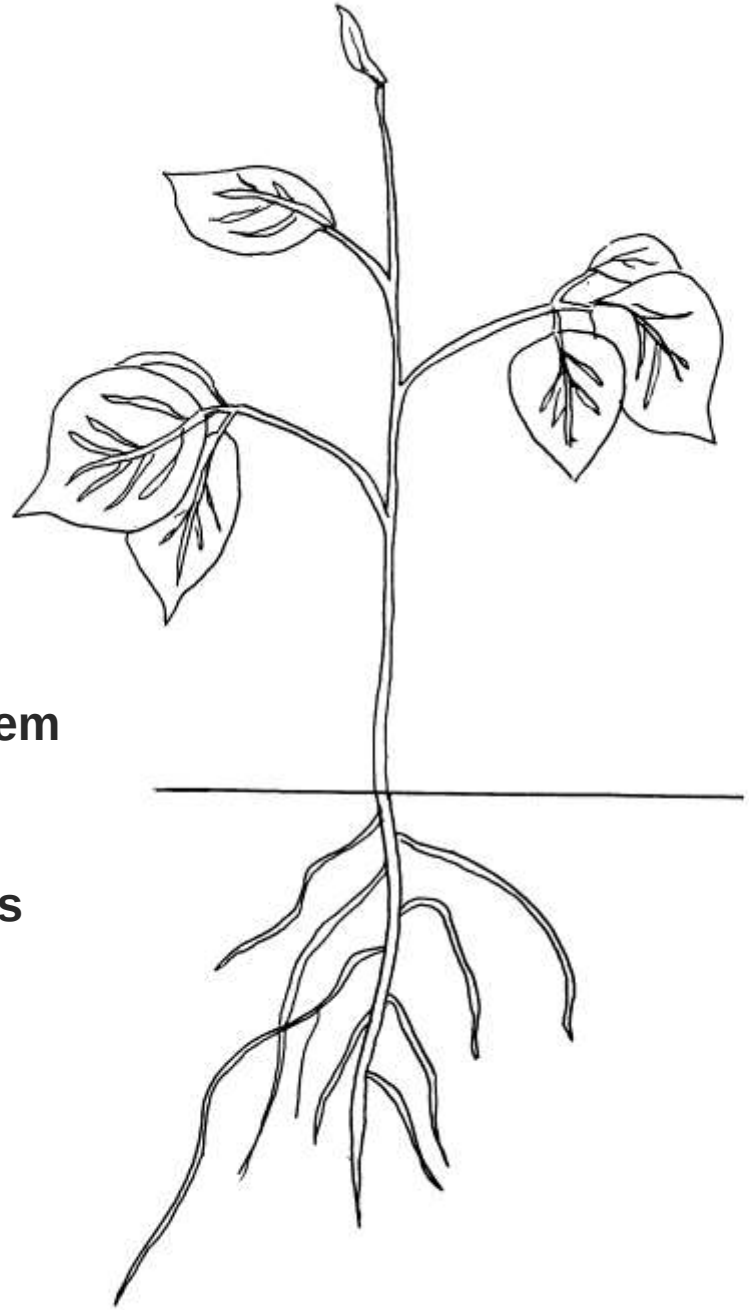
- I can describe the process of transpiration within a plant.

Transpiration

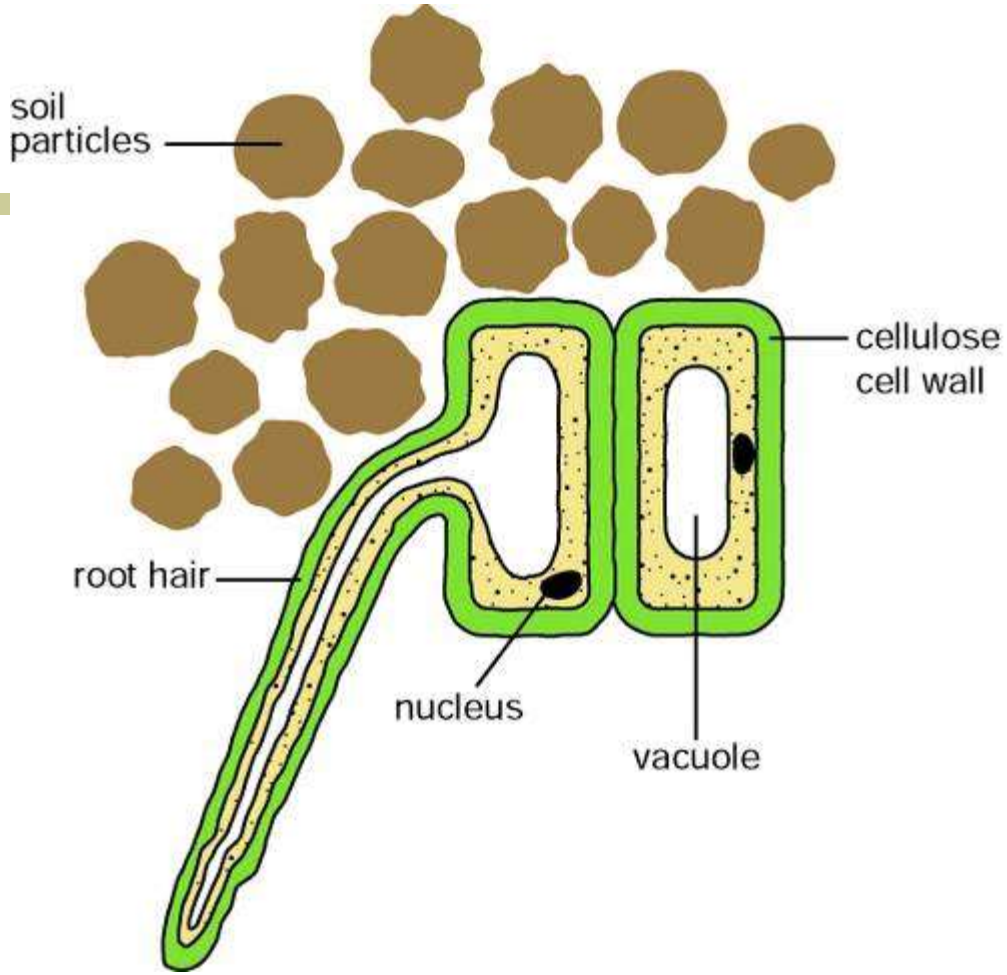


Transpiration

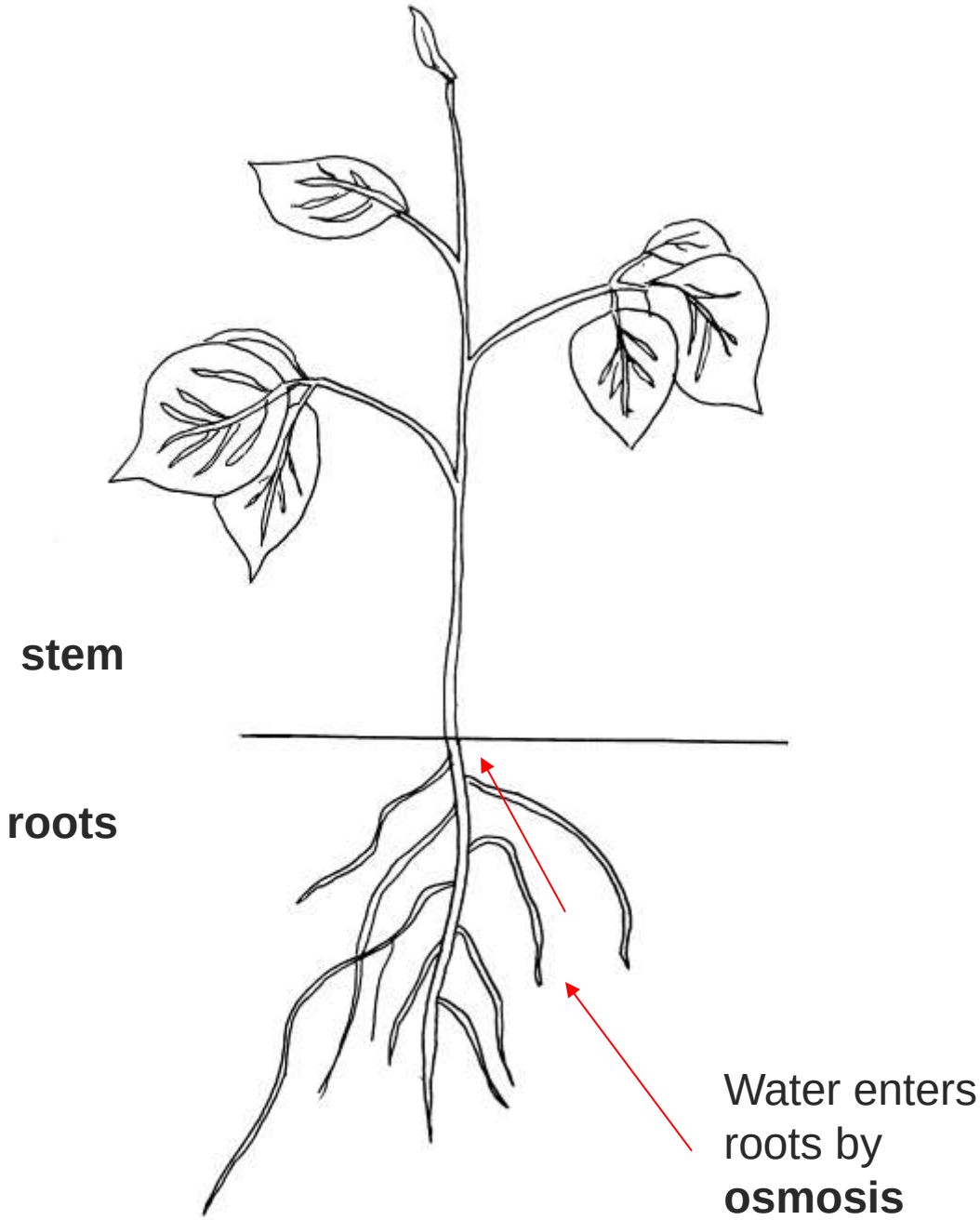
- Water moves through the plant from roots to leaves and is lost to the air as water vapour through the stomata.
- The opening and closing of stomata are controlled by guard cells which are found in the leaf epidermis.
- This is known as the **transpiration stream**.
- About 98% of water entering a plant is lost to the air through transpiration.
- Remaining 2% is used for photosynthesis.

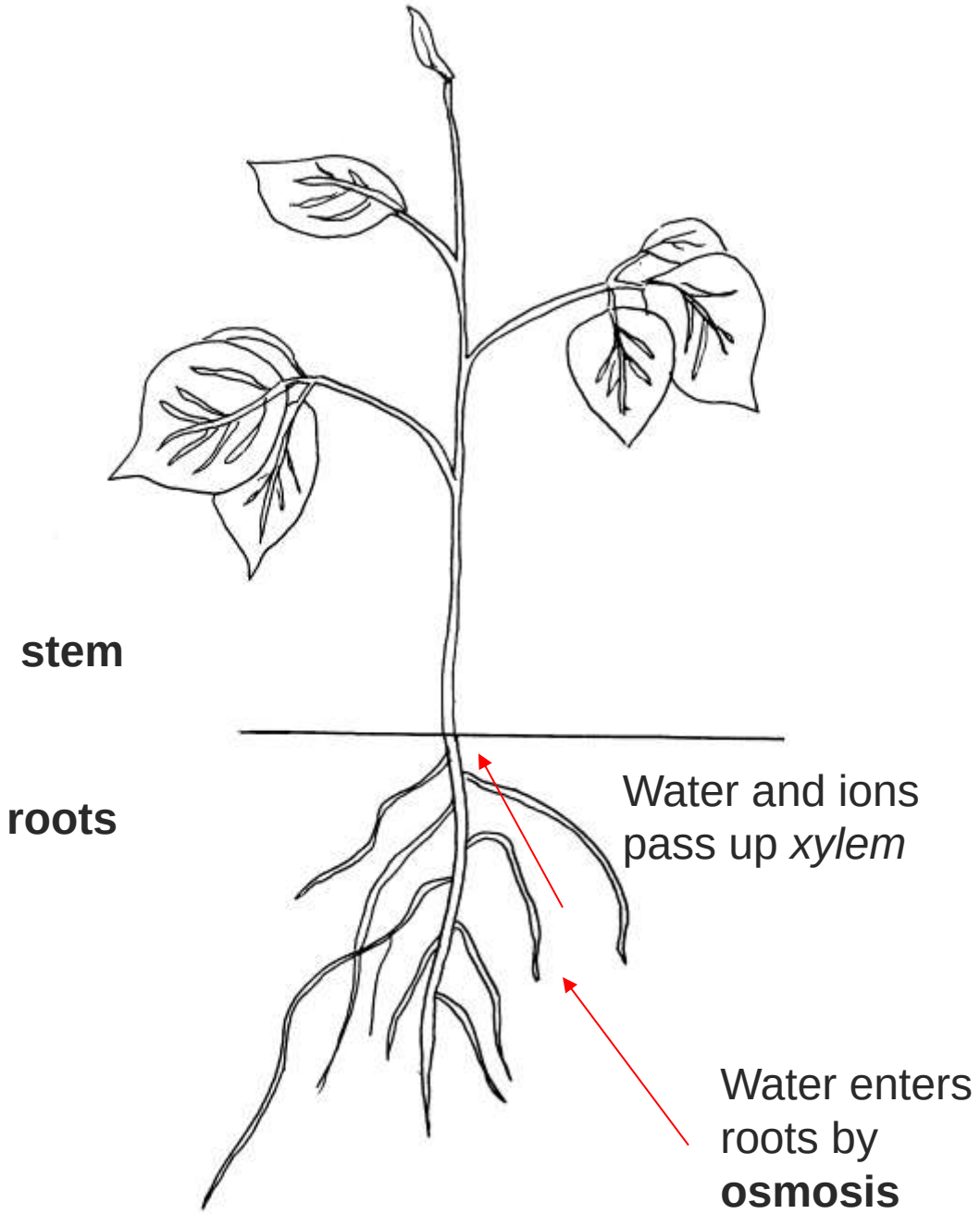


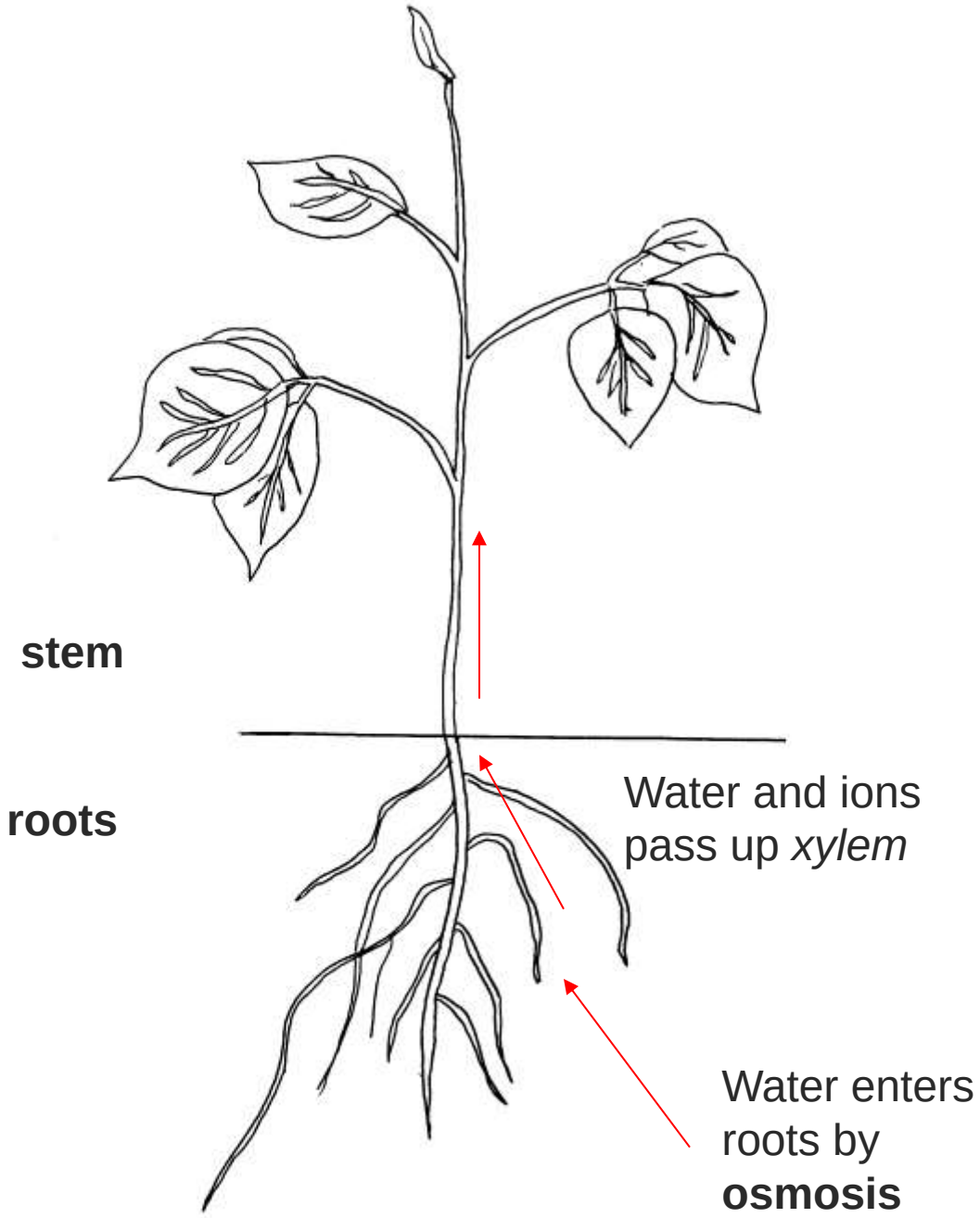
Collect a diagram and 3 different colours of pencil – you will be adding to this throughout the next few slides so make sure you leave space.



