# The structure and arrangement of leafs

**Leaf from a tree:** below is a short description of an ordinary leaf. This is the most common set up for a leaf. Each cell has their important task for survival. The characteristic of an ordinary terrestrial leaf is:
The leaf is wide and thin to expose as much photosynthetic cells as possible. The leaf has a waxy cuticle to protect the leaf from losing to much water. Below the cuticle is the epidermis that protects the plant from pathogens. The cuticle is secreted by epidermis. Under the epidermis palisade mesophyll can be found. They contain photosynthetic cells called chloroplast. Chloroplast are solar-powered-food-making cells for the rest of the plant. These absorb sunlight to join carbon dioxide and water molecules. The final product is glucose molecules. The by-product of this process is oxygen. Below the palisade mesophyll there are several types of cells: Xylem vessels are heavy lignified and they are conducting water and mineral salts to the rest of the leaf. Phloem sleave tubes remove products of photosyntasis, imports amino acid and redistribute ions (xylem and phloem are together vascular bundles). Spongy mesophyll are cells that contain some chloroplast, they are irregular in shape with large space in between the cells to allow exchange of gases. Water evaporates from these cells.
Under the leaf is the lower epidermis. It has a similar structure and function as upper epidermis but thinner.
In the lower epidermis guard cells and stomata is present.
Stomata are pores in the leaf allowing diffusion of gases. Stomata are formed by two guard cells on each side of an opening of a pore.
The stomata are responsible for the exchange of gases, it will also allow for loss of excess water or the retention of water. The stomata close at night and open during the day.

# Nymphaea

**Water lily**

The floating leaf such as the water lily's have their roots in a bottom of a pond and their leaves and flowers are floating on the surface of the water. The leaf is big and thin. This is to increase the surface to leave as many photosynthetic cells as possible exposed to the sun. The water lily has had to make adaptations to survive this environment.

The epidermis produces a leathery and waxy cuticle. The cuticles task is to protect the plant from evaporation. The cuticle is important, as the plant has to protect itself from attacked by any bacteria, fungi or pathogens. This helps the plant floating and water can roll off keeping the leaf clean from dust assisting in photosynthesis. It also helps the structure of the plan so it dose not curl up or gets folded over by wind or waves. As the Nymphaea is always floating, the epidermis have all their stomata on the top of the leaf. This unusual arrangement allows the leaf to exchange gases. It also makes the plant loose more water but water is never a problem for a water lily.
The stomata have pores in the epidermis accompanied by guard cells that has the ability to open the pores up or close them.
The nympheae epidermis has parlisade mesophyll that is rich in photosynthetic chloroplast. The Parlisade mesophyll is particularly thick in the water lily. The cells are stacked on top of each other and have big air spaces. These air spaces help the plant afloat. In the parlisade mesophyll are sclereids cells that are dead, hard, fibrous cells that support the structure to the leaf and provide some toughness for the leaf and prevent the parlisade mespophyll from collapsing.
Below is the spongy mesophyll. Where some gas exchanges occur it also has intercellular cavities (aerenchyma), which provide buoyancy. The bottom of the leaf has epidermis but the stomata are plugged, not letting any water in to the air spaces.

# Marram grass

Marram grass has adapted to survive life on a beach where it faces challenges such as sand blast, drought and a salty environment. When it rains fresh water drains quickly away in the sand. The marram grass has made many adaptations to retrain water. The plant has developed some salt resistant.
The marram grass is surrounded by water but fresh water is hard to come by on a beach. Marram grass has developed shallow root system and is dependent on condensation from fresh water in the sand dunes. In turn this helps the sand to stay on the beach.
The roots suck up the water and distribute it to the rest of the plant.
If the marram grass would have big leafs as the water lily or a tree leaf the marram grass would loose the water quickly due to evaporation.
So marram grass has developed many additional adaptations to protect the water is has retained. The leaf itself it long, thin and rolled up. It has developed a thick waxy cuticle to reduce transpiration and protects it leaf from sandblast. The upper epidermis does not have any stomata. This is to reduce transpiration further. In the lower epidermis are hinge cells, these cell regulate the structure and control the cavity of the leaf. If the marram grass is under stress and does not have much water the hinge cells becomes flaccid making the marram grass to roll up to almost a circle and create a humid atmosphere inside the leaf. They are ether flaccid or rigid depending on whether the cells release or retrain water. In this way the marram grass can protect the water supply remaining in the plant and at the same time reduce the plants surface exposed from the drying effects of wind and sun. (In the lower epidermis stomata is present.) The mesophyll with its photosynthetic tissue is protected from direct sunlight. This is to reduce demand from water.
The lower epidermis has fine hair that interlock in the rolled up state helping the plant to retain the water. When the plant spread the leaf out the fine hair can collect water vapour. When the plant is rolled up it prevent the plant from collecting carbon dioxide and no foodstuff for the plant is produced. This is a small price to pay for survival of the plant.

# Erica

**Heather**

Erica grows in bog land where the earth often gets waterlogged and soil has a high content of acid. The heather is exposed to we t, cold and windy weather and the soil has high peat content. To survive the Erica had to make adaptations. The plant does not retain water very well, as the leaf is small, thin and almost like a needle. The heather has developed defense mechanisms against dehydration. The leaf has a particularly thick epidermis and the cuticle is waxy and shiny. This is to protect the leaf from the winds dehydrating effects. The shine of the cuticle helps the leaf to reflect the heat this is also done to protect the plants water supply. The erica is partially rolled up this is to protect the under surface of the leaf against the wind. Stomata are only present under the leaf (abaxial surface). The stomata are sunken and surrounded by hairs and allow water vapor build up in t his enclosed aria. These hairs and sunken stomata help to reduce the water evaporation. The hair also supplies the leaf with their own environment under the leaf to retrain water. The heather has evergreen leafs which means it can use the leaf more than on e year to produce food for the plant.

# Further questions:

1) How to prepare a microscope on a high power.

a) Place the object on the stage
b) Adjust the lens to the lowest magnification.
c) Adjust the light adjuster making sure enough light gets in to the lens.
d) Look at the object from the side of the stage and use the lens adjuster making sure the lens is just above the object.
e) Look down the eye piece and adjust the focus until the object is in focus.
f) Change the magnification to a higher power. Adjust the focus until you se the slide clearly.

2a) 1 Epidermis, 2 Collenchyma, 3 Parenchyma, 4 Xylem,
5 Sclerenchyma, 6 Cambium

2b) **Epidermis** has tough fibers. Epidermis protects the plant from pathogens and forces like wind. The epidermis in helianthus is one cell thick but has developed small, thin hair. This is to preserve water in the plant by limiting air movement and to reflect light. The epidermis also produces the cuticle. This is to protect the plant further from water loss and invasion against bacteria and pathogens.

**Sclerenchyma** is like a cap of the vascular bundle. They have developed in to supporting fibers that offer the plant strength. They are heavy lignified and have no living content.

**Cambium** is a non-specified cell cells that are found in the middle of xylem or phloem. They are square like cells that can either divide to xylem or phoem, depending where the cells are needed.

Source:
www.microscopy-uk.net

http://www.seftoncoast.org.uk
www.biologie.uni-hamburg.de

# Adaptations of Plants

For Mr. Love

**By Jaenette Satherlund**