Osmosis in plants

1. Plants rely on osmosis to support their stems and leaves
   - Water moves into the cells, causing the vacuole to swell, making the cell and rigid
2. So plants need the fluid surrounding the cell to have a higher concentration of water to keep the water moving in the right direction
   - Into the low concentrated cytoplasm.

Summary= the differences in concentration of solutions inside and outside the cell cause water to move in or out of the cell by osmosis

Active transport

Cells need to move substances in and out

- This can be done by diffusion, along the concentration gradient
- But sometimes the substances have to be moved against the concentration gradient

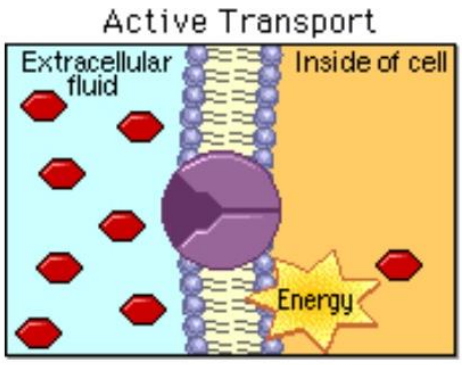
Active transport:

- Allows cells to move substances form an area of low concentration to high
- Against the concentration gradient
- Across a cell membrane
- Using energy

So can absorb ions from dilute solutions, and move substance form 1 place to another

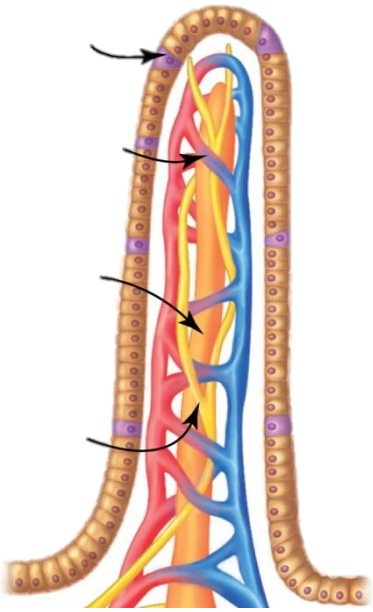
It energy for the active transport system to carry a molecule across a membrane, this energy comes from cellular respiration

- Therefore the cells that are involved in active transport have lots of mitochondria



This transport requires energy in the form of ATP

Exchange in the gut



Absorption in the small intestine

The small intestine is lined with villi:

- Which increase the SA, increasing the uptake of digested food by diffusion
- Each villus is covered with microvilli, increasing the SA even more
- Have a single layer of surface cells
- Good blood supply

Exchange in plants

Gas exchange

Leaf adaptations for gas exchange

- A flat, broad shape to increase SA for diffusion
- Thin- so the distance the CO_2/ oxygen has to diffuse in/out of the photosynthesising cells and the air is short
- Have air spaces- allow CO_2 to come into contact with lots of cells, and give a large SA for diffusion

Leaf cells are constantly losing water by evaporation, and if the stomata were open to collect CO_2 all the time then the plant would lose water too fast and die

So when its dark and the plant isn't photosynthesising it doesn't need CO_2, so the stomata closes

- The leaves are adapted to only allow CO_2 in when needed

(A lot of this is in B2.2)

Uptake of mineral ions and water

Roots are adapted to take up water and mineral ions efficiently:

- Thin
- Large SA
- Too hair cells- have tiny projections that push out between the soil particles

The plants roots are also adapted to use active transport to take up mineral ions

- They have lots of mitochondria for energy

Water moves into the root hair cell by osmosis across the partially permeable root cell membrane

Then it only has a short distance to move across the root to the xylem where it is move up and around the plant, to the cells for photosynthesis

B3.2- Transporting Materials

The circulatory system and the heart

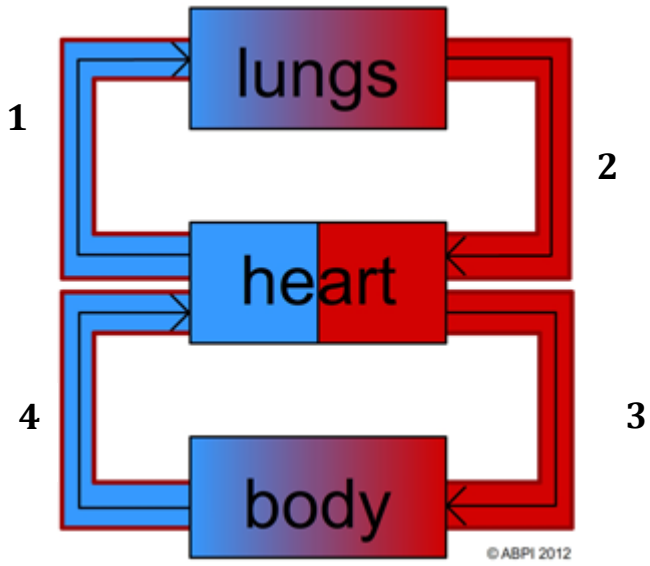
The blood circulatory system- the system where blood is carried around the body