Root hairs = larger surface area for water intake


stem
roots
Water enters roots by **osmosis**


stem
roots
Water and ions pass up *xylem*
Water enters roots by **osmosis**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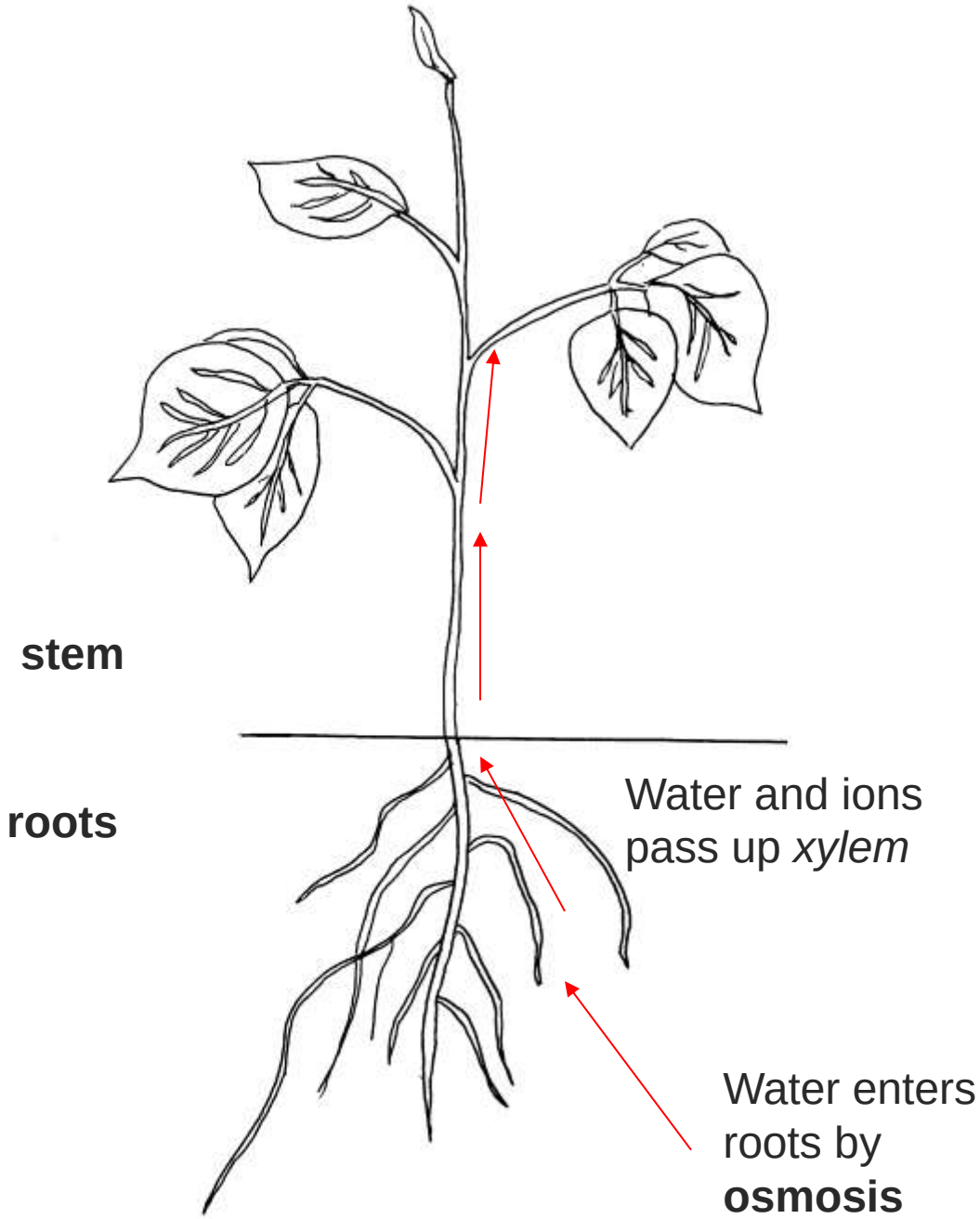
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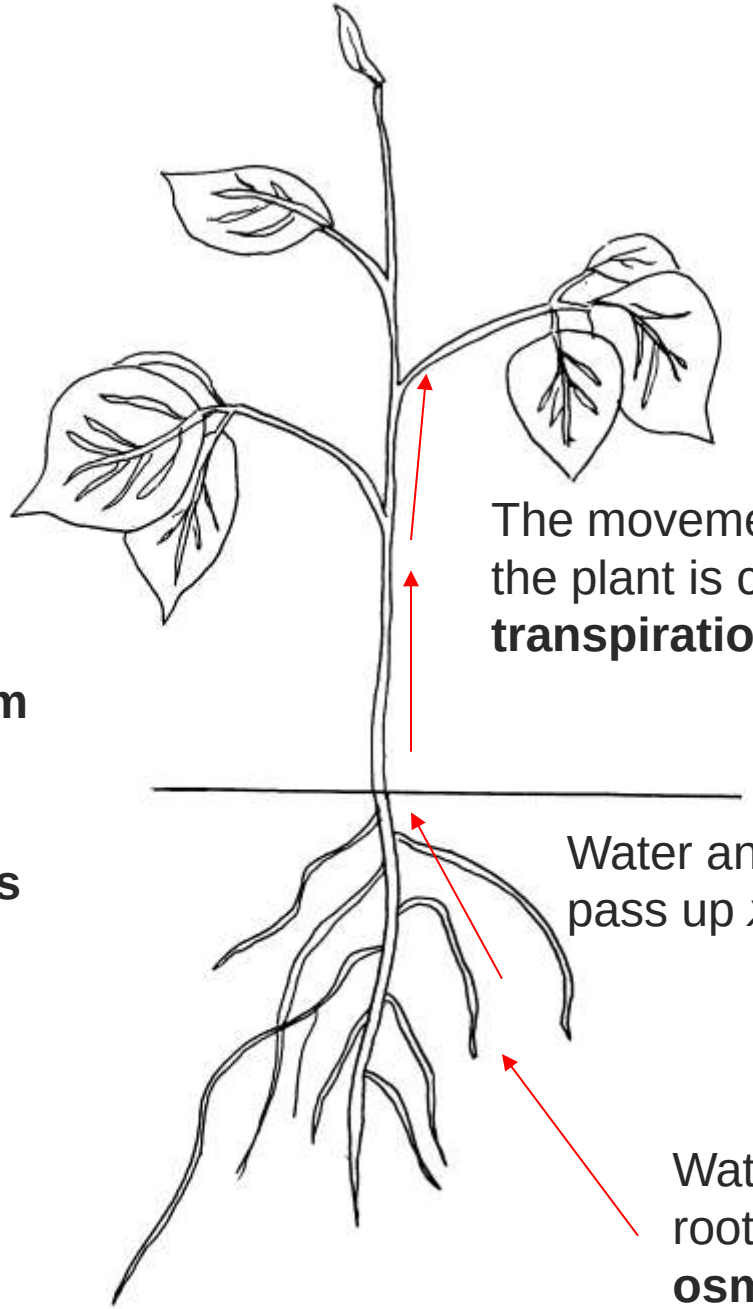


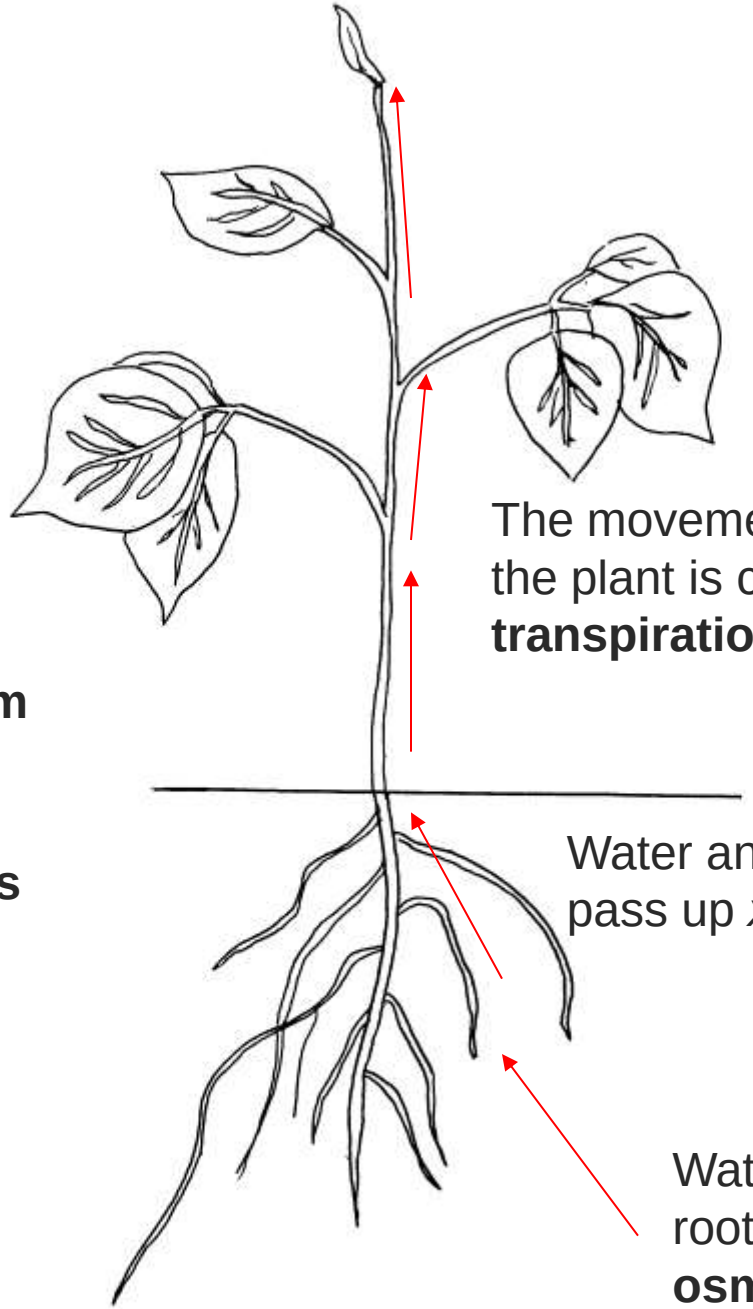
stem

roots

The movement of water through the plant is called the **transpiration stream**

Water and ions pass up *xylem*

Water enters roots by **osmosis**



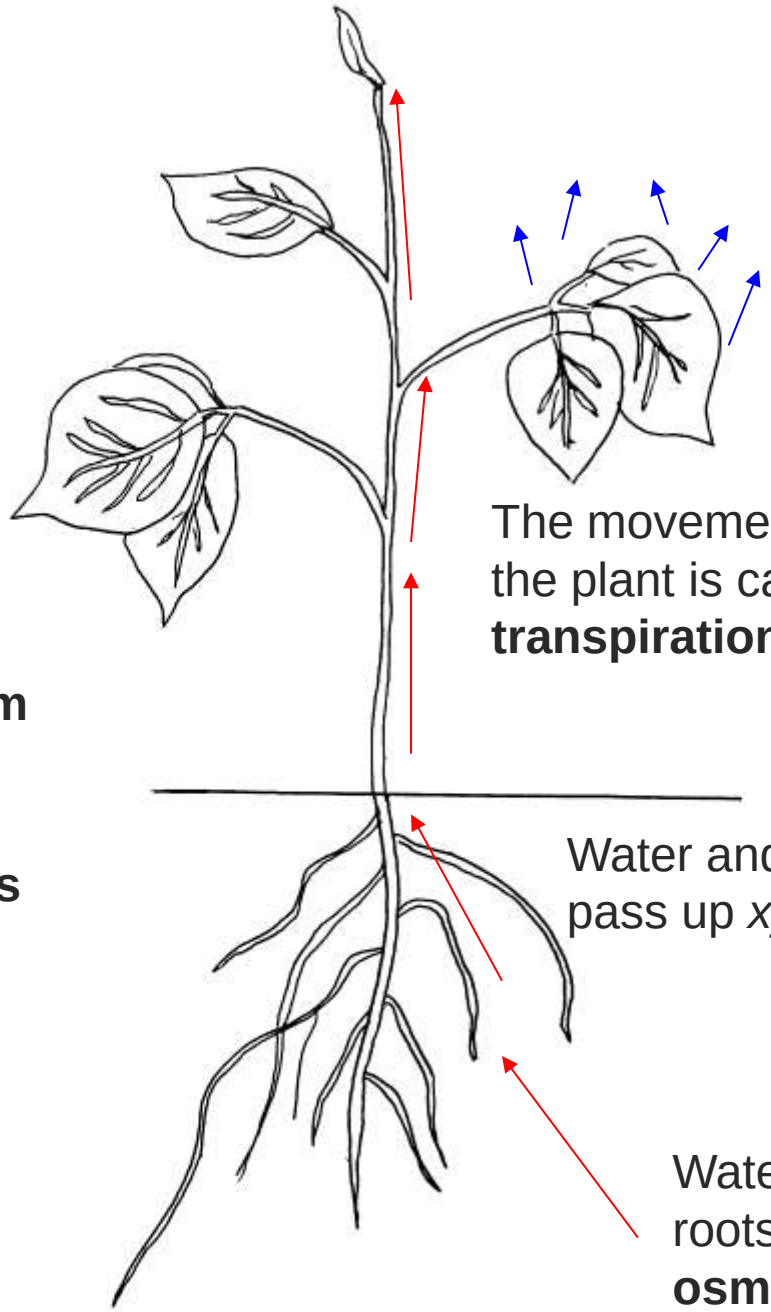
The movement of water through the plant is called the **transpiration stream**

stem

roots

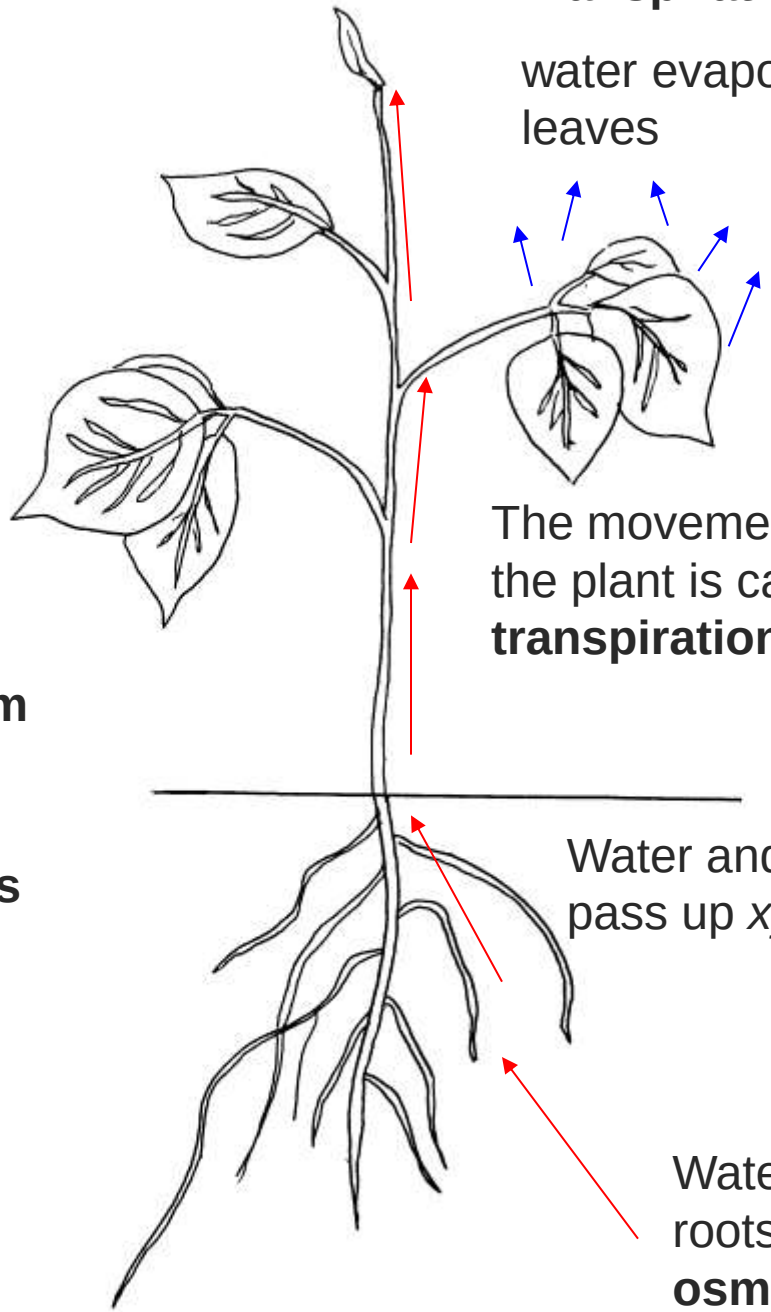
Water and ions pass up *xylem*

Water enters roots by **osmosis**


stem
roots
The movement of water through the plant is called the **transpiration stream**
Water and ions pass up *xylem*
Water enters roots by **osmosis**

