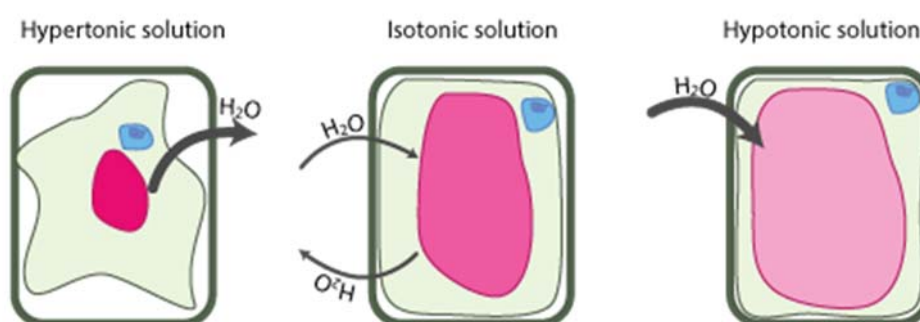


## Osmosis under the microscope

Osmosis is the movement of water molecules across a semipermeable membrane down the water concentration gradient. Osmosis occurs when free water molecules move from a region of high solute concentration to a region of low solute concentration. This phenomenon can be observed under the microscope in living cells.

When cells are bathed in a solution where the solute concentration is higher than in the cell cytoplasm (a hypertonic solution) the cell will lose water. When cells are bathed in a solution where the solute concentration is lower than inside the cell cytoplasm (a hypotonic solution) the cell will gain water.

Figure 1 Effects of hypertonic, isotonic and hypotonic solutions on plant cells



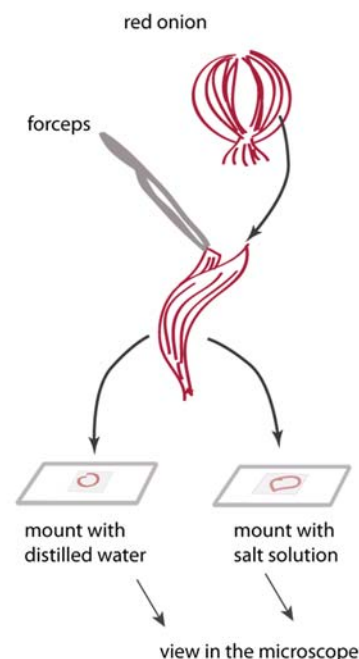
In this practical you will observe osmosis in red onion epidermal cells. These cells are useful because the water soluble red pigment in red onion, anthocyanin, is stored in the vacuole. The vacuolar membrane is permeable to water, so water moves between the cytoplasm and vacuole as well as across the plasma membrane. Therefore changes may be observed in the vacuole.

### Materials

- Fresh red onion
- Compound microscope with magnification up to 400x
- 2 microscope slides
- 2 coverslips
- Distilled Water ( $dH_2O$ ) and transfer pipette
- 2.5% salt solution (2.0% is usually good, 2.5% is a more obvious effect)
- Pasteur pipette or transfer pipette
- Forceps and scalpel blades
- Marker pen
- Digital camera to capture microscope images of the cells

## Method – onion epidermal peel

- Collect a segment of red onion and all other materials. Label 2 microscope slides: 'dH<sub>2</sub>O' and 'salt solution'.
- Peel a thin layer of epidermis from a red surface of the onion.
- Place it on the slide. Add 1-2 drops of dH<sub>2</sub>O to cover the tissue. Place a coverslip over the tissue.
- Peel a thin layer of epidermis from a red surface of the onion.
- Place it on the slide. Add a 1-2 drops salt solution to cover the tissue. Place a coverslip over the tissue.
- View the samples under the compound light microscope at an appropriate magnification (usually 100x or 400x) . It helps to close the iris diaphragm to some degree to increase contrast and see the cell walls clearly.



## Results

- Make an annotated diagram of a cell in dH<sub>2</sub>O and a cell in salt solution.
- Record the magnification.
- Estimate cell size (if you have previously calibrated your microscope).
- Label all structures observed.
- If possible, photograph the cells in the microscope view and include a print in your log book.

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## Other plants for this experiment

Conduct the same experiment with other leaves:

- Red *Aeonium*, has red pigment in vacuole of leaf epidermal cells. Do an epidermal peel (as per Leaf epidermal peel practical, and perform this experiment. It may be a little harder to interpret as the cells are irregularly shaped, so do it after students have done the uniform rectangular cells of red onion
- Whole *Elodea* leaves. The vacuole shrinks and the chloroplasts congregate around the shrunken vacuole.

## Alternative approach

An alternative approach is to prepare one wet mount of the epidermis in water, then add high salt solution to one side of the coverslip and draw it through with absorbent paper held at the opposite side of the coverslip.

Disadvantage of this method: technically difficult for students – this can be a good challenge for some but not encouraging for others.

Need to have the coverslip raised at corners with a little vaseline to enable fluid exchange.

## Laboratory Preparation

2.5% salt solution: sodium chloride 2.5g/100mL

Table salt is suitable but does not dissolve as well as NaCl.

Sucrose or glucose solution can also be used for this type of practical. Disadvantage of sugar is the stickiness of spilt drops.

Red onion fresh from green grocer. Cut segments for student groups.