- supplies body cells with glucose and O_2
- removes $C0_2$, water and urea
- Made up of blood vessels, the heart and the blood

A double circulation= 2 transport systems

1. Carries deoxygenated blood from the heart to the lungs and back
   - Allows oxygen and CO2 to be exchanged with the air in the lungs
2. Carries oxygenated blood around the rest of the body and returns deoxygenated blood back to the heart

1- Deoxygenated blood goes form the heart to the lungs to be oxygenated
2- Oxygenated blood returns to the heart
3- Oxygenated blood goes from the heart to the rest of the body, when the oxygen is used up
4- Deoxygenated blood the returns to the heart



	last long (Haemoglobin based products)
Some carry more oxygen than blood (Haemoglobin based products)	Can cause severe side-effects (PFCs)
	Doesn't clot or fight disease (Haemoglobin based products)

Types of artificial blood:

1. Plasma/saline
   - The simplest way to replace blood is with plasma or saline (salt water)
   - Plasma carries dissolved oxygen, but saline doesn't
   - Doctors do this is to replace the volume of blood lost to keep a person's BP normal, to buy time of their body to make more blood, or for a donor to be found

2. Perfluorocarbons (PFCs)
   - Form of artificial blood –contains chemicals that can dissolve oxygen

PROS	CONS
Can be kept for a very long time	Don't carry much O_2 so needed in large amount
Don't carry disease	Broken down easily
	Severe side effects

3. Haemoglobin based products
   - Doesn't contain any RBC
   - Take from animal/human blood, or can be made synthetically or by genetically engineered bacteria

PROS	CONS
Doesn't needed to be kept in a fridge	Doesn't clot or fight disease
Carries more O_2 than normal blood	Broken down quickly

Transport systems in plants

Phloem:

Kidney transplants

Clean and balance the blood chemistry

The donor kidney is place in the groin and attached to the blood vessels in the bladder

Rejection

As the kidney come from a different person there is a risk of rejection

- As the antigens will be different, the antibodies of the immune system of the recipient could attack the antigens of the donor organ
- Results in rejection and the destruction of the kidney

To reduce rejection

- Match the antigens as much as possible-you a kidney with a tissue type very similar to recipients, and with the same blood group
- The recipient is given immunosuppressant drugs to suppress their immune system, to prevent rejection

Finding donors

Never enough, so many don't get the chance of getting another kidney

- Not enough are on the donor register
- Car are safer now, so less are in accidents

Xenotransplantation

- Producing genetically engineered pigs with organs that could be used for human transplants

Stem cells could also be a way to grow new kidneys

Dialysis VS transplant

Dialysis		Transplant	
PROS	**CONS**	**PROS**	**CONS**
Readily available	Have to follow a carful diet	Free form the restrictions of dialysis	Don't last long, so a person has to go back on dialysis and wait for another donor
Can lead a relatively normal life	Have to spend regular long sessions connected to the machine	Eat what you want	Immunosuppressant dugs- prevents patents from dealing with infectious diseases well, which is bad as they have to take them from the rest of their lives
	Over the years the balance of substances can become harder to control		Risk of rejection
	Long term dialysis is more expensive than a transplant		

Issues linked with the treatment of kidney failure

- In developing countries many cell their kidneys for money
- Some people can be so desperate for themselves or a loved one for a kidney transplant may result to buying one illegally
- Transplants and dialysis both cost the UK a lot of money

Then it is dried and purified to make Mycoprotein

- On its own has little flavour, but a range of flavours and textures can be given to make it similar to other foods
- It is a meat substitute

Mycoproteins are versatile, high in protein and fibre, low in fat and calories and very sustainable, so is used a lot in the developing world

Asepsis

= absence of unwanted microorganisms

Aspesis is vital in biotechnological processes involving microorganisms as the nutrient medium may also support the growth of many unwanted microorganisms (contaminant).

The effect of unwanted microorganisms:

- Compete with culture microbes for nutrients and space.
- Reduce the yield of useful products from the culture microbes.
- May cause spoilage of the product.
- May produce toxic chemicals.

Aseptic technique= the measures taken to ensure unwanted microorganisms do not contaminate the culture that is being grown or the products that are extracted.

At laboratory and starter culture level	At large-scale culture levels
• Fume cupboard – air circulation carries any airborne contaminants away from the bench space • Sterile equipment – sterilise all equipment before use (e.g. flame loop, or by UV light). Use a autoclave. • Closed cultures – keep closed where possible	• Sterile fermenters – washing, disinfecting and steam cleaning the fermenter- Fermenters made of polished stainless steel to prevent microbes and medium sticking • Sterile nutrient media – sterilise all media before adding to the fermenter. • Fine filters – filters on inlet and outlet pipes avoid microorganisms entering or leaving fermentation vessel.

The oceans

It is important to maintain fish stocks at a level where breeding continues successfully, otherwise certain species such as cod and Bluefin tuna might disappear completely.