Transpiration

water evaporates from leaves



The movement of water through the plant is called the **transpiration stream**

stem

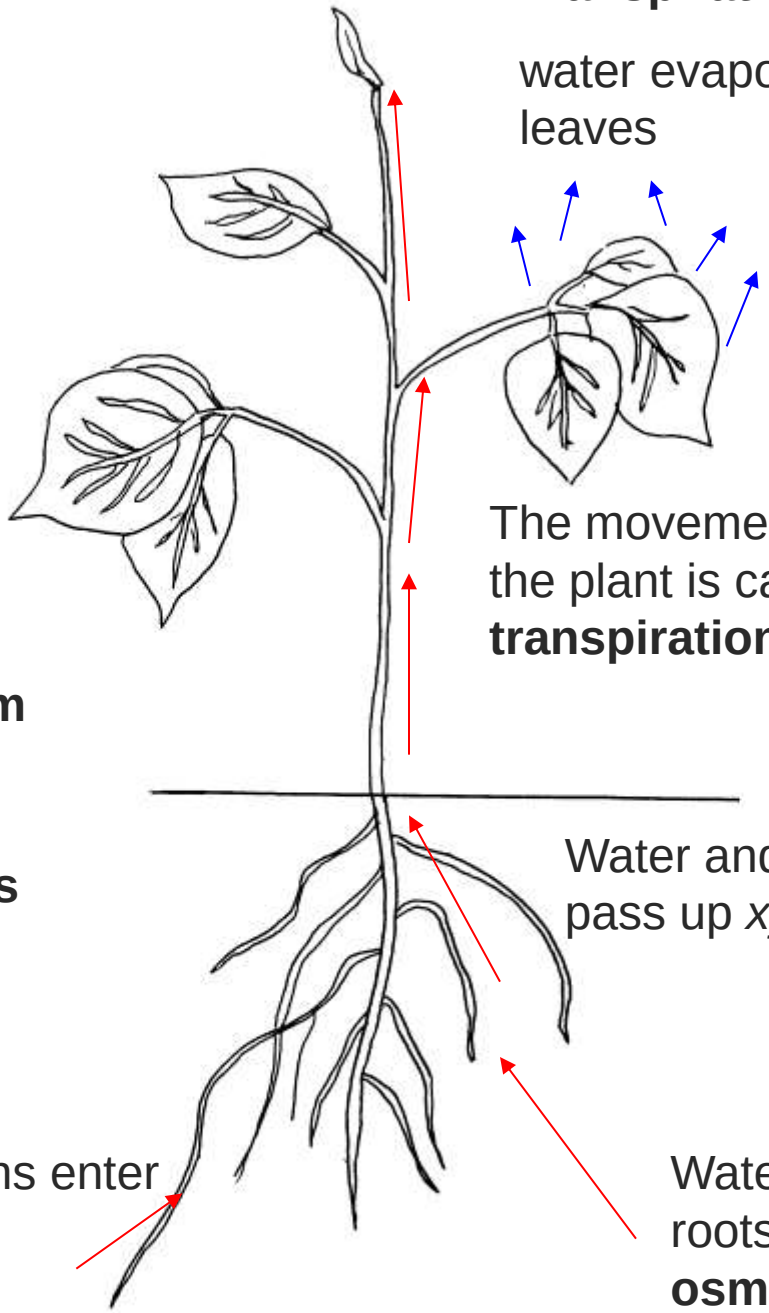
roots

Water and ions pass up *xylem*

Water enters roots by **osmosis**

Transpiration

water evaporates from leaves



The movement of water through the plant is called the **transpiration stream**

stem

roots

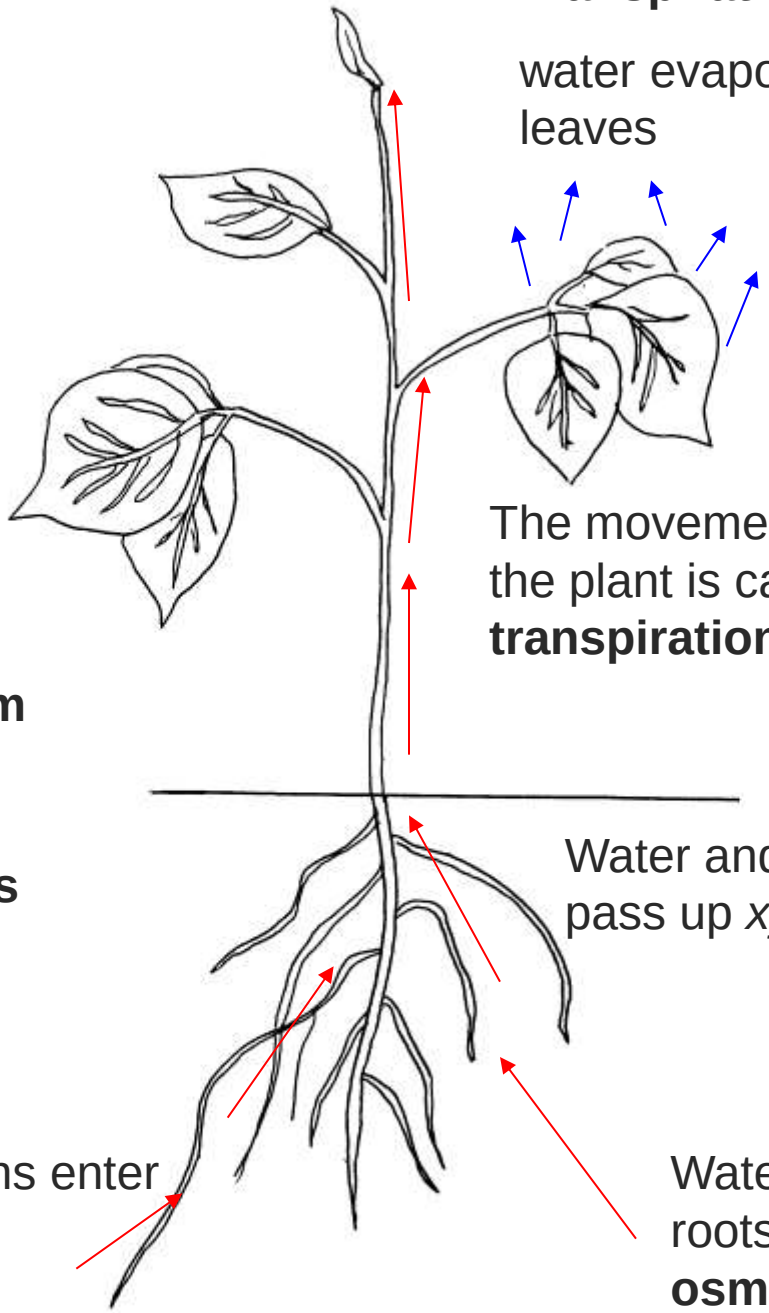
Water and ions pass up *xylem*

Mineral ions enter by **active transport**

Water enters roots by **osmosis**

Transpiration

water evaporates from leaves



The movement of water through the plant is called the **transpiration stream**

stem

roots

Water and ions pass up *xylem*

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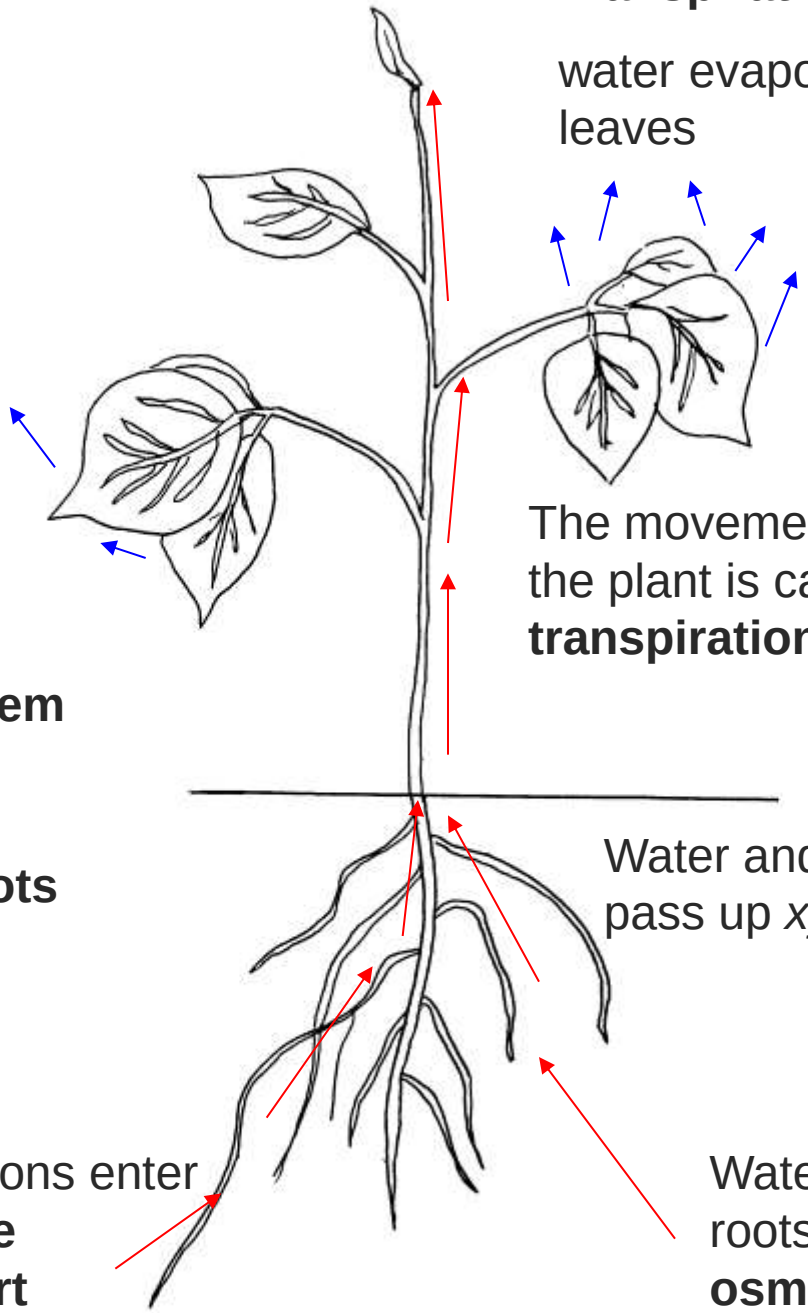
Water enters roots by **osmosis**

Transpiration

water evaporates from leaves



The movement of water through the plant is called the **transpiration stream**

stem

roots

Water and ions pass up *xylem*

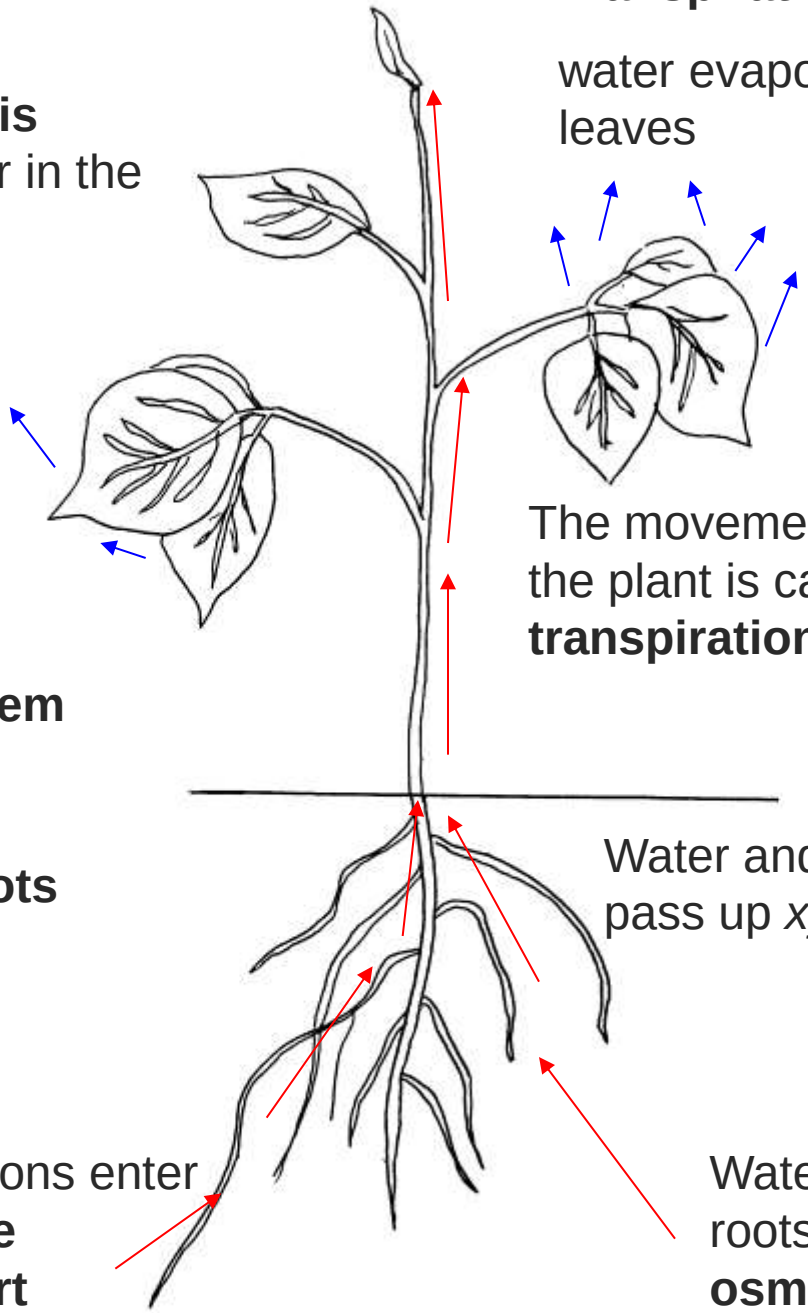
Mineral ions enter by **active transport**

Water enters roots by **osmosis**

Photosynthesis
produces sugar in the leaves

Transpiration

water evaporates from leaves



The movement of water through the plant is called the **transpiration stream**

stem

roots

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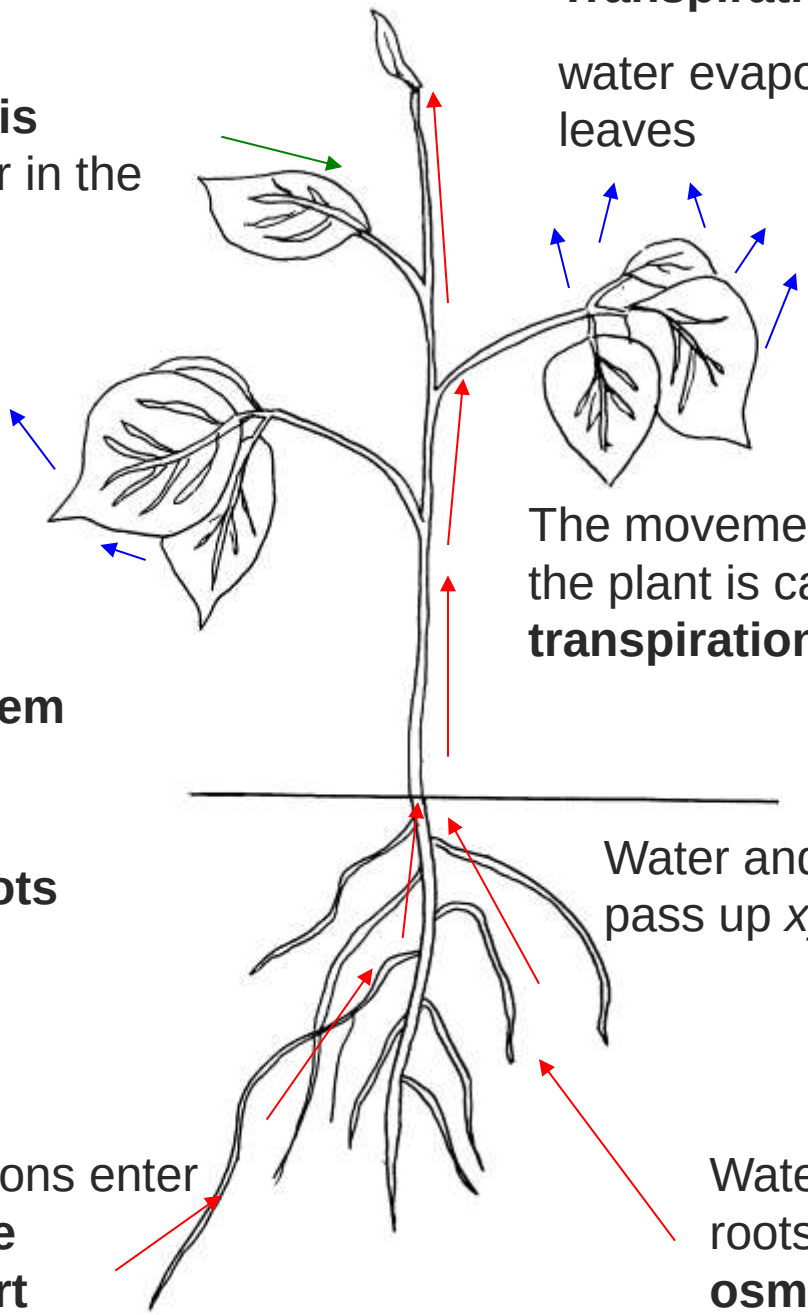
Transpiration

water evaporates from leaves



The movement of water through the plant is called the **transpiration stream**

stem

roots

Water and ions pass up *xylem*

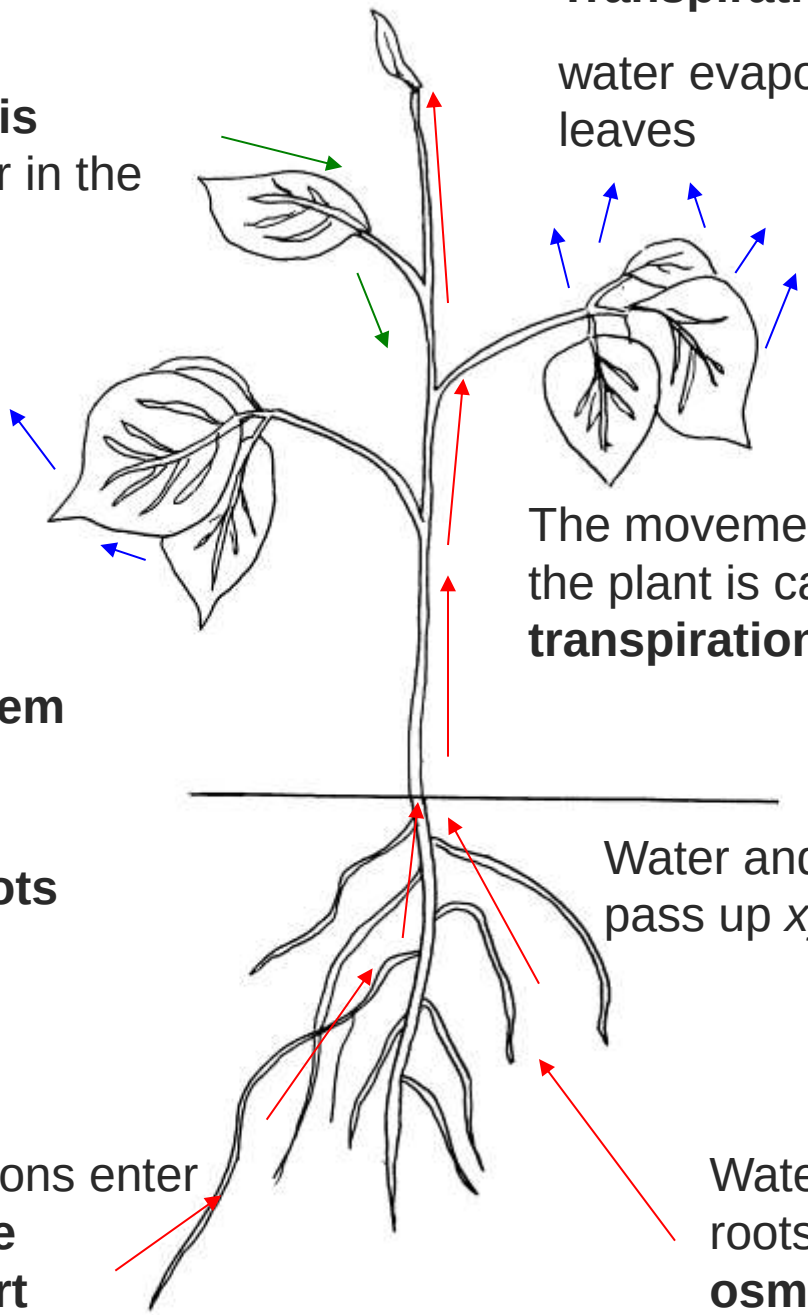
Mineral ions enter by **active transport**

