Scott Davies
Biology investigation
Planning

My main aim in this experiment is to find out if osmosis occurs in a potato, and how it affect the potato in different molar solutions of sucrose and water.

Definition

Osmosis is the passage of water from a region of high water concentration through a semi-permeable membrane to a region of low water concentration.

Semi-permeable membranes are very thin layers of material (cell membranes are semi-permeable) Which allow some things to pass through them but prevent other things from passing through.

Cell membranes will allow small molecules like Oxygen, water, Carbon Dioxide, Ammonia, Glucose, amino-acids, etc. to pass through. Cell membranes will not allow larger molecules like Sucrose, Starch, protein, etc. to pass through.

A region of high concentration of water is either a very dilute solution of something like sucrose or pure water. In each case there is a lot of water: there is a high concentration of water.

A region of low concentration of water is a concentrated solution of something like sucrose. In this case there is much less water.

When you put an animal or plant cell into a liquid containing water one of three things will happen.

If the medium surrounding the cell has a higher water concentration than the cell (a very dilute solution) the cell will gain water by osmosis.

Water molecules are free to pass across the cell membrane in both directions, but more water will come into the cell than will leave. The net (overall) result is that water enters the cell. The cell is likely to swell up.

If the medium is exactly the same water concentration as the cell there will be no net movement of water across the cell membrane.

Water crosses the cell membrane in both directions, but the amount going in is the same as the amount going out, so there is no overall movement of water. The cell will stay the same size.

If the medium has a lower concentration of water than the cell (a very concentrated solution) the cell will lose water by osmosis.

Again, water crosses the cell membrane in both directions, but this time more water leaves the cell than enters it. Therefore the cell will shrink.

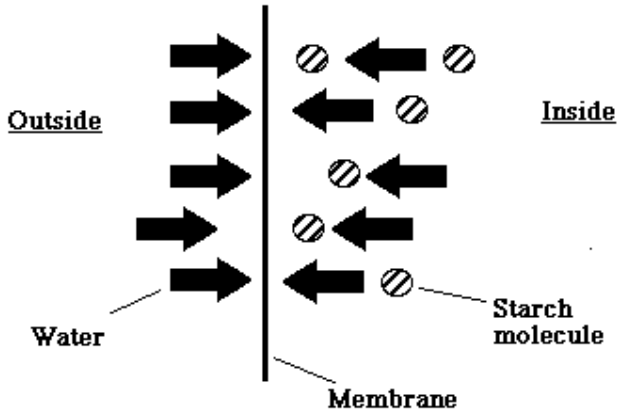
The Consequences of Osmosis

Firstly what happens to plant cells:

Plant cells always have a strong cell wall surrounding them. When the take up water by osmosis they start to swell, but the cell wall prevents them from bursting. Plant cells become "turgid" when they are put in dilute solutions. The pressure inside the cell rises, eventually the internal pressure of the cell is so high that no more water can enter the cell. This liquid or hydrostatic pressure works against osmosis. Turgidity is very important to plants because this is what make the green parts of the plant "stand up" into the sunlight.

When plant cells are placed in concentrated sugar solutions they lose water by osmosis and they become "flaccid"; this is the exact opposite of "turgid". If you put plant cells into concentrated sugar solutions and look at them under a microscope you would see that the contents of the cells have shrunk and pulled away from the cell wall: they are said to be plasmolysed.

When plant cells are placed in a solution which has exactly the same osmotic strength as the cells they are in a state between turgidity and flaccidity. We call this incipient plasmolysis. "Incipient" means "about to be". When I forget to water the potted plants in my study you will see their leaves droop. Although their cells are not plasmolsysed, they are not turgid and so they do not hold the leaves up into the sunlight.



In the experiment there will be one variable, which is the concentration of the sycros solution. The different solutions will be: 0%,25%,50%,75% and 100% sycrose.
I will keep constant the volume of solution, the size of the potato, the time and the beaker that the solution ond potato will be placed in.

The information that I will collect will be the length and mass before the experiment and after.

Prediction

I think that the water molecules will move through the pores of the potato giving the potato an increase in size, making it turgid. So the less sucrose, the more gain in size.

In the experiment I will make it a fair test by keeping the same and only veriable which is the sucrose solution. the volume of solution, time limit, the weight and size of the solution will all be the same.

Method

A range of sucrose sugar solutions will be prepared with concentrations 0 molar, 0.25 molar, 0.5 molar, 0.75 molar and 1 molar.
This will be done by adding varying amounts of distilled water to varying amounts of sucrose solution.
Sections of potato will be peeled using a scalpel, cut out using the same cork boror all the time and will be measured using a ruler.
This part of the preparation must be done very accurately as a change in the surface area may allow more or less osmosis to occur.
The mass of each chip will be measured as well so that more results can be obtained. two chips will be placed in each beaker each time so that I can take an average for each beaker.
I will use 25ml of each concentration of sucrose solution and once in the test tubes they each will be labelled.
The potato pieces will then be placed in the different test tubes and then left for 24 hours.
Then the potato pieces will be removed, the surface solution removed using paper towels and then they will be re-weighed.
This will hopefully produce accurate results from which I will be able to draw a more accurate conclusion.

Obtaining

Weight

Concentration sycrose	Starting weight	End weight	% change (start /end)100
100%	3.355	1.990	-41%
75%	3.412	2.143	-37%
50%	3.402	2.547	-25%
25%	3.340	3.190	-4%
0%	3.393	3.826	+13%

Length

Concentration sucrose	Start length	End length A	B	Average (A+B)/2	Change in length	% change (300/100) x change in length
100%	3cm	27mm	28mm	27.5mm	-2.5mm	-7.5%
75%	3cm	29mm	28mm	28.5	-1.5mm	-4.5%
50%	3cm	26mm	26mm	26	-4mm	-12%
25%	3cm	29mm	30mm	29.5	-.5mm	-1.5%
0%	3cm	31mm	32mm	31.5	+1.5mm	+4.5%

Analysing

In the result ive obtained shows me that my prediction was correct, noticed an odd result on the 50% sycrose solution, were as it had a loss in length of –4, but it should have been –1 I can see this by the best fit in the graph.

Conclution

It seems that when there is a trace of sycrose in the solution there is always a loss, this could be because the sycrose we used had a high concentration, and adding water didn't do much to dilute it, but the experiment was to see what effect different concentrations would have to the potato and the effect it has is the higher the concentration of sycrose the less gain in both mass and length.
When I stated "I think that the water molecules will move through the pores of the potato giving the potato an increase in size, making it turgid. So the less sucrose, the more gain in size", I was correct.

Evaluation

In my experiment I only used one lot of each different solution, even though I used two potato pieces in each beaker to work out an average for more reliable data, I should have done the whole experiment again so if there was a problem with any of the solutions in the first experiment, I would have a second set of results. I think eventhough the mass and length results both correlate the set of mass results are more precise than the length because there are much higher levels of changes, making it easier to see the full effect of different sucrose solutions.