

24.18 IMPORTANCE OF WATER FOR PHOTOSYNTHESIS

Water is an extremely important component of a plant's inner workings. Without proper water supply, and a way to maintain the water supply, the plant will not be able to function and will die. Some plants are able to function on little water, such as desert cacti (singular cactus) which often only get watered two or three times per year. Other plants, such as house plants and ornamental flowers, need to be watered two or three times per week to maximally grow. Water is critical in four plant processes: photosynthesis, turgor pressure, hydrolysis, and transport.

We have already discussed photosynthesis at length, but recall that during photosynthesis, the plant uses water and carbon dioxide to make glucose. Without water, photosynthesis cannot occur. We also discussed **hydrolysis** (Chapters 3 and 6). Hydrolysis is the use of water to break larger molecules into smaller ones through the actions of enzymes. Remember that hydrolysis is a chemical reaction that all organisms perform, not just plants. Water is essential for the hydrolysis of large molecules into smaller ones.

24.19 IMPORTANCE OF WATER FOR TURGOR PRESSURE

Turgor pressure is the pressure that keeps herbaceous stems upright and leaves full. Plant cells have large central vacuoles, which contain high concentrations of solutes. Water is drawn into the vacuole by osmosis, causing the vacuole to swell to a large size. This pushes the cytoplasm and organelles up against the plasma membrane, making the cell "stiff" or "tight" with the pressure from the large vacuole. When the turgor pressure in all the plant cells is high, the cells push against one another and maintain the shape of the fleshy parts of the plant.

To help picture this, think about what happens when a plant is not watered for a long time. As the soil and the plant dries out, the leaves and stems lose water and start to wilt. The turgor pressure is low. As soon as the plant is watered, the turgor pressure returns to normal, and the plant returns to its usual shape.

24.20 WATER AND NASTIC MOVEMENTS

Turgor pressure is also responsible for **nastic movements** in plants. Nastic movements are simply physical movements of the plants due to changes in the plant's environment. They occur as the result of changes in turgor pressure. The response of the plant occurs independently of the direction of the stimulus. **Thigmonastic movements** are nastic movements in response to touching or shaking a plant. This results in rapid changes in turgor pressure to move some part of the plant. Closing of the Venus flytrap around its prey is an example of thigmonastic movements.

Nyctinastic movements occur in response to changes in light. These are slower changes in turgor pressure that occur in response to day and night changes. Many species of plants have flowers that fold their petals "closed" at night, then "open" them during the day. The same thing is seen in certain plants with the orientation of their leaves to the sun; at night the leaves are folded vertically and when the sun comes out, the leaves move to a horizontal position.

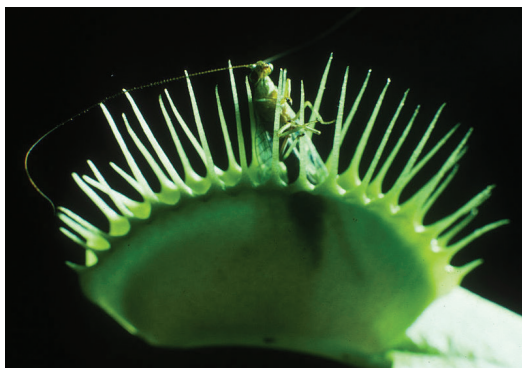
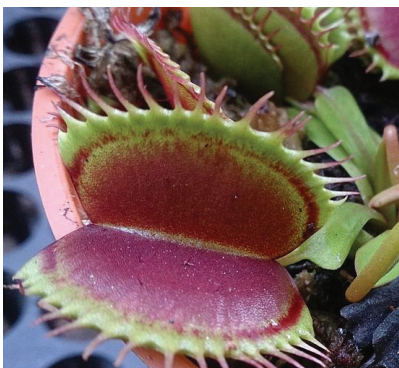


Figure 24.20.1

Thigmonastic Movements

When you see a Venus flytrap close its leaf blades to trap an insect, you are seeing a type of **nastic** movement (also called nyctasty). When a small bug (or your finger) stimulates little hairs (called trigger hairs) on the trap leaf blades, very rapid changes in turgor pressure cause the leaves to close quickly.