Water enters roots by **osmosis**

Photosynthesis
produces sugar in the leaves

Transpiration

water evaporates from leaves



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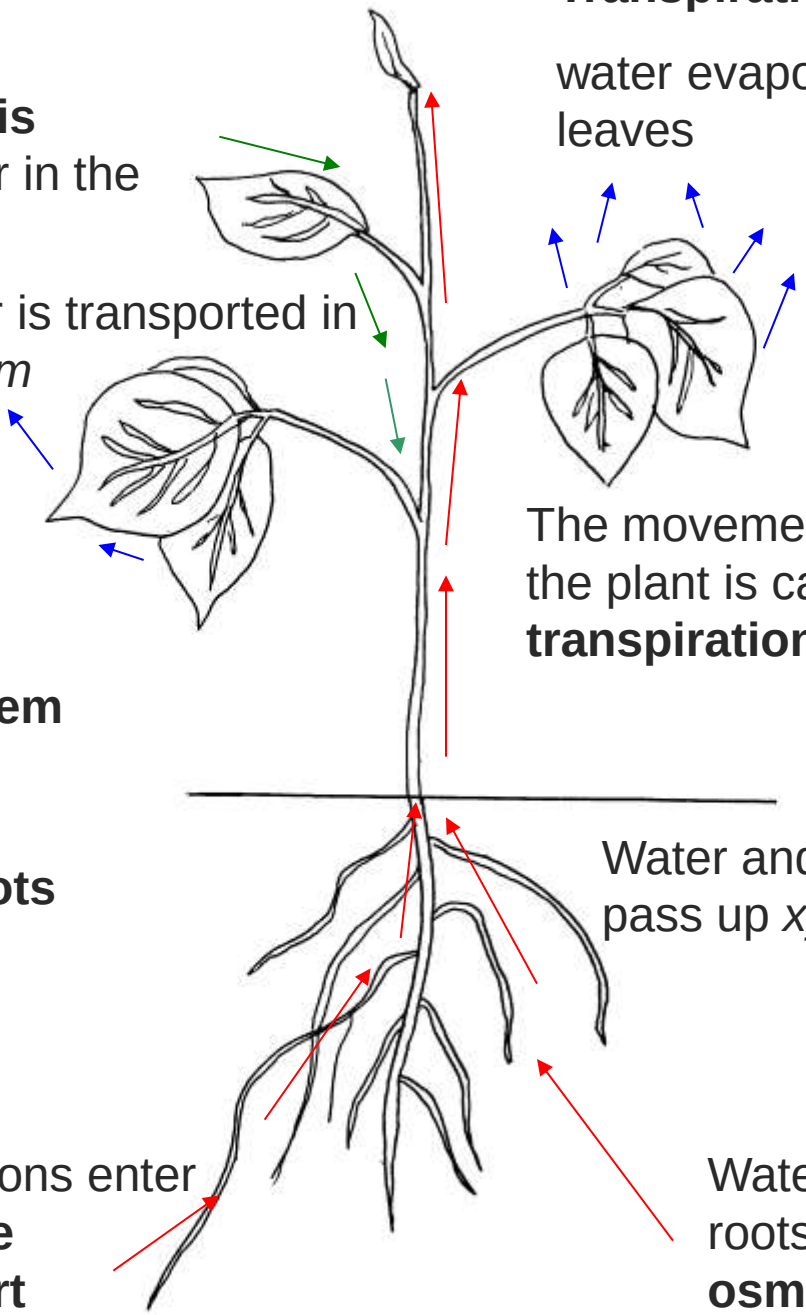
water evaporates from leaves

Sugar is transported in *phloem*



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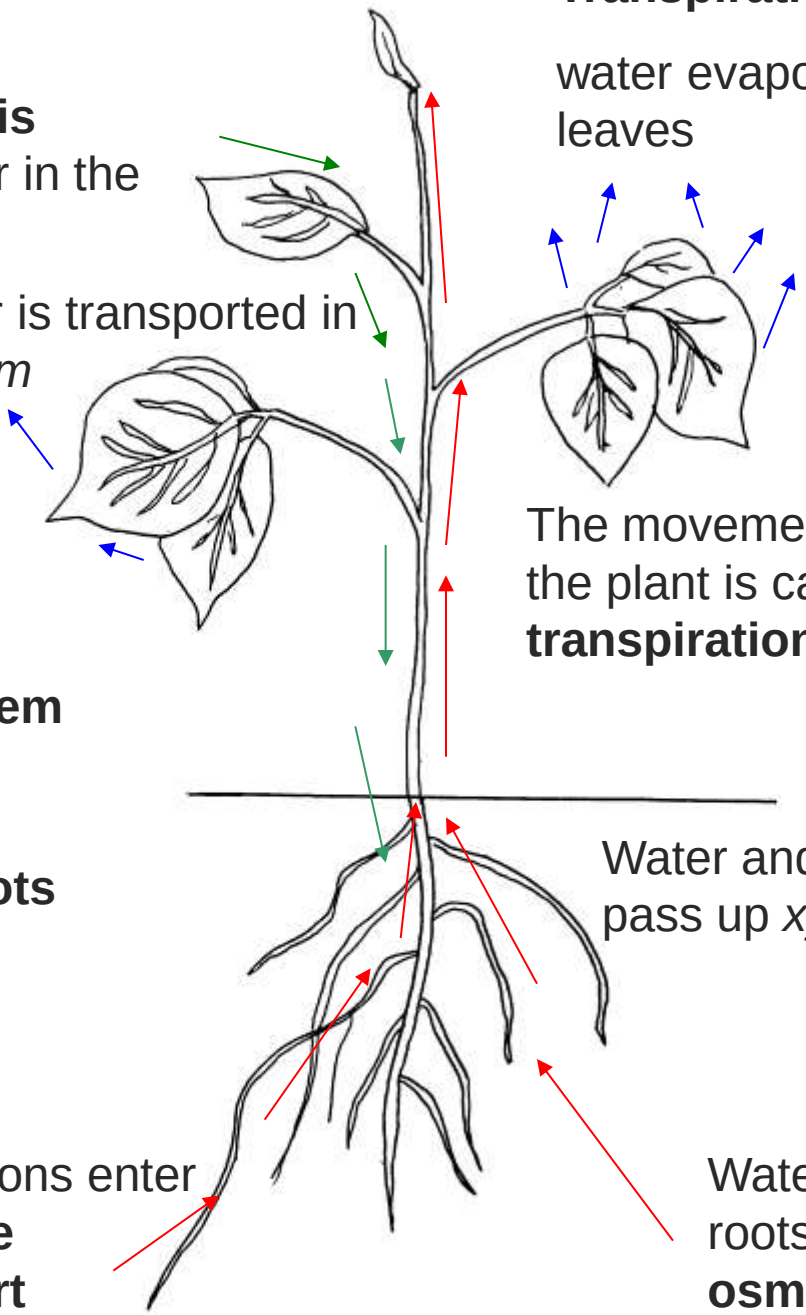


The movement of water through the plant is called the **transpiration stream**

stem

roots

Water and ions pass up *xylem*

Mineral ions enter by **active transport**

Water enters roots by **osmosis**

National 4/5 Biology
Unit 2 – Multicellular Organisms

Lesson 3 – **Animal transport and exchange systems**

Learning Intentions

- To develop knowledge on transport and exchange within animals.

Success Criteria

- I can explain and recognise the structure and role of the heart.
- I can identify arteries, veins and capillaries.
- I can state the function of red blood cells.
- I can explain and recognise the structure and role of the lungs.

The blood

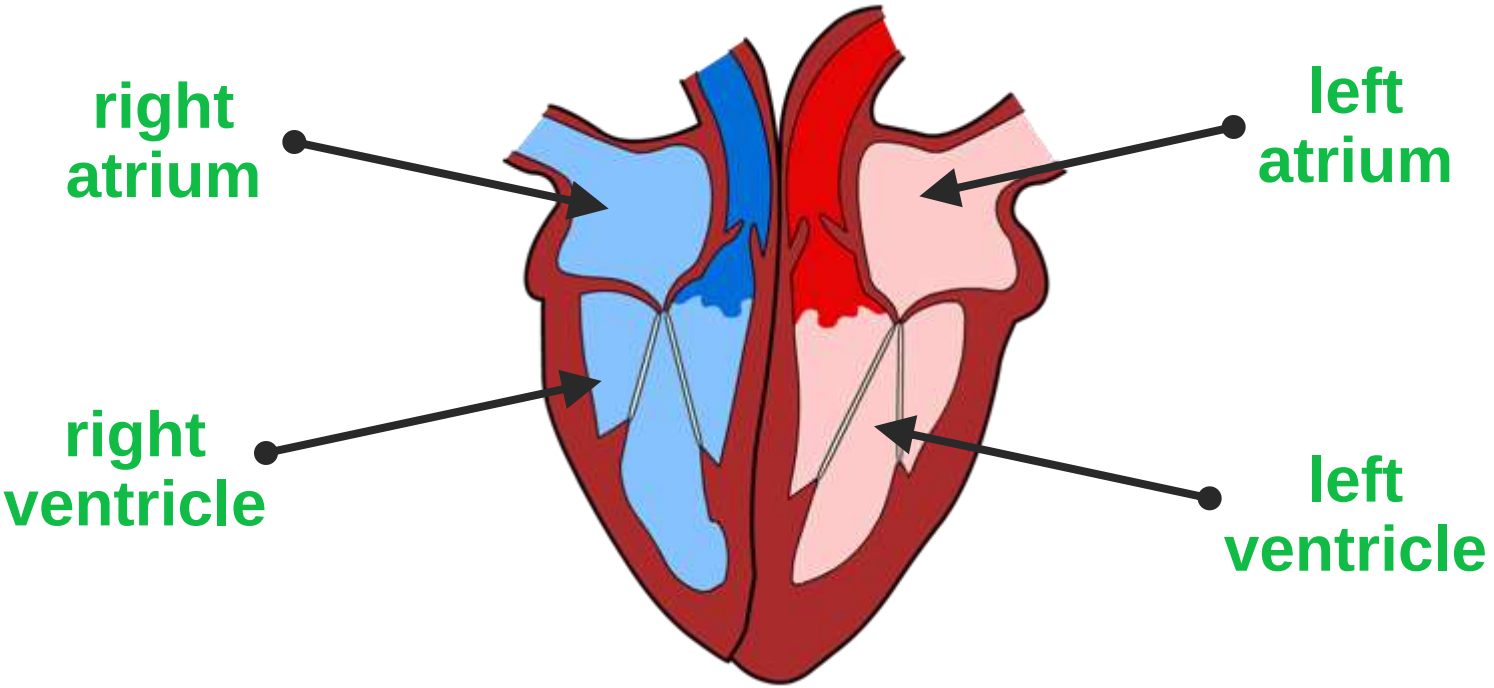
- In mammals, the blood is responsible for the transport of nutrients, oxygen and carbon dioxide.
- The blood is pumped round the body by the heart.

The heart

The four chambers of the heart have special names:

An upper chamber is called an atrium (plural: atria).

A lower chamber is called a ventricle.



Activity 1

- Collect and label the heart diagram.
- Labels will be added to this during the lesson so keep space!

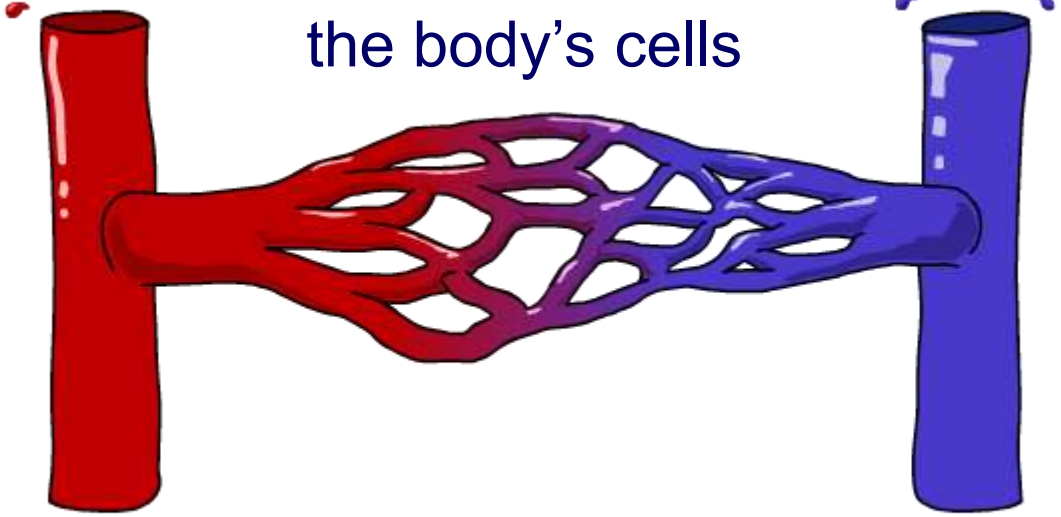
Blood vessels

There are three types of blood vessels.

blood from the heart

blood to the heart

Capillaries carry blood to and from the body's cells



Arteries carry blood **a**way from the heart

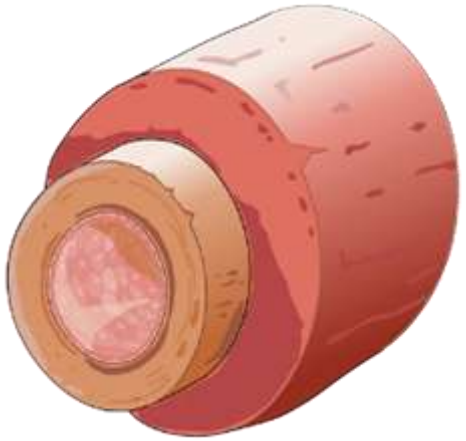
Veins carry blood back **in**to the heart

Why are there different types of blood vessels?

Blood vessels

Arteries:

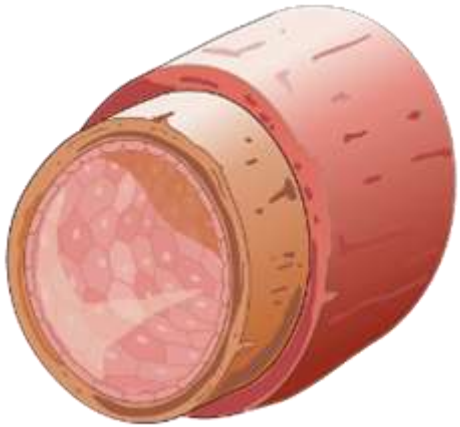
- thick muscular wall
- narrow central channel (lumen)
- carry blood under high pressure



Blood vessels

Veins:

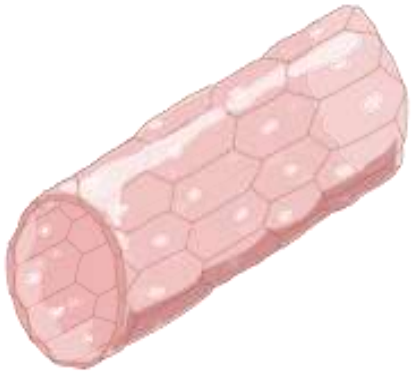
- thin wall
- wide central channel (lumen)
- carry blood under low pressure
- contain valves which prevent the backflow of blood



Blood vessels

Capillaries:

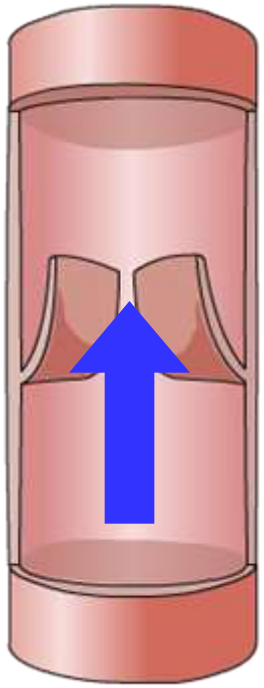
- form networks at organs and tissues
- thin walled - only one cell thick
- large surface area allowing exchange of materials

