Investigating the effect of temperature on the permeability of plant cell membranes

Transcript

The cells of all organisms have a plasma membrane. It is an effective barrier that is only permeable to molecules through specific, controlled, mechanisms.

However, environmental factors such as temperature and chemicals, can affect the permeability of the plasma membrane and disrupt the normal function of the cell.

This investigation shows how varying the temperature of a cell's environment affects the permeability of its plasma membrane. It is not possible to observe membranes directly, so this investigation is an indirect study using raw plant tissue from the beetroot vegetable.

Beetroot cells contain a variety of red and purple pigments, called betalains, which can pass through the cell wall but not through the plasma membrane.

Distilled water is measured into each of six boiling tubes.

Each boiling tube is placed into a different water bath for at least 10 minutes to ensure the water reaches the required temperature. A wide range of temperatures are used from ice-cold to near boiling.

A beetroot is cut in half carefully using a sharp knife or scalpel onto a white tile.

A cork borer is used to cut cylinders from the beetroot.

The peel is removed using a scalpel. The cylinders are cut to create six pieces, each two centimetres in length.

The cylinders are washed thoroughly for at least one minute to remove any pigment found on their surface. They are then blotted dry to remove the water.

A cylinder is placed into a boiling tube for each temperature.

The timer is immediately started and the tubes are left in the water baths for 20 minutes.

The boiling tubes are removed from the water baths and gently agitated to ensure that any pigment is fully dissolved in the water.

Making sure that the beetroot is at the bottom of the boiling tube, solution from each tube is carefully extracted and transferred to a colorimeter cuvette.

It is not possible to label the cuvettes directly as this will disrupt the reading of the colorimeter. Temperatures are labelled on a piece of paper and the samples are placed accordingly.

A colorimeter is set to transmit green light and to measure absorbance.

It is then calibrated using distilled water.

A sample is now put in the colorimeter. The observation of the colour and the reading from the colorimeter are recorded. This process is repeated for each sample, making sure to re-calibrate the colorimeter with distilled water between samples.

The whole experiment is repeated three times for each temperature to calculate a mean.

The results are plotted on a suitable graph and conclusions are made about the relationship between temperature and the permeability of the plasma membrane.

The effect of temperature on the permeability of the plasma membrane is one reason why the internal temperature of organisms must be very carefully regulated.