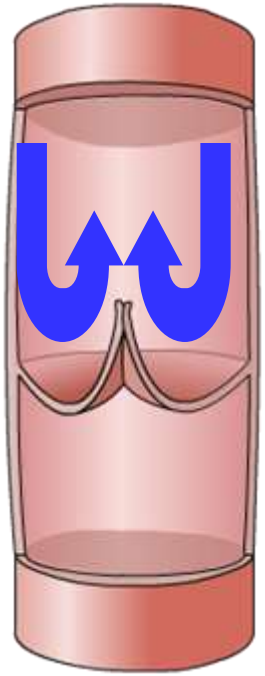


Blood vessels: valves

vein valve open

blood to the heart





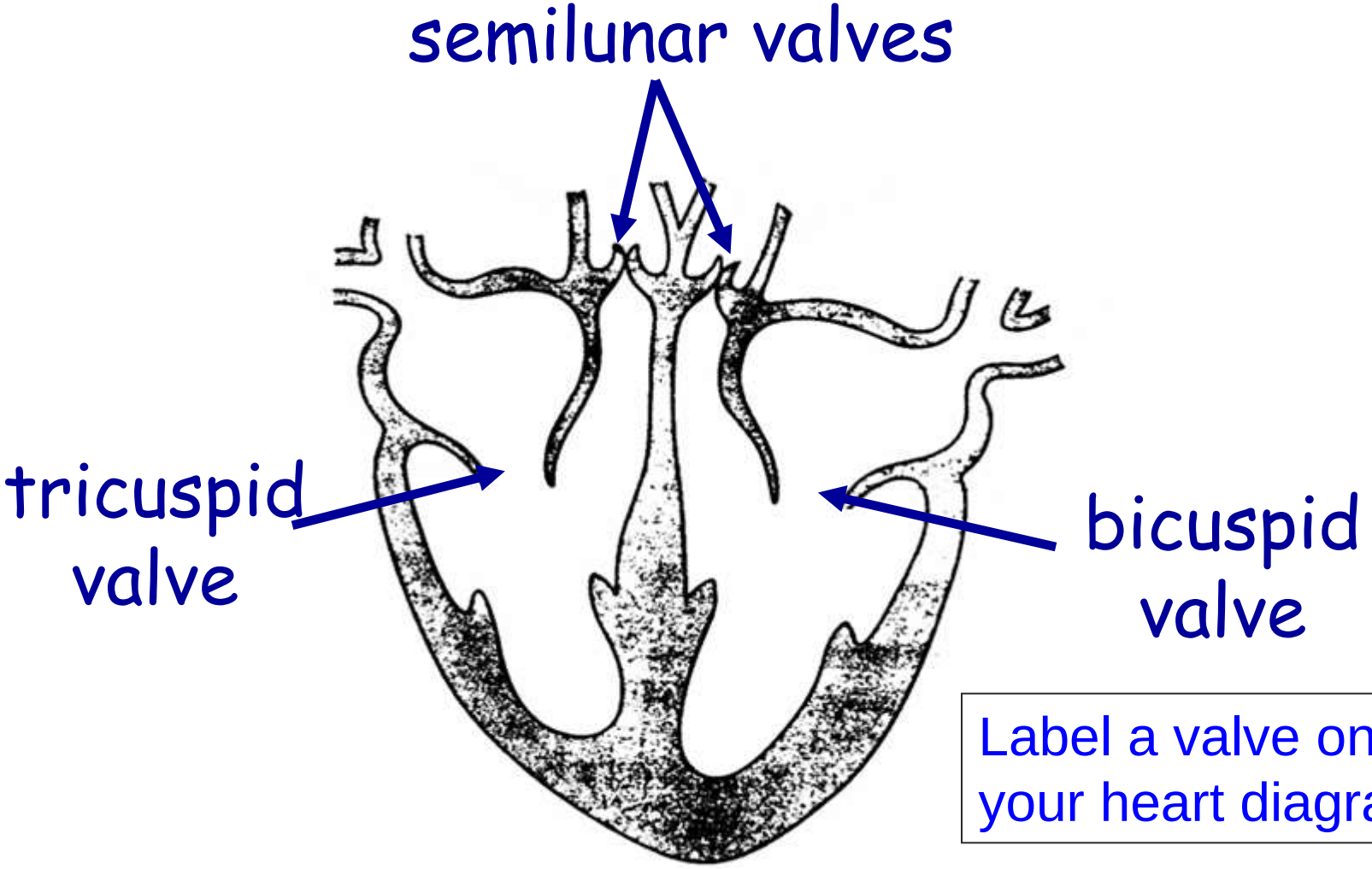
backflow prevented

vein valve closed

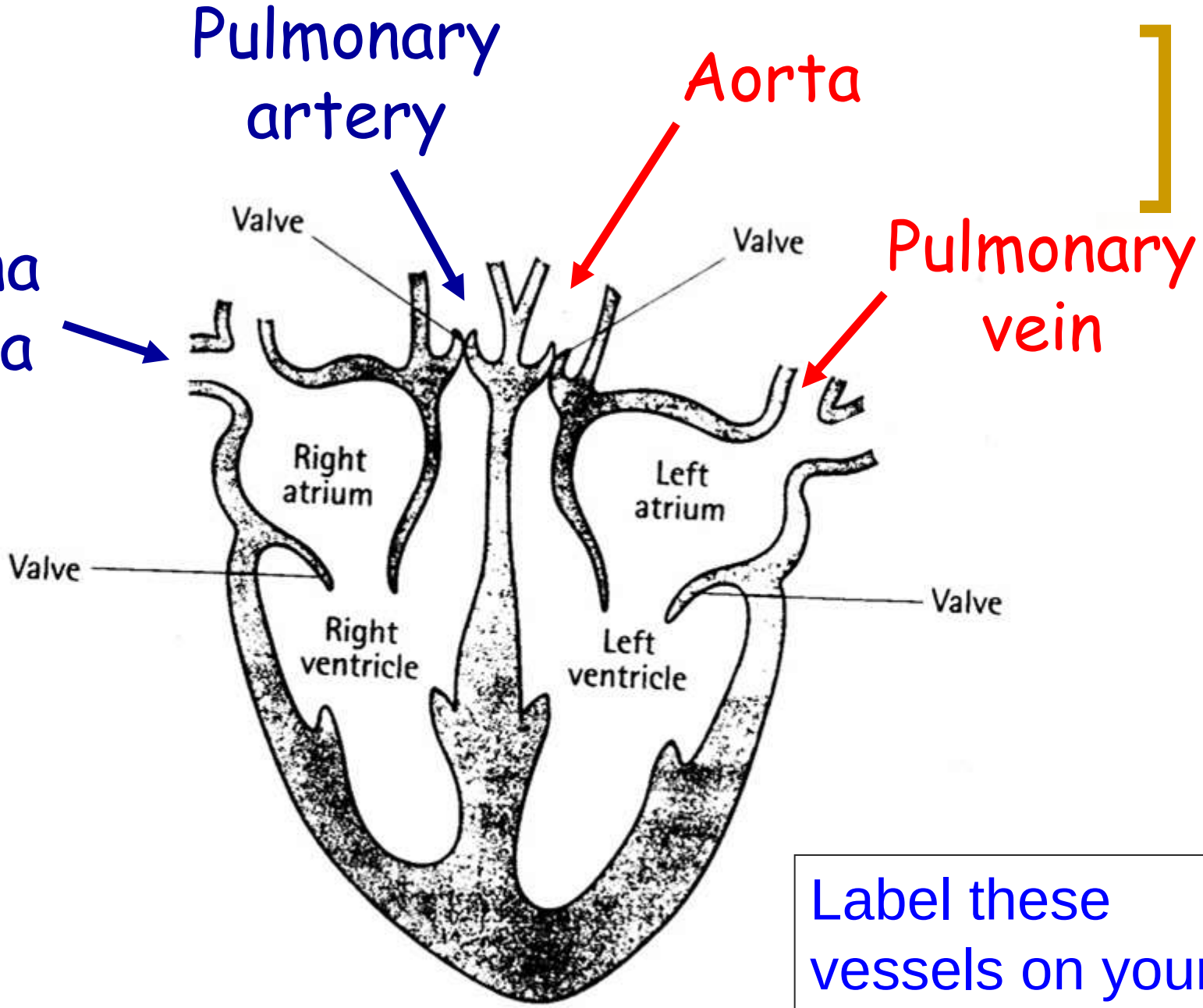
The valves allow blood to flow in the correct direction…

…but close if blood starts to flow in the wrong direction.

The four valves in the heart



Label a valve on your heart diagram.



Blood vessels in the heart

Label these vessels on your diagram

Circulation of blood through the heart

Blood low in oxygen is called deoxygenated blood.

Deoxygenated blood returns from the body tissues…

- in the vena cava
- enters the right atrium
- is pumped through the tricuspid valve
- into the right ventricle
- then pumped through the semilunar valve
- out through the pulmonary artery
- to the lungs where it picks up oxygen

Circulation of blood through the heart

Blood high in oxygen is called oxygenated blood

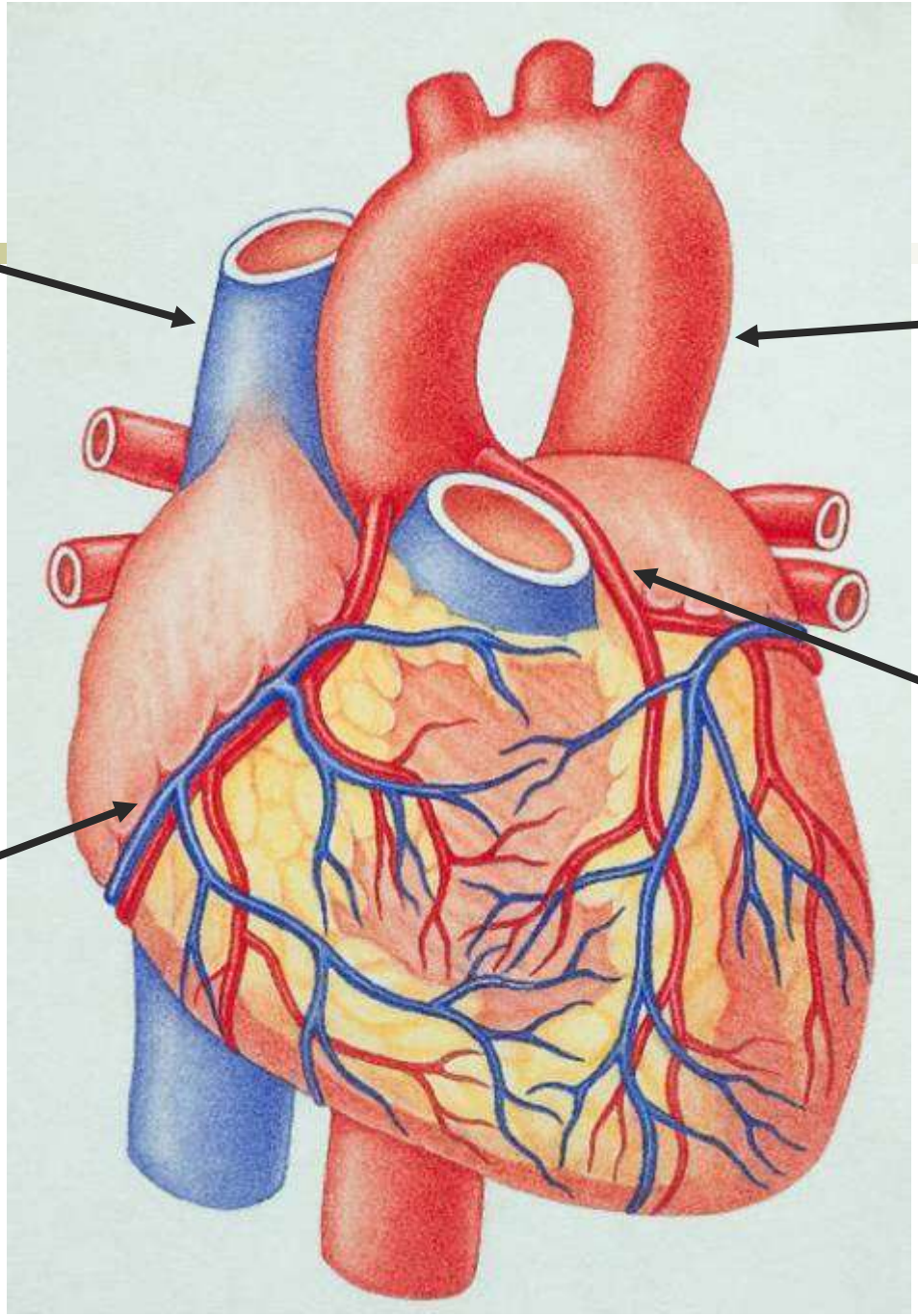
Oxygenated blood returns from the lungs…

- in the pulmonary vein
- enters the left atrium
- is pumped through the bicuspid valve
- into the left ventricle
- then pumped through the semilunar valve
- out through the aorta
- to the body

The coronary blood vessels

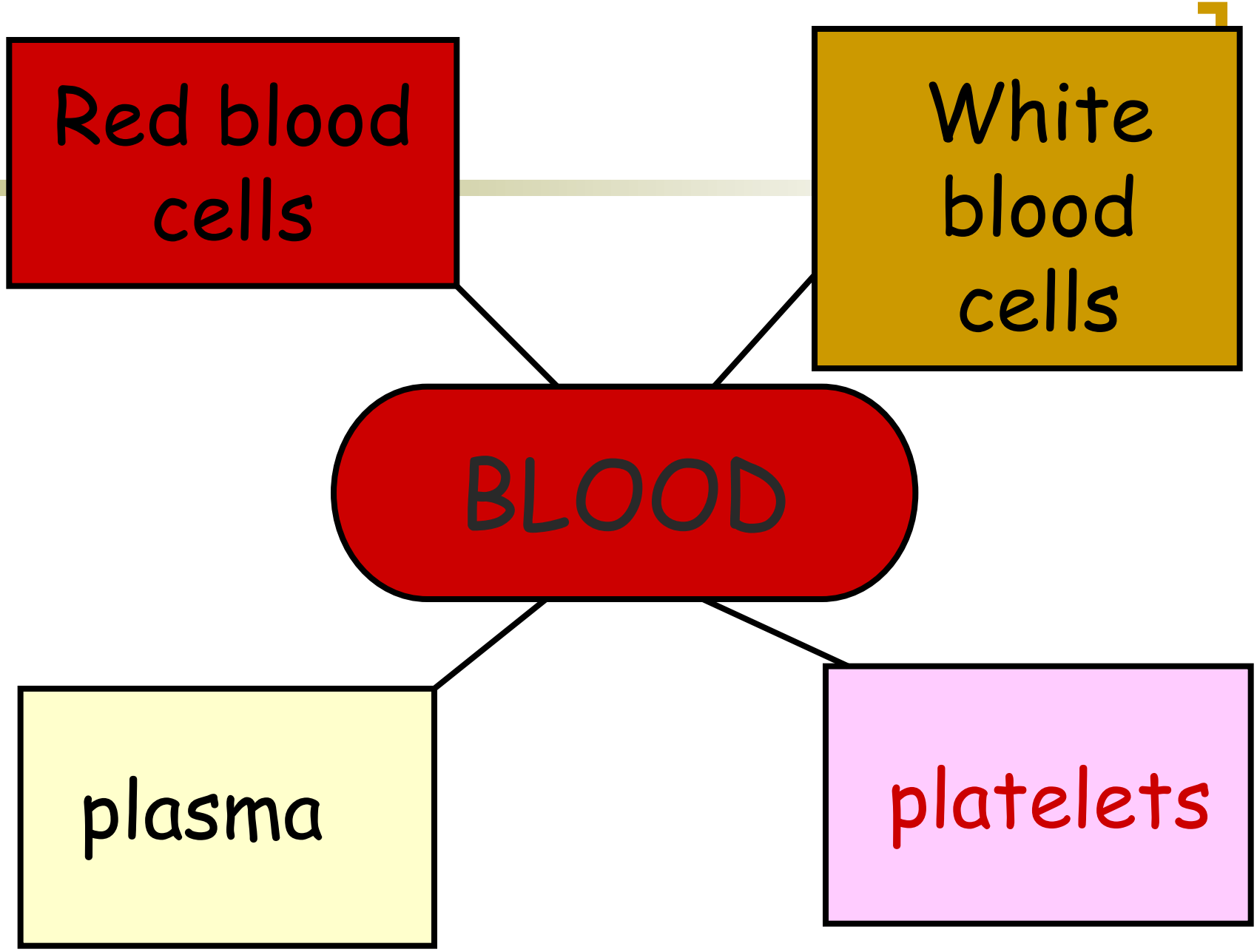
The heart muscle requires its own blood supply which is provided by the coronary blood vessels which can be seen on the outside of the heart.

- coronary arteries branch off the aorta
- coronary veins join the vena cava


vena cava
aorta
coronary artery
coronary vein

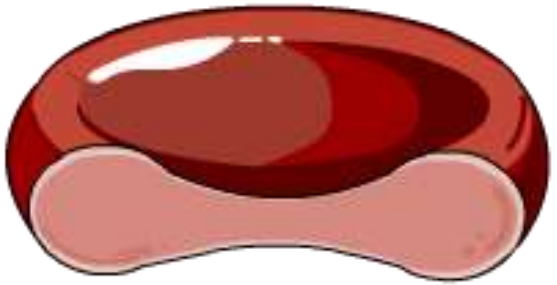
Optional activity

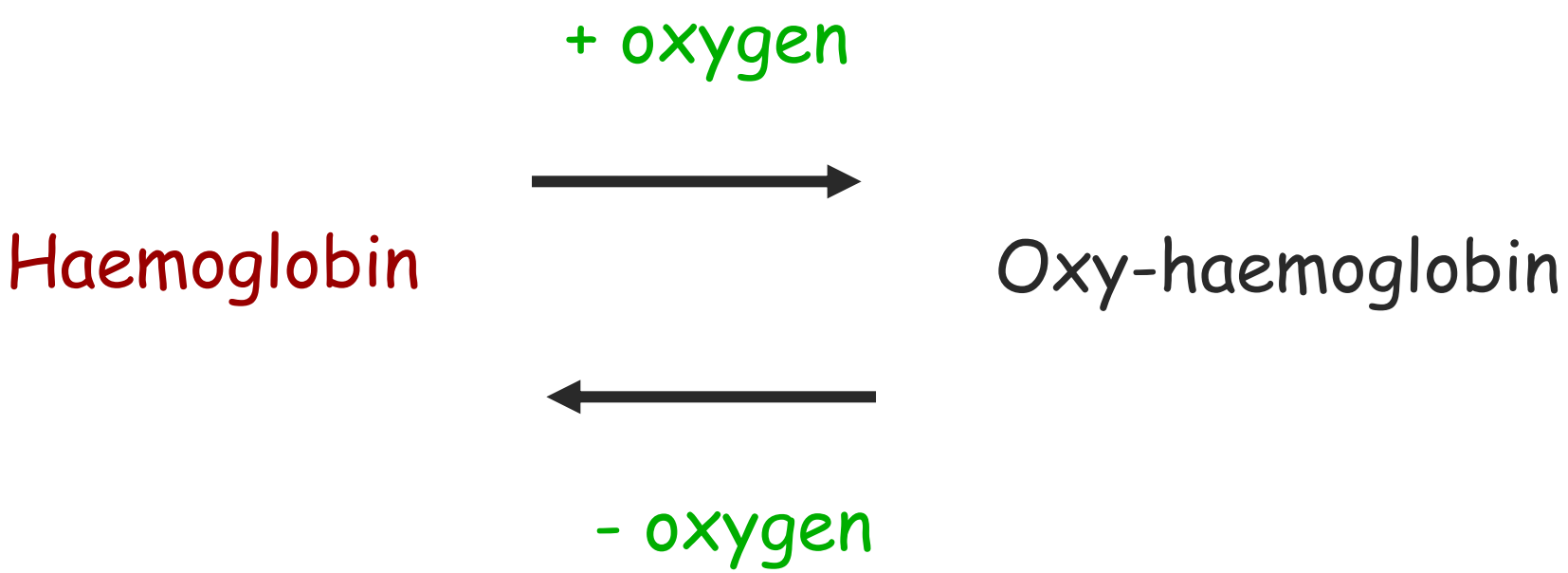
- Heart dissection


Red blood cells
White blood cells
BLOOD
plasma
platelets

Red blood cells

- also called erythrocytes
- disc-shaped
- made in the bone marrow
- contain a red-coloured compound called **haemoglobin** which bonds with oxygen to form oxyhaemoglobin
- transport **oxygen** to the tissues.



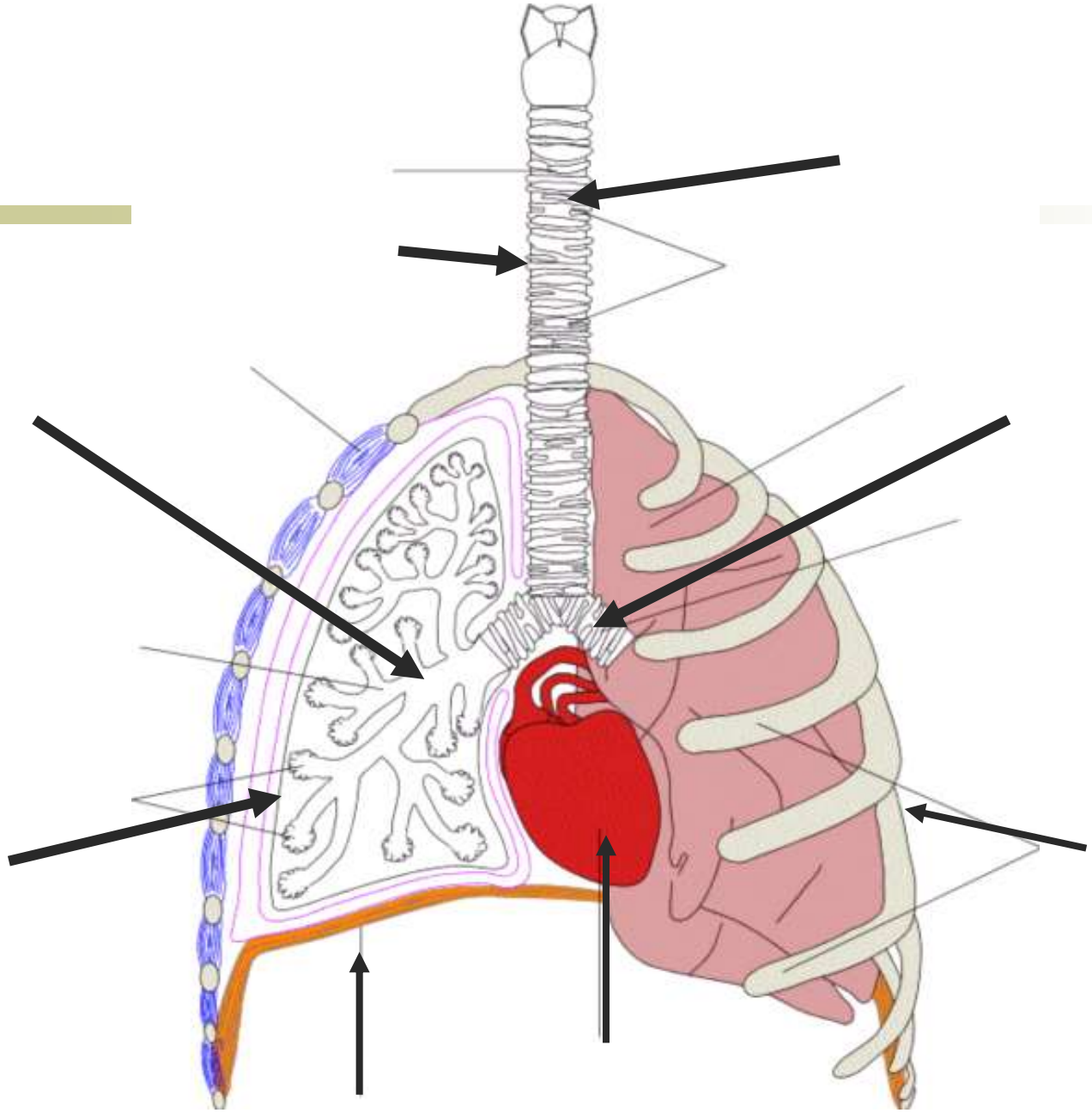

+ oxygen
Haemoglobin
Oxy-haemoglobin
- oxygen

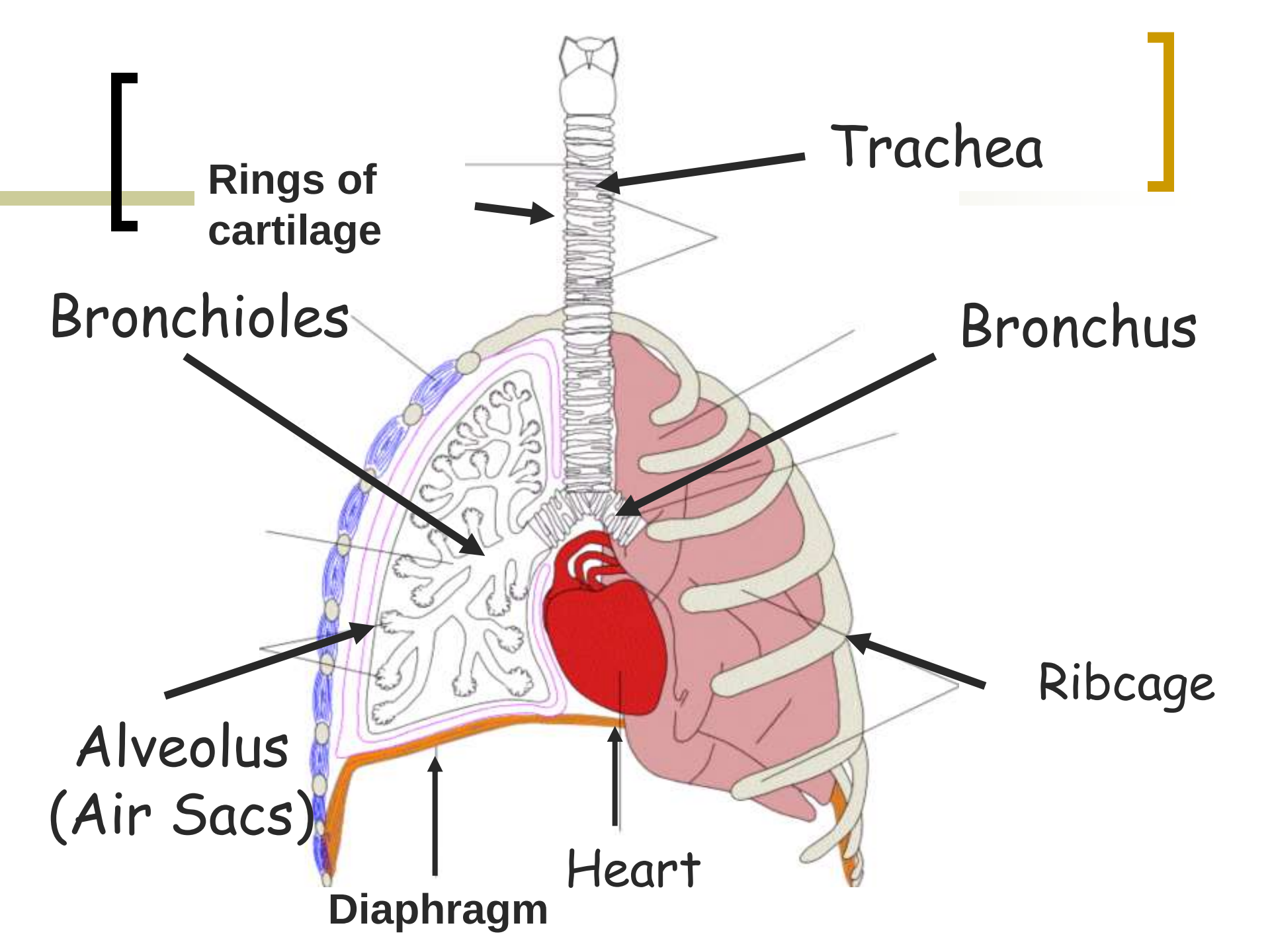
The respiratory system (lungs)

The lungs are responsible for gas exchange in mammal's.

Label the following on your diagram:

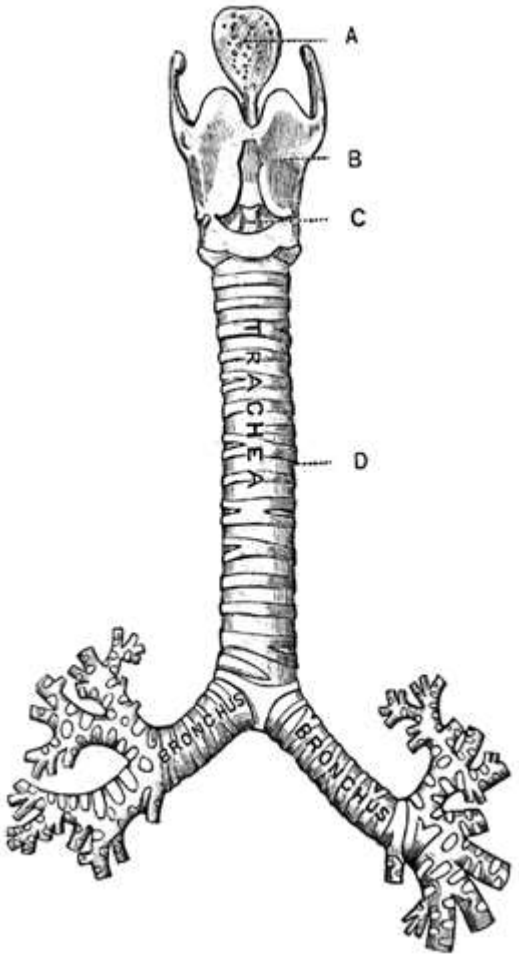
- Trachea
- Bronchus
- Bronchioles
- Cartilage rings
- Alveolus
- Ribs
- Diaphragm




Rings of cartilage
Trachea
Bronchioles
Bronchus
Alveolus (Air Sacs)
Ribcage
Diaphragm
Heart

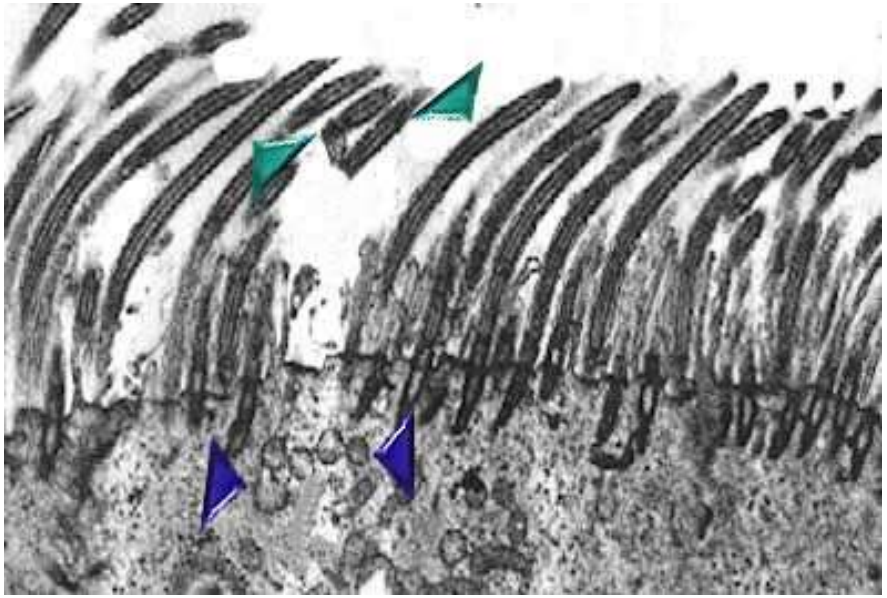
Cartilage

- The trachea and bronchi are held permanently open by incomplete rings of cartilage.



Cilia and mucus

The trachea, bronchus and bronchioles are lined with small hairs called cilia and mucus.



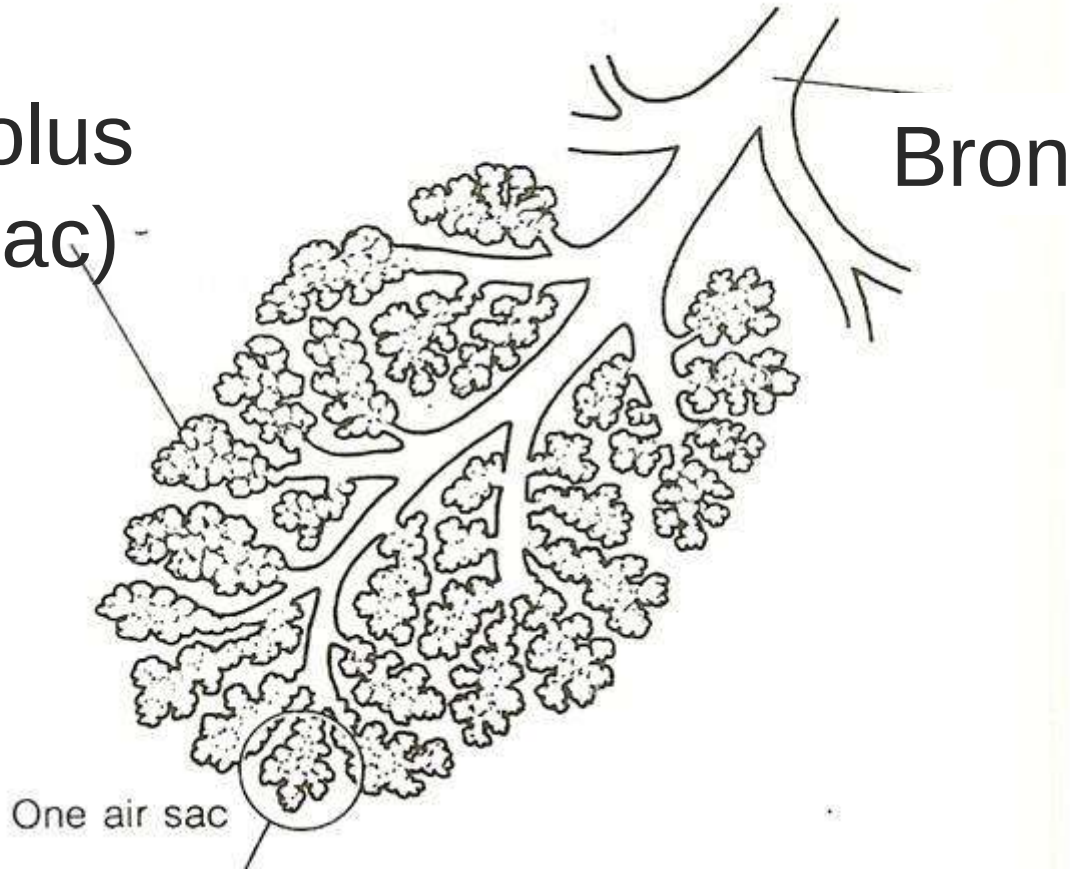
- **Mucus** is a sticky fluid. It traps dirt and microorganisms.

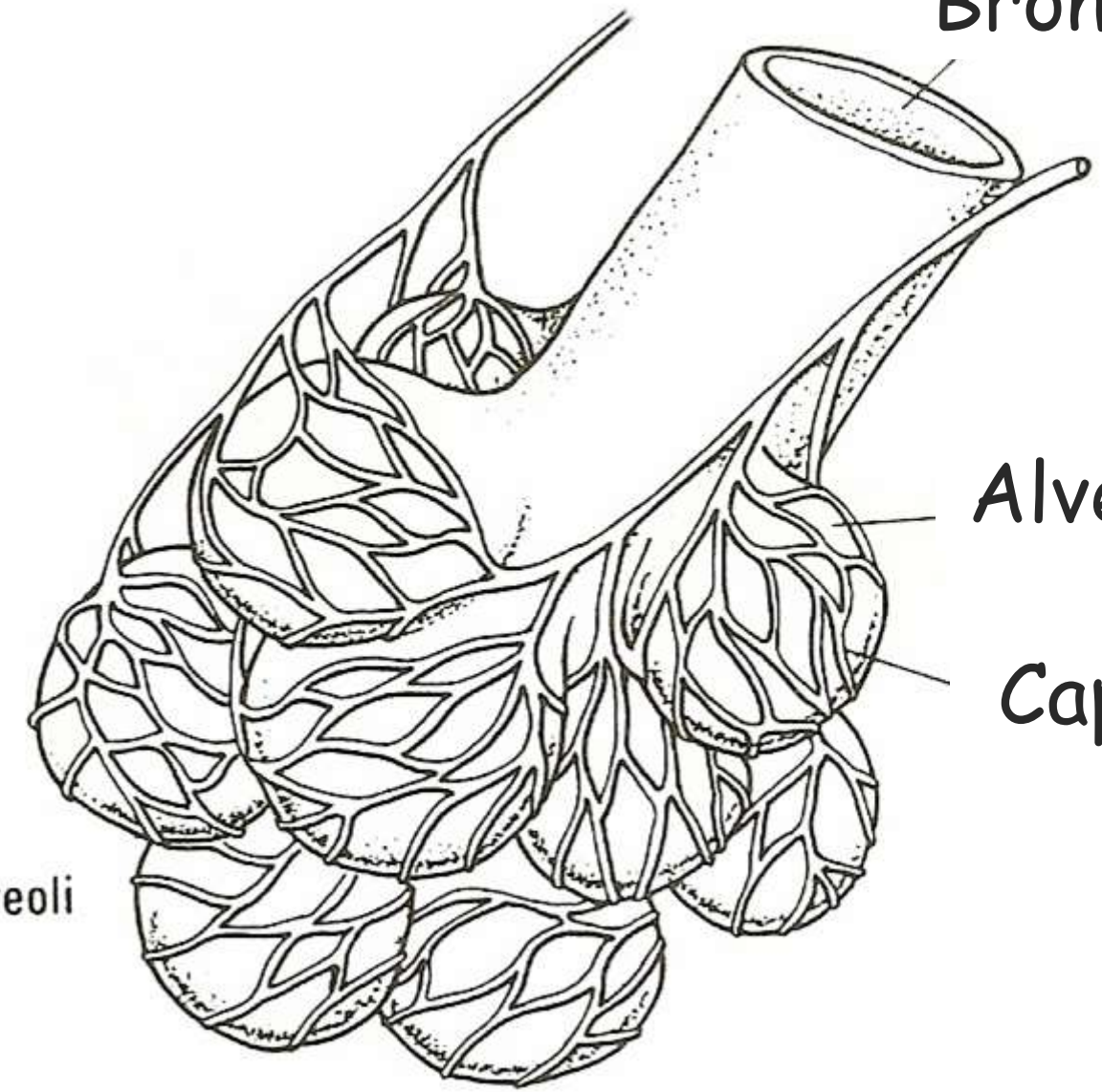
- **Cilia** moves the trapped dirt and microorganisms up and out of the lungs.

The alveoli

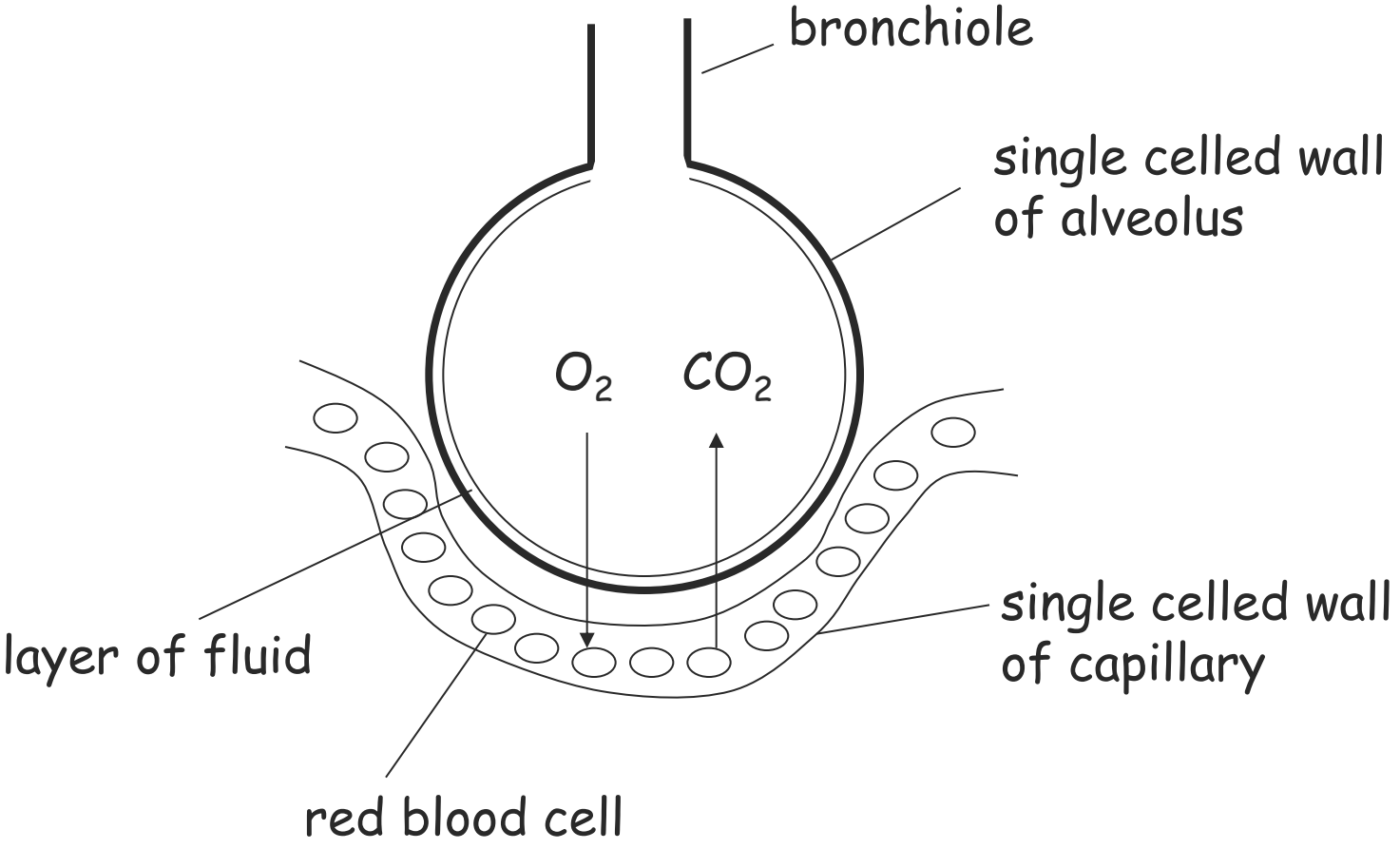
Alveolus
(air sac)

Bronchiole





A group of alveoli


bronchiole
single celled wall of alveolus
O_2
CO_2
layer of fluid
single celled wall of capillary
red blood cell

The alveoli

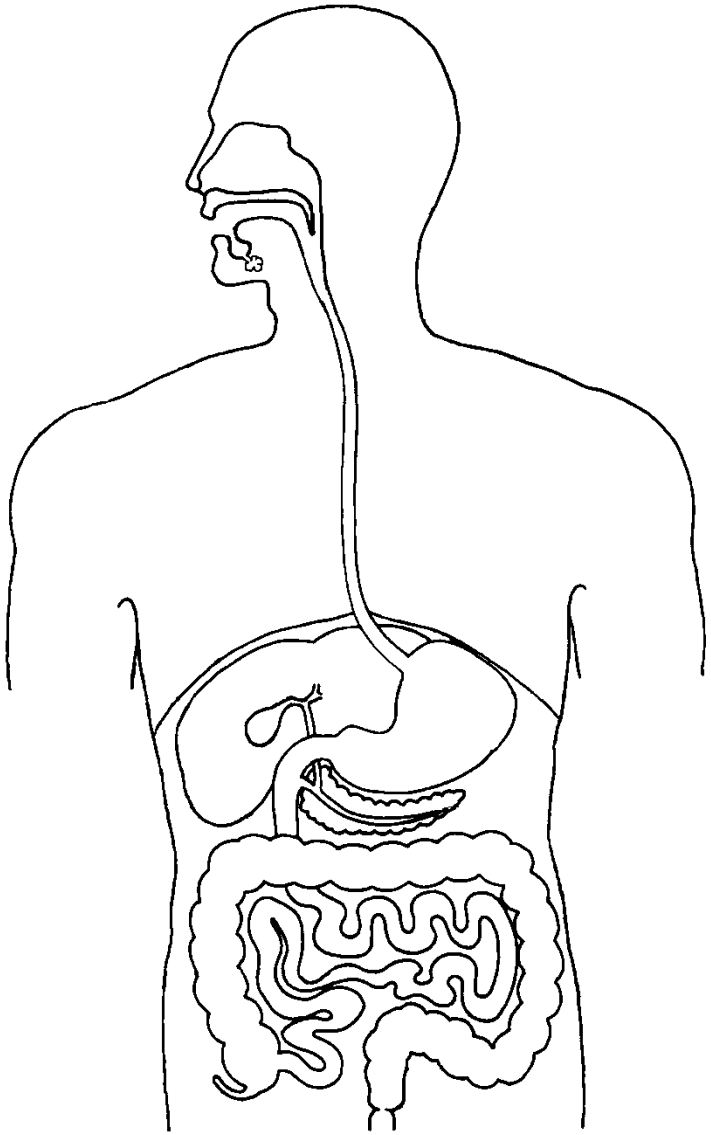
- Oxygen and carbon dioxide are exchanged at the alveoli.
- The alveoli have many features that make them efficient for gas exchange…..

Feature	Provided by	Advantage
large surface area	many alveoli	large volumes of gases can be exchanged
good blood supply	large capillary network	blood has continual O_2 uptake and CO_2 removal
very thin walls	single celled wall of alveolus and capillary	reduces distance which gases have to diffuse
moist surfaces	fluid lining the alveolus	O_2 must dissolve before it can diffuse through cells

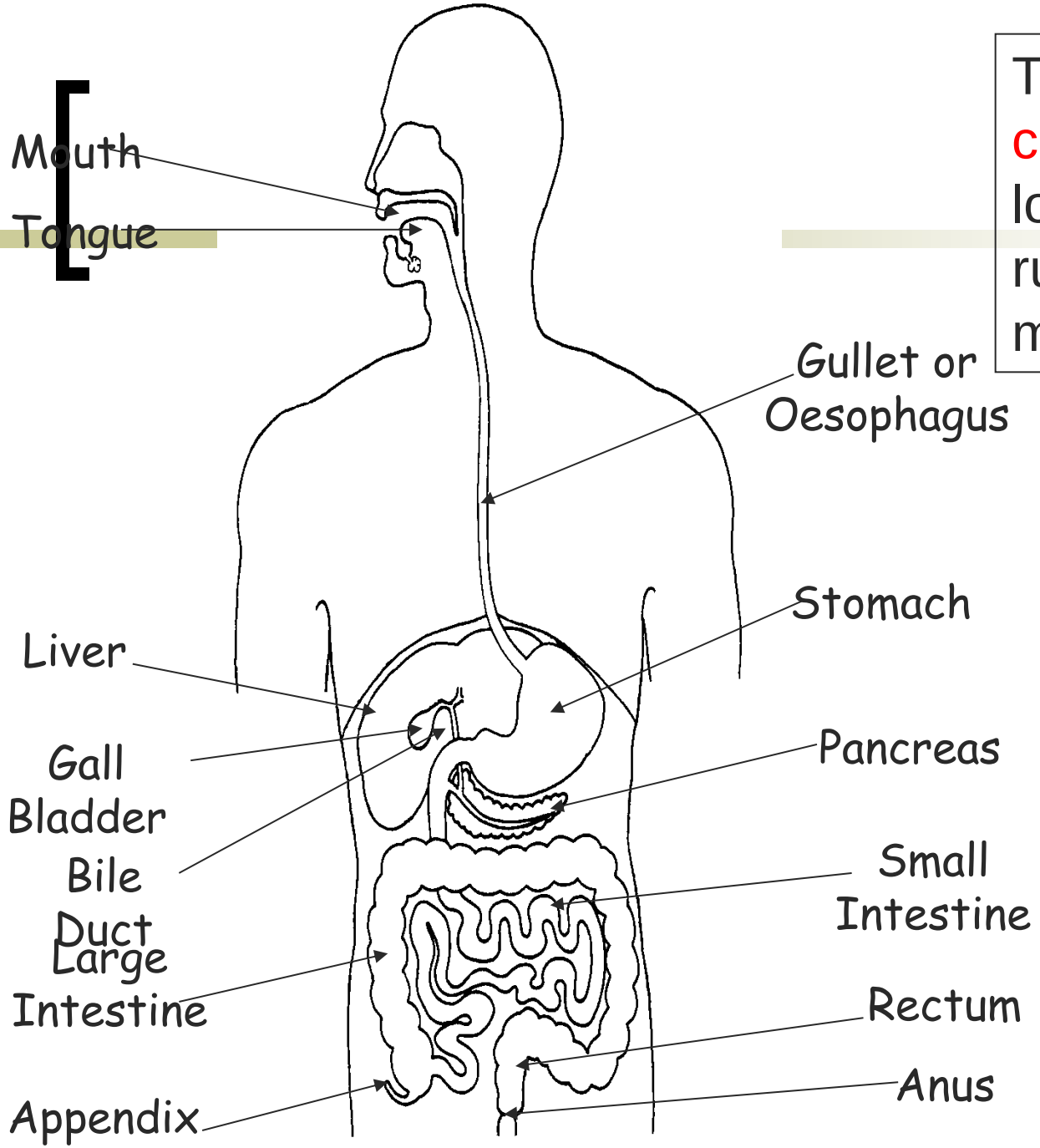
Optional activity

- Lung dissection

The digestive system

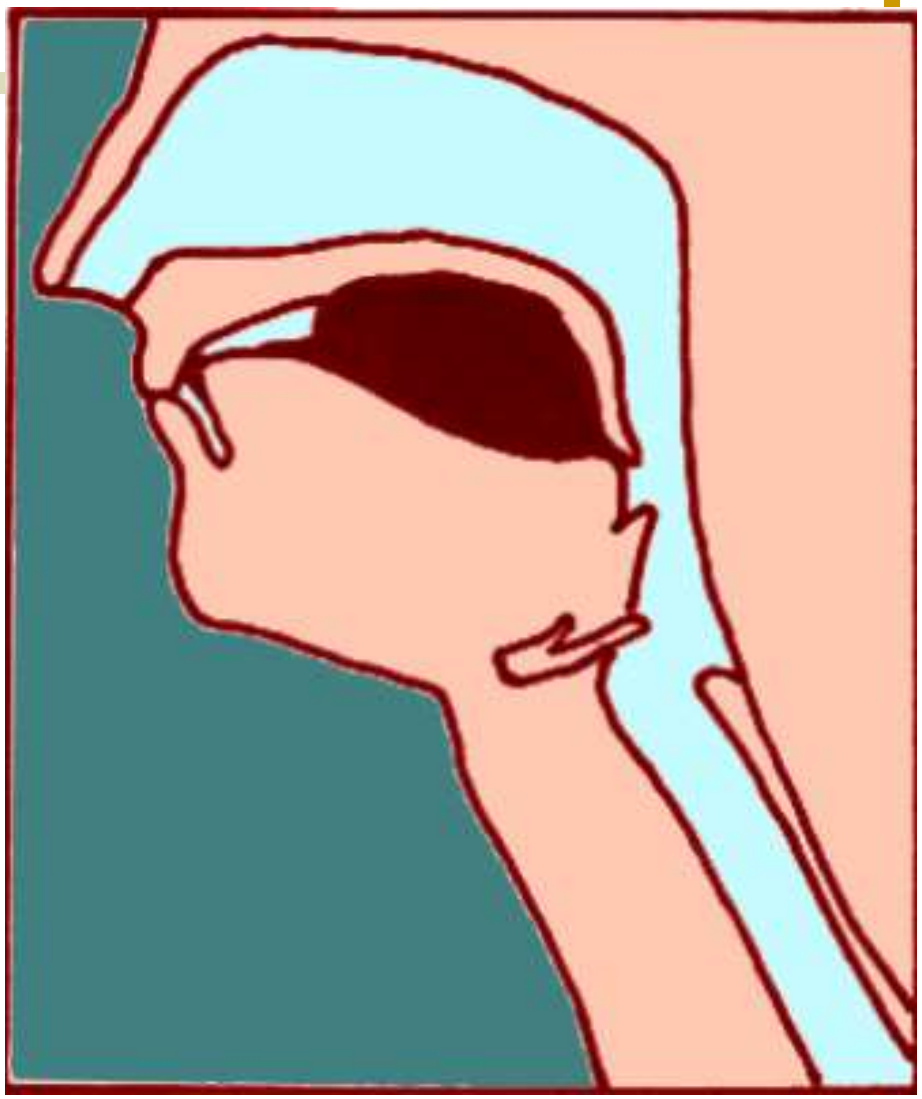


The alimentary canal (the gut) is long muscular tube running from the mouth to the anus.



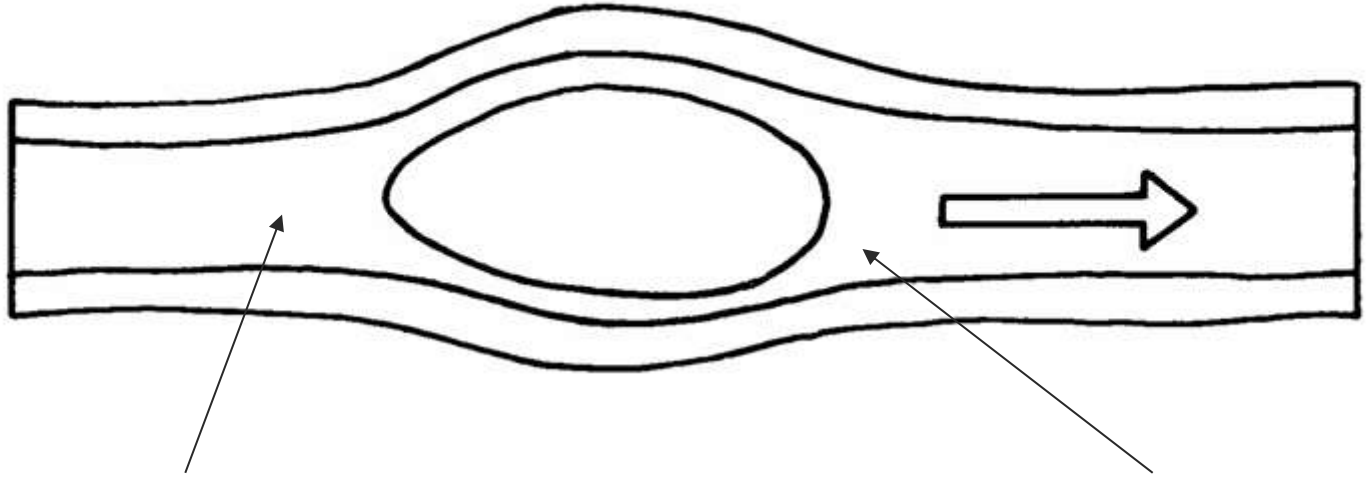
Food is move through the digestive system by the process of Peristalsis.

Peristalsis occurs throughout the length of the alimentary canal and not just in the oesophagus.



Peristalsis

Contractions of the gut wall (peristalsis) pushes food through from the oesophagus to the stomach, small intestine, large intestine, rectum and anus.

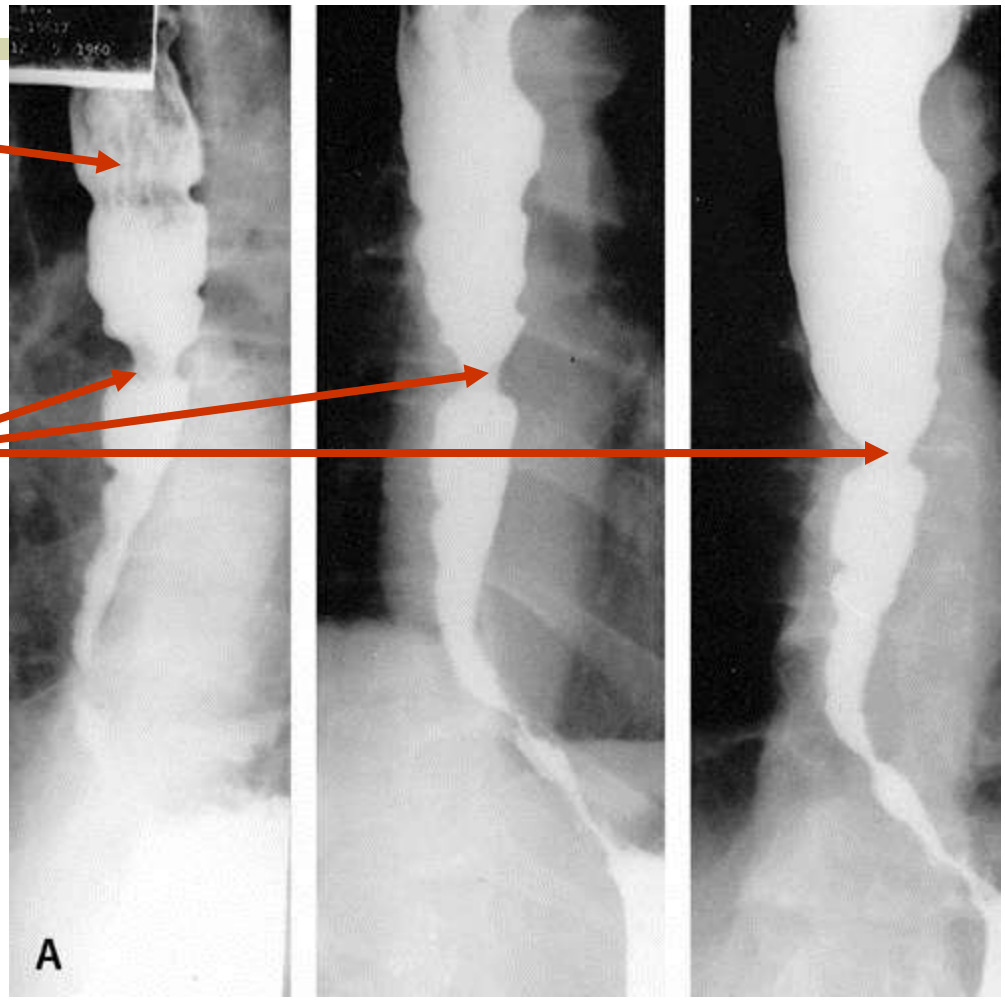


Muscles behind the food contract.

Muscles in front of the food relax.

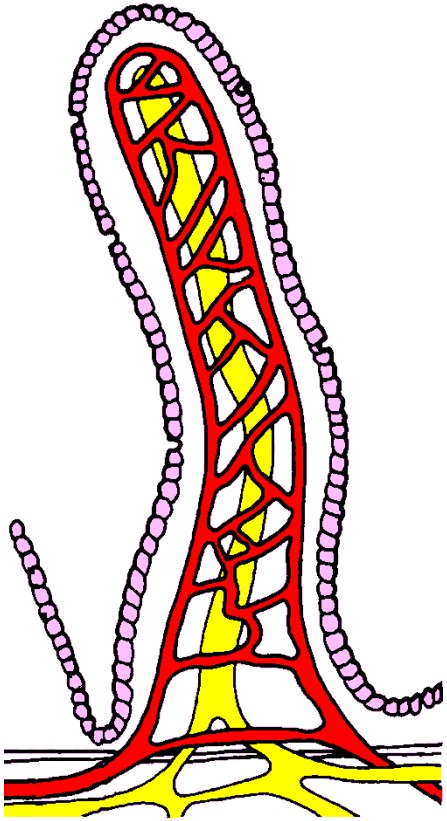
Gut with food.

Muscular contraction.



The small intestine

- The small intestine is made up of structures called villi.
- Villi are responsible for absorbing the products of digestion.



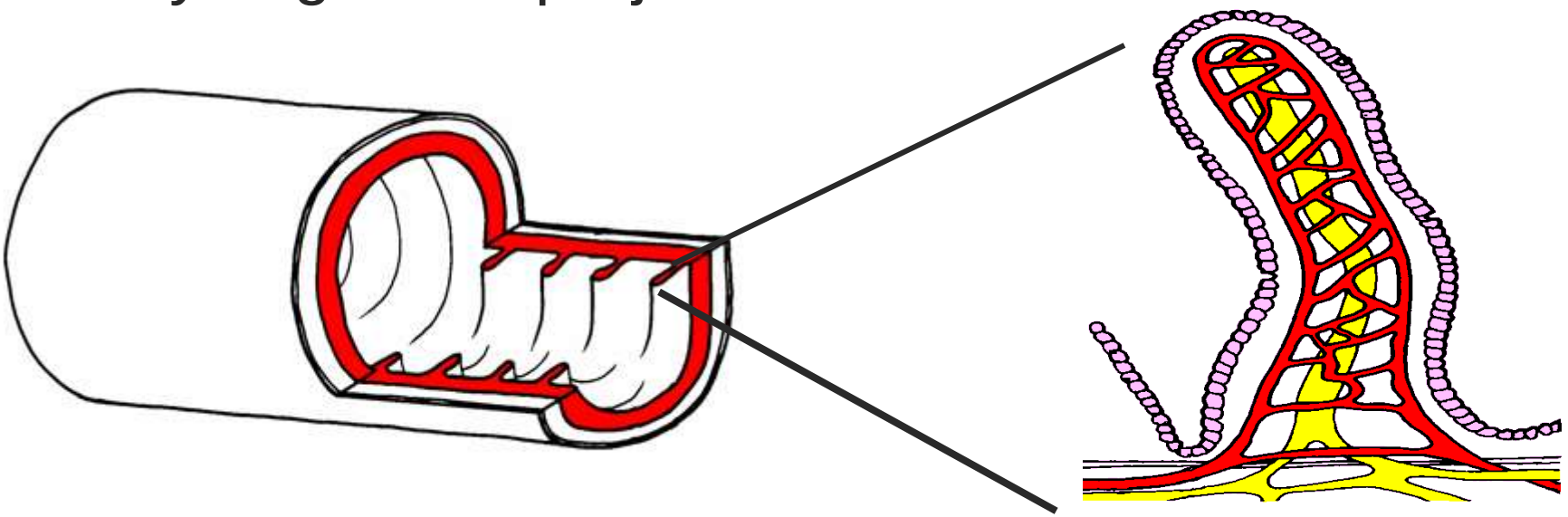
How long is the small intestine?

To absorb food efficiently the small intestine has three main adaptations.

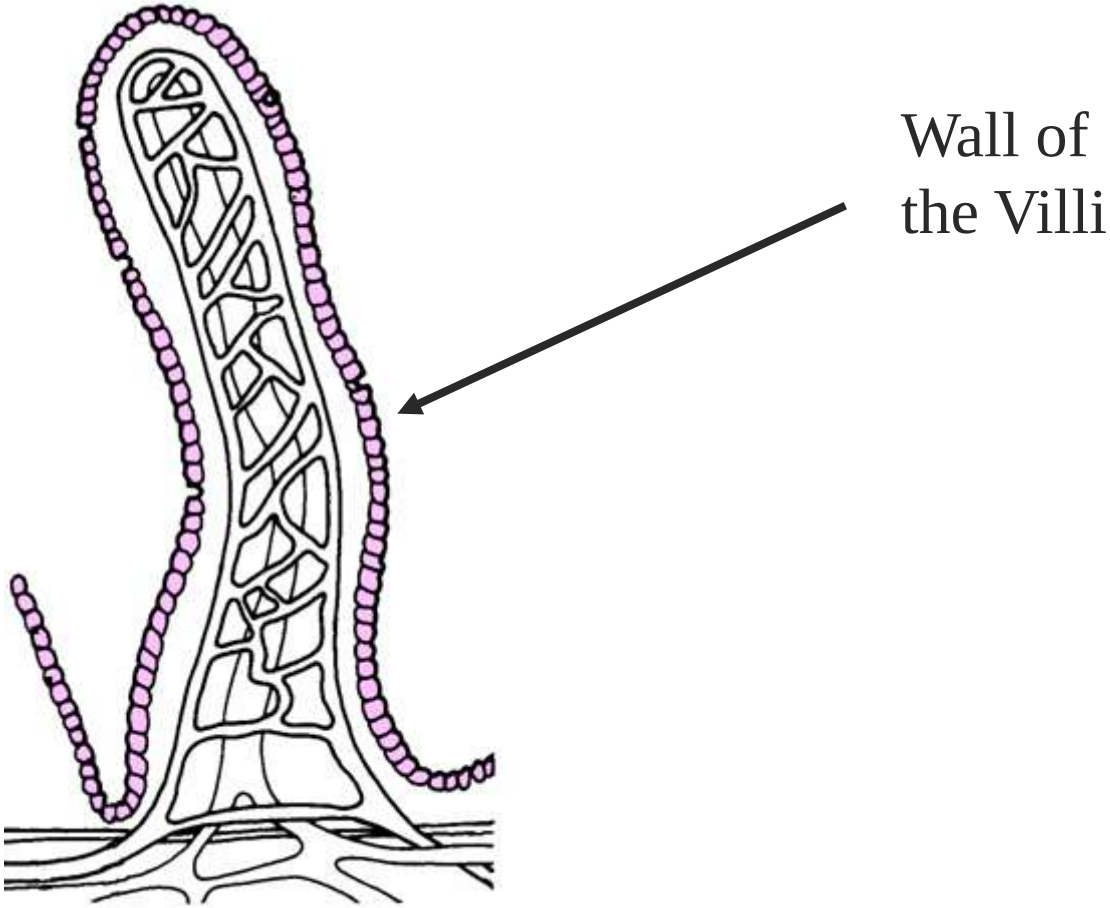
1. It has a very large surface area. This is because:

(a) It is very long (6 meters from end to end).

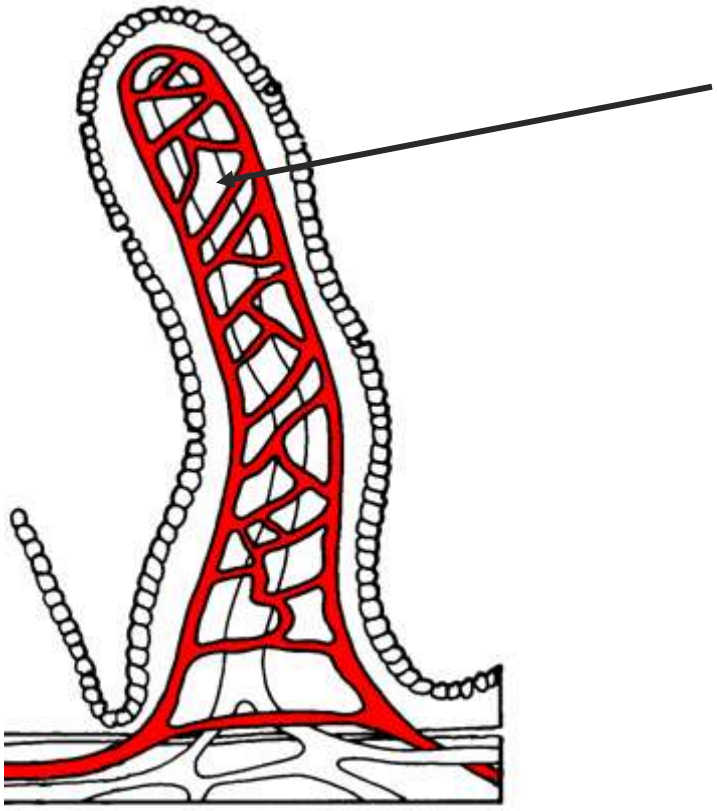
(b) The inner surface is folded and covered with many finger-like projections called Villi.



2. The walls of the small intestine are very thin e.g. one cell thick. This allows rapid absorption of materials.



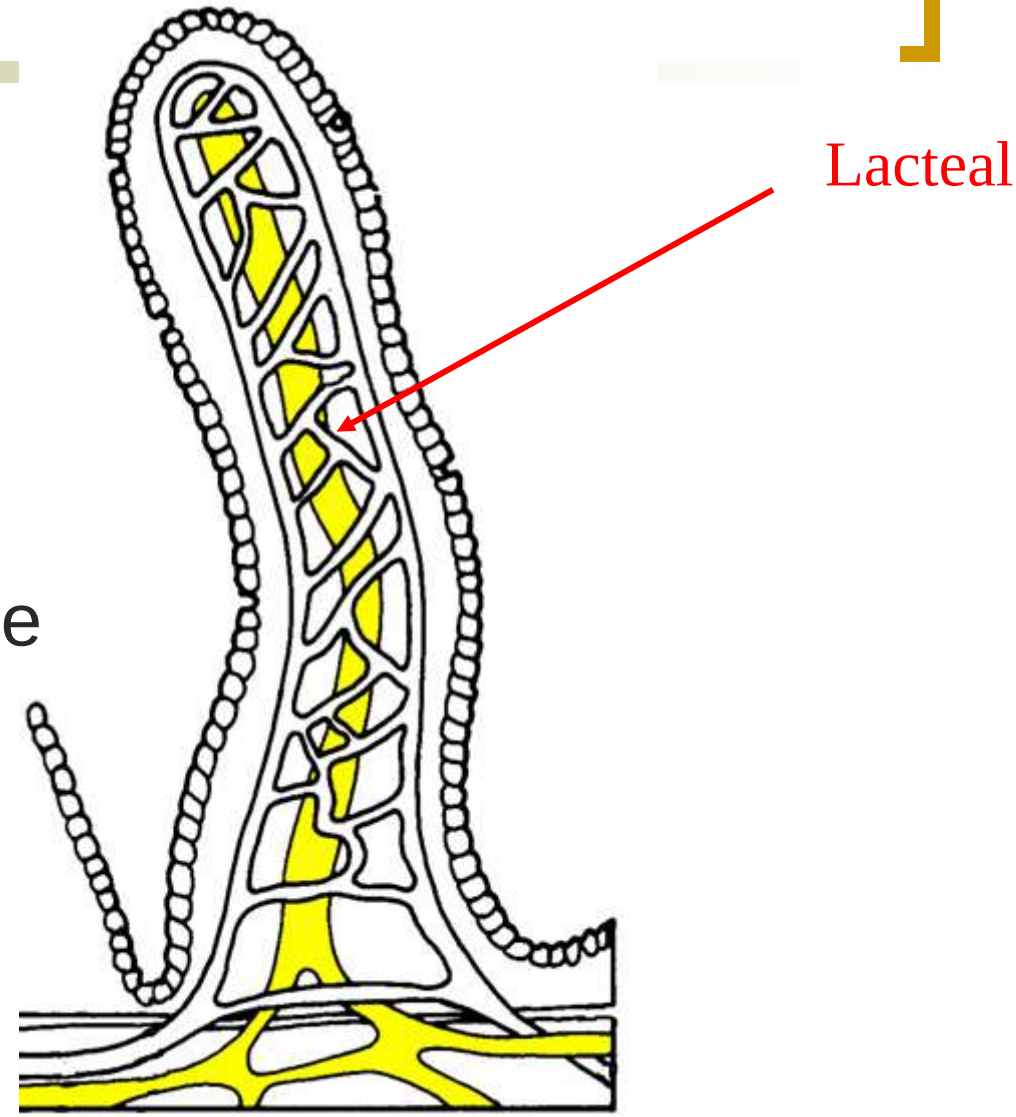
3. The small intestine has a very good blood supply. This allows the products of digestion to be carried away quickly.



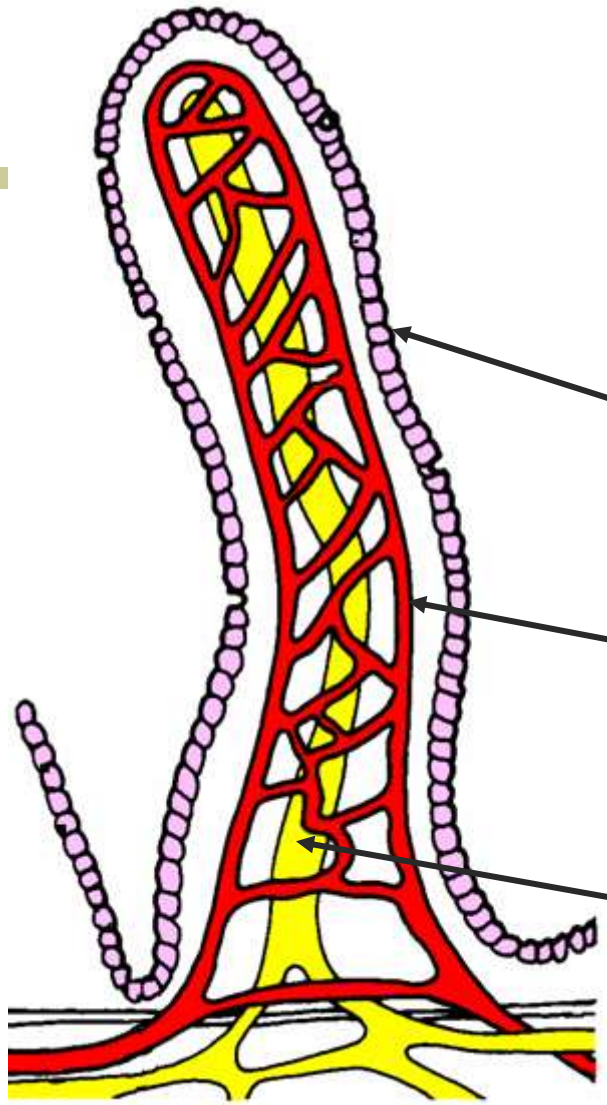
Blood Capillary for absorption of glucose and amino acids.

Each villi has a central lacteal.

This is to carry away the products of fat digestion.



Collect and label a villi diagram.



Thin wall of villi

Capillary (glucose and amino acid absorption)

Lacteal (fat absorption)

National 4/5 Biology
Unit 2 – Multicellular Organisms

Lesson 1 – **Lifestyle choices**

Learning Intentions

- To develop knowledge on the effects of lifestyle choices on animal transport and exchange systems.

Success Criteria

- I can describe how certain lifestyle choices (high fat, high salt diet, lack of exercise, tobacco, alcohol or high stress) can directly or indirectly increase the chances of fatty deposits, blood clots, heart attacks, strokes, diabetes and stress.
- I can describe the effect of exercise on pulse rate
- I can debate whether all illnesses should be treated for free under the National Health Service

Lifestyle choices

- Lifestyle choices can directly or indirectly effect health.
- These choices can be positive or negative.

- Several physiological measurements can be taken to monitor health.

Physiological measurements

- Use equipment to look at body temperature, blood pressure, pulse rate, body fat etc.
- Carry out an investigation on the effect of exercise on these measurements.

Research task 1

- Research the effect of lifestyle choices on health:
- High fat or high salt diet
- Lack of exercise
- Use of tobacco or alcohol
- High stress experiences
- Lack of iron

Outcome of research - note

- These factors directly and indirectly increase the chances of fatty deposits in blood vessels, blood clots, heart attacks, strokes, diabetes and stress.
- Lack of iron means haemoglobin cannot be made and can lead to anaemia.
- Heredity plays a part in the incidence of some conditions.

Homework

- Research environmental factors e.g. heavy metals, radiation and pollution and how they effect health.

Research task 2

- How can healthier lifestyle choices directly and indirectly improve the physical and mental health of an individual.

Debate

- All illnesses should be treated for free under the National Health Service in the UK.

- In groups, discuss for and against arguments for the